PROJECT TERMINATION REPORT

Part II: Details

PROJECT TITLE: The Economic Impact of Regulations on Shellfish and Trout Aquaculture Growth in the Western United States

REPORT GIVEN IN YEAR 2019

PROJECT WORK PERIOD: (2/11/2016 - 8/31/2019)

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PARTICIPANTS:
List of Principal Investigators
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PROJECT OBJECTIVES:

1. To develop detailed information on the complete set of regulations for which West Coast shellfish growers and western-region trout farmers must comply.

2. To estimate the total costs and economic impacts associated with the total set of regulations for which shellfish growers and western-region trout farmers must comply.

3. To disseminate project results broadly to industry associations and aquaculture research and extension specialists for use in discussions with policy makers.

TECHNICAL SUMMARY AND ANALYSIS

Two surveys were designed and implemented (West Coast shellfish and trout/salmon) to estimate the economic effect of regulations. Each survey was designed to: 1) develop detailed information on regulations; and 2) estimate total costs associated with these regulations. Work group meetings were held February, 2016, October, 2016, October, 2017, and October, 2018.

No established typology had existed for characterizing farm-level effects of regulations. Results of preliminary analyses were reported in 2018; however, the initial approach did not differentiate

between the different economic effects of increased costs and lost revenue that affect farms in different ways. The analyses were re-done this past year. Increased costs are now reported separately from lost revenue effects that were further sub-categorized into lost sales (value of sales into specific markets that were lost due to regulatory action and were documented in farm records) and lost opportunities (value of sales not received because of regulatory barriers to expansion or diversification; values based on respondent estimates, not farm records).

Shellfish Survey

The survey of West Coast shellfish growers was completed as proposed in the West Coast states of Washington, Oregon, and California. The total annual regulatory cost tabulated from the observations across the three study states was over $15.6 million (Table 1).

Table 1. Total annual regulatory cost of West Coast shellfish by state (US$).

State	Per state
California	$6,158,446
Oregon	$246,908
Washington	$5,144,430
Pacific coast	$11,549,784
(Adjusted for coverage 74%)	$15,607,817

Regulatory costs per farm across the region, averaged $240,621. Among the study states, California demonstrated the highest total reported regulatory cost per state ($6.2 million) and average regulatory cost per farm ($473,727). Washington state followed with a total per-state regulatory cost of $5.1 million and an average estimated per farm cost of $171,481. Per-ha, the mean regulatory cost across the West Coast region was $68,936.

The effects on farm sales revenue (lost sales and lost opportunities) were $110 million

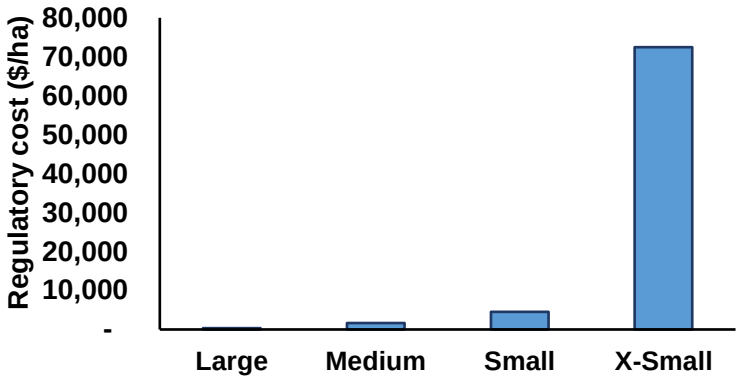
Table 2. Annual effects on farm sales revenue of shellfish by state (US $).

State	$/state
Lost sales	
California	$3,170,430
Oregon	$560,000
Washington	$78,024,400
Pacific coast	$81,754,830
Adjusted for coverage (74%)	$110,479,500
Lost opportunities	
California	$19,187,921
Oregon	$9,242,431
Washington	$97,358,518
Pacific coast	$125,788,870
Adjusted for coverage (74%)	$169,984,960

in lost sales and $170 million in lost opportunities (Table 2). Washington state exhibited the largest statewide effects for both lost sales and lost opportunities, followed by California.

Thirty-seven percent of respondents indicated a desire to expand their operations and were unable to do so due to regulatory constraints. Data were sorted into the following four farm size groupings: large (≥ 200 hectares), medium (≥ 40 hectares and <200 hectares), small (< 40 hectares), and extra-small (< 4 hectares). Analysis by farm size demonstrated greater regulatory cost burdens per ha on smaller-scale producers, 382 times greater regulatory costs, 10 times greater lost sales and nearly 5 times greater lost opportunities than on large farms (Fig. 1). Results show that the West Coast shellfish industry has experienced extensive delays in permitting resulting in substantial lost opportunities. High regulatory costs have prevented entry of new businesses, contributed to the exit of existing farms, and otherwise prevented the industry from responding to growing demand for U.S. shellfish aquaculture products.

Figure 1. Total annual regulatory cost by farm.



Trout Survey

The trout survey has been completed. The additional funding ($90,400 from USDA-APHIS and $20,000 from the U.S. Trout Farmers Association) resulted in a national salmonid survey that included the 17 states that produce 99% of the value of salmonids nationally.

Total annual regulatory costs nationally were $16.1 million (Table 3). Values per state varied due to varying sizes of the industry in different states. For example, the top salmonid-producing states of Idaho, the coastal states, and North Carolina exhibited the greatest state-wide regulatory costs as would be expected. Per farm, the national mean regulatory cost per farm was $150,506 but varied from $3,026 per farm in West Virginia to $798,076 per farm in the coastal states.

Lost revenue resulted from markets and production lost due to regulatory action and from permit delays and denials that thwarted attempts to expand. The greatest percentage of total lost revenue was that from thwarted expansion attempts (57%), followed by the value of lost markets (25%), and then the value of lost production (18%). While some states reported no lost revenue, others, particularly the major salmonid-producing states had substantial values of lost revenue (Table 4). Other states such as Utah, Michigan, and Colorado that showed substantial lost revenue due to regulatory actions are also states with high percentages of decline in the number of salmonid farms (40%, 63%, and 62% decreases in the numbers of salmonid farms, respectively, from 1998

to 2014). Salmonid farmers in several of these states have had prominent regulatory disputes and, in some cases, on-going litigation. The lost revenue, combined with increasing fixed costs, were reported to result in farms exiting the business. Respondents in six states reported that attempts to expand production had been thwarted in the permit review process that prevented those farms from operating at an efficient and optimal scale of production.

Table 3. Regulatory cost on salmonid farms by state.

State	$/state
Colorado	$331,202
Idaho	$6,457,617
Michigan	$546,565
New York	$21,580
North Carolina	$957,271
Ohio	$73,952
Pennsylvania	$168,186
Utah	$291,967
Virginia	$115,205
West Virginia	$30,260
Wisconsin	$381,185
Coastal states	$5,586,533
Midwest states	$239,581
NATIONAL	$15,201,104
Coverage adjusted	$16,085,824

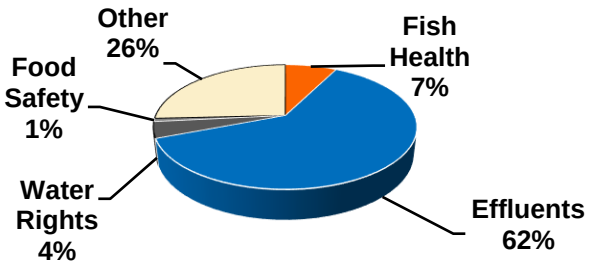
Table 4. Lost revenue from the value of lost market sales, lost production, and thwarted expansion per state.

State	Lost markets ($ M)	Lost production ($ M)	Thwarted expansion ($ M)
Colorado	0.780	0.086	0
Idaho	1.194	0.515	0.087
Michigan	0.371	0.990	0
New York	0	0	0
North Carolina	0.100	0.738	22.550
Ohio	0	0	0
Pennsylvania	0.392	0.270	0.004
Utah	2.064	0.570	0.050
Virginia	0.017	0.035	0
West Virginia	0.022	0.058	0
Wisconsin	0.104	0.376	0.023
Coastal	1.550	1.300	15.000
Midwest	0.035	0.017	0
NATIONAL	6.627	4.955	37.921
W/coverage	7.096	5.306	40.128

Total regulatory costs were classified into key types of cost categories that included: permits and licenses, direct costs other than permits, manpower, and costs of unexpected changes due to regulations. Direct costs other than permits/licenses constituted 68%, manpower costs 23%, unexpected farm-level changes 7%, and the costs of the permits/licenses only 2% of the total regulatory cost. Direct costs other than permits/licenses include the costs of testing discharge water samples or fish health testing costs, delivery and shipping of samples to laboratories, the cost of fish sacrificed for fish health testing, and the manpower required for sampling, delivering samples, monitoring, record-keeping, and reporting.

Regulatory costs were sorted by type of regulation, with primary categories of effluent discharge, fish health, water rights, food safety, and all other regulations (Fig. 2). Of these, effluent discharge regulations composed 62% of total regulatory costs, and fish health 7% of total regulatory costs. All other types of regulations composed 26% of total regulatory costs, water rights 4%, and food safety regulations 1%.

Figure 2. Regulatory cost by type of regulation (% of total regulatory costs).



As a percentage of total production and marketing costs, per-farm regulatory costs composed 12% and the value of lost revenue was 28%. While the total regulatory cost per farm increased with farm size, the regulatory cost per kilogram generally decreased with the size of farm. The cost/kg in the smallest farm size category ($7.30/kg) was 18 times greater than that in the largest size category ($0.41/kg).

Per farm, the mean regulatory cost on foodfish farms was 11 times greater than that on farms that produced primarily for the recreational market. On a per-kg basis, however, regulatory costs were 30% greater for producers that primarily sold into the recreational as compared to foodfish markets. Farms selling to recreational markets also had greater (4.4 times greater) costs per kg from the value of lost markets. Overall, the value of total lost revenue due to regulatory action averaged 30% and 27% of total costs, respectively, for foodfish and recreational-based farms.

Effluent discharge regulatory actions constituted high percentages of the regulatory costs (67%) and lost revenues (91%) for foodfish producers. For recreational salmonid farms, fish health costs were proportionately greater (31% of regulatory costs and 71% of lost revenue) than on foodfish farms.

The majority of regulatory costs were fixed costs. To manage greater fixed costs requires expanding the size of the farm to spread greater fixed costs across greater production. Study findings, however, showed that the regulatory system forced farms to reduce the scale and also prevented them from selling into existing markets. The combination of lost production and lost sales further decreased the overall scale of the farm. Thus, the regulatory system has forced farms to reduce their production scale and hindered them from taking the steps necessary to adjust effectively to increased regulatory fixed costs.

Respondents reported generally good demand for trout, as interest in locally raised food has increased. Yet more than half of respondents knew of farms that had been driven out of business by the regulatory framework, and volumes of imported salmonids have increased rapidly in recent years. U.S. consumers are demanding more locally grown foods; yet the on-farm regulatory burden appears to be contributing to a decline in domestic production of salmonid products that are desired by U.S. consumers. Study results show a strong need for attention to be paid to reducing those portions of farm-level regulatory costs that are duplicative and redundant.

IMPACTS:

Title: The Economic Impact of Regulations on Shellfish and Trout Aquaculture Growth in the Western United States

Relevance:

While regulations are developed in response to desires to improve quality of life of U.S. citizens, the suite of regulations that affect U.S. aquaculture often overlap, trigger other permitting requirements, and frequently result in a lengthy and convoluted chain of approvals. There is growing concern that the regulatory framework in the U.S. has contributed to declines in several sectors of U.S. aquaculture in addition to preventing growth of others. Yet there has been no attempt to measure the economic effects of the total regulatory regime on West Coast shellfish and trout farms.

Response:

West Coast shellfish and U.S. trout farms were surveyed to collect farm record data on the actions taken by farms to comply with the total sets of regulations with which they must comply and the associated costs.

Results:

Quantitative estimates of increased costs due to local, state, federal, and federally mandated state regulations demonstrated the types of regulations and the corresponding reporting, monitoring, and compliance requirements that have created the greatest adverse economic effects on U.S. trout/salmon and West Coast shellfish farms. Quantifying these impacts provides a basis for changes that would streamline regulatory processes to reduce the on-farm regulatory burden and promote growth and development of sustainable U.S. aquaculture in accordance with the goals of the 1980 National Aquaculture Act.

The value of the original proposal (limited to Western region trout farms) was such a high priority that U.S. Trout Farmers Association and USDA-APHIS contributed funding to expand the project nationally for trout and salmon farms. Consequently, this has and will continue to increase the impact from this study.

Impacts:

Project results have increased awareness of the magnitude of the regulatory cost burden on U.S. aquaculture farms and stimulated increased numbers of discussions and meeting related to ways to reduce on-farm regulatory costs.

Project results are being used by various aquaculture associations in discussions with policymakers related to the types of reforms necessary to reduce the on-farm cost burden while maintaining adequate oversight. These have included:

- At the 2017 meeting of the Pennsylvania Aquaculture Advisory Council, "Your study on regulatory costs of trout is a really important study." Invited presentations were made to the Inter-agency Working Group on Aquaculture and the USDA-ERS in 2018.
- In 2017: A 1-page briefing summary of results from the Pacific Coast Shellfish Survey was distributed by the Pacific Coast Shellfish Growers Association to members of Congress during a Walk-on-the-Hill.
- In 2018, Preliminary results were submitted in response to the request for comments on streamlining regulatory processes and reducing regulatory burden by the National Oceanic and Atmospheric Administration, Department of Commerce.
- 2019: Project results were used by the National Aquaculture Association to ask the Environmental Protection Agency (EPA) to reduce frequency of testing for discharge. In response, EPA conducted a follow-up analysis of permitting and sampling, with follow-up meetings held to request additional reforms by EPA to reduce frequency of testing discharge water on farms with no history of violations.
- 2019: Project results used by NAA during a Walk-on-the-Hill and summaries provided to members of Congress.
- 2019: Results used in a report presented by Jonathan van Senten to Director Sawyers, Office of Wastewater Management, EPA, in a June 25, 2019 meeting requested by NAA.
- 2019: Results used in review by NAA of a different project that is comparing U.S. aquaculture regulations to FAO guidelines, to urge the project team to not ignore the importance of state laws, regulations, and enforcement (the project team had been considering only federal regulations in spite of the fact that many of the regulatory compliance implementation and enforcement is the responsibility of state agencies in the U.S.).
- 2019: A new grant has been funded by USDA-NIFA to measure the on-farm regulatory cost burden on East Coast shellfish, catfish, tilapia, hybrid striped bass, and Florida tropical farms. The WRAC data and results provided justification for this work and demonstration of successful methods to measure regulatory costs on farms.
- 2019: Engle has been asked to deliver a workshop to FDA-CVM related to ways that FDA can potentially reduce on-farm regulatory costs of aquaculture producers.

Collaborators:

*Dr. Michael H. Schwarz, Virginia Polytechnic Institute and State University
*Dr. Carole R. Engle, Engle-Stone Aquatic$ LLC, Virginia Polytechnic Institute and State University
*Dr. Jonathan van Senten, Virginia Polytechnic Institute and State University
*Gary Fornshell, University of Idaho
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*Dr. William Hanshumaker, Oregon State University
*Bobbi Hudson, Pacific Shellfish Institute
Outreach Coordinator: Gary Fornshell
Industry Advisor: Bill Dewey, Taylor Shellfish Farms, Shelton, Washington
Other: US Trout Farmers, Pacific Coast Shellfish Growers, Extension Aquaculture Specialists, USDA-APHIS

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PUBLICATIONS, MANUSCRIPTS, AND PAPERS PRESENTED:

See attached list.

Carole R. Engle

SUBMITTED BY: _____October 7, 2019_____
Work Group Chair Date

APPROVED: _____
Project Monitor Date

PUBLICATIONS, MANUSCRIPTS, OR PAPERS PRESENTED:

Publications and Manuscripts

Journal Articles

Engle, C.R., J. van Senten, and G. Fornshell. 2019. Regulatory costs on U.S. salmonid farms. Journal of the World Aquaculture Society 50(3):522-549. doi.org/10.1111/jwas.12604.

Fact Sheets: All fact sheets are available at:

http://depts.washington.edu/wracuw/front%20page/Effects-of-Regulations_Engle.html AND

https://www.arec.vaes.vt.edu/arec/virginia- seafood/research/Regulatory_cost_ US_salmonids. html

Engle, C.R., J. van Senten, and G. Fornshell. 2019. The effects of regulations on the U.S. salmonid industry: National findings. WRAC Fact Sheet, Western Regional Aquaculture Center, University of Washington, Seattle, Washington. Available at:

Engle, C.R., J. van Senten, and G. Fornshell. 2019. The effects of regulations on the U.S. salmonid industry: Colorado findings. WRAC Fact Sheet, Western Regional Aquaculture Center, University of Washington, Seattle, Washington.

Engle, C.R., J. van Senten, and G. Fornshell. 2019. The effects of regulations on the U.S. salmonid industry: Coastal States findings. WRAC Fact Sheet, Western Regional Aquaculture Center, University of Washington, Seattle, Washington.

Engle, C.R., J. van Senten, and G. Fornshell. 2019. The effects of regulations on the U.S. salmonid industry: Idaho findings. WRAC Fact Sheet, Western Regional Aquaculture Center, University of Washington, Seattle, Washington.

Engle, C.R., J. van Senten, and G. Fornshell. 2019. The effects of regulations on the U.S. salmonid industry: Michigan findings. WRAC Fact Sheet, Western Regional Aquaculture Center, University of Washington, Seattle, Washington.

Engle, C.R., J. van Senten, and G. Fornshell. 2019. The effects of regulations on the U.S. salmonid industry: Midwest States findings. WRAC Fact Sheet, Western Regional Aquaculture Center, University of Washington, Seattle, Washington.

Engle, C.R., J. van Senten, and G. Fornshell. 2019. The effects of regulations on the U.S. salmonid industry: New York findings. WRAC Fact Sheet, Western Regional Aquaculture Center, University of Washington, Seattle, Washington.

Engle, C.R., J. van Senten, and G. Fornshell. 2019. The effects of regulations on the U.S. salmonid industry: North Carolina findings. WRAC Fact Sheet, Western Regional Aquaculture Center, University of Washington, Seattle, Washington.

Engle, C.R., J. van Senten, and G. Fornshell. 2019. The effects of regulations on the U.S. salmonid industry: Ohio findings. WRAC Fact Sheet, Western Regional Aquaculture Center, University of Washington, Seattle, Washington.

Engle, C.R., J. van Senten, and G. Fornshell. 2019. The effects of regulations on the U.S. salmonid industry: Pennsylvania findings. WRAC Fact Sheet, Western Regional Aquaculture Center, University of Washington, Seattle, Washington.

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Engle, C.R., J. van Senten, and G. Fornshell. 2019. The effects of regulations on the U.S. salmonid industry: Wisconsin findings. WRAC Fact Sheet, Western Regional Aquaculture Center, University of Washington, Seattle, Washington.

Infographics: All infographics are available at:

http://depts.washington.edu/wracuw/front%20page/Effects-of-Regulations_Engle.html AND

https://www.pubs.ext.vt.edu/tags.resource.html/pubs_ext_vt_edu:government-programs-policy

Engle, C.R., J. van Senten, and G. Fornshell. 2019. The effects of regulations on the U.S. salmonid industry: National findings. WRAC Infographic, Western Regional Aquaculture Center, University of Washington, Seattle, Washington.

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Engle, C.R., J. van Senten, and G. Fornshell. 2019. The effects of regulations on the U.S. salmonid industry: Midwest States findings. WRAC Infographic, Western Regional Aquaculture Center, University of Washington, Seattle, Washington.

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Media Articles

Engle, C.R., J. van Senten, and G. Fornshell. 2019. Regulatory costs on U.S. salmonid farms. Trout Talk Newsletter. United States Trout Farmers Association, Spring, 2019.

Engle, C., J. van Senten, G. Kumar, E. Cassiano, M. DiMaggio, C. Watson, and F. Asche. 2019. What do regulations cost your aquaculture farm business? Fish Farming News, August, 2019.

Abstracts

van Senten, J. and C. Engle. 2019. The economic effect of permitting delays on Pacific Coast shellfish aquaculture. Abstract. Annual meeting of the Pacific Coast Shellfish Growers Association, Portland, Oregon, September 17, 2019.

van Senten, J. and C.R. Engle. 2019. Regulatory compliance costs on West Coast shellfish farms. Abstract. Aquaculture America 2019. New Orleans, LA.

van Senten, J. and C.R. Engle. 2019. U.S. interstate trade regulation for aquaculture: what is the cost to U.S. producers? Abstract. Aquaculture America 2019. New Orleans, LA.

Engle, C.R. and J. van Senten. 2018. Measuring the costs of regulations in aquaculture. Fish Farming News Issue 4.

Engle, C.R. and J. van Senten. 2018. The regulatory cost burden on U.S. aquaculture farms. Abstract. Aqua 2018, World Aquaculture Society, Montpellier, France.

van Senten, J. and C.R. Engle. 2018. The cost of regulatory compliance on West Coast shellfish farms. Abstract. National Shellfish Association Annual Meeting, Seattle, March 18-22, 2018.

van Senten, J. and C.R. Engle. 2018. The farm-level effects of regulations on US trout producers. Abstract. Aquaculture America 2018. Annual Meeting of the U.S. Aquaculture Society and the National Aquaculture Association. Policies and Permitting Session, San Antonio, Texas, February 23, 2018.

van Senten, J. and C.R. Engle. 2018. The costs of regulatory compliance on West Coast shellfish farms: effects and impacts on producers. Abstract. Aquaculture America 2018. Annual Meeting of the U.S. Aquaculture Society and the National Aquaculture Association. Policies and Permitting Session, San Antonio, Texas, February 22, 2018.

van Senten, J. and C.R. Engle. 2017. The regulatory burden: types of economic effects on West Coast shellfish farms. Abstract. Annual Meeting of the National Shellfish Association, Knoxville, Tennessee.

Press articles for the past year that reference this project include:

- 10/5/2018 Engle quoted on trout regulatory costs in "Raising Fish: Aquaculture business Growing in Somerset County." Daily American.
- 12/28/2018 Fornshell quoted on project results in article "Western Innovator: A Fish Farmer's Best Friend." Capital Press.
- 3/11/2019 Engle interviewed by Jason Smith of Undercurrent News.
- 9/2019 Fornshell quoted in article in Aquaculture North America, "It's a Tough Business, but Science Offers Hope."
- 9/9/2019 Fornshell quoted in article in Aquaculture North America, "Survey Reveals Extent of Financial Burden on US Trout Farmers."
- 9/6/2019 NAA Update: WRAC Posts US Salmonid Farming Regulatory Impact Fact Sheets, Video and More.
- 9/6/2019 Washington Fish Growers Association web page: WRAC Posts Salmonid Farming Regulatory Impact Sheets, Video and More.
- 8/2019 Fish Farming News Article: What do regulations cost your aquaculture farm business?
- 9/18/2019 NAA Update: What do Regulations Cost Your Aquaculture Farm Business?
- 9/27/2019 CAA article: WRAC: Results from a study on the regulatory costs on U.S. salmonid farms.
- 10/1/2019 US Marine Aquaculture communication Toolkit Newsletter reported on salmonid regulatory cost fact sheets and infographics and posted link.

Presentations:

van Senten, J. and C. Engle. 2019. The economic effect of permitting delays on Pacific Coast shellfish aquaculture. Annual meeting of the Pacific Coast Shellfish Growers Association, Portland, Oregon, September 17, 2019.

Fornshell, G. and J. Mollison. 2019. Regulatory Costs on U. S. Trout Farms: Fact Sheets, Infographics and World Premiere Video – Let's Start the Conversation about Regulations! U.S. Trout Farmers Association Fall Conference. Seattle, WA. September 5, 2019.

Fornshell, G. , C.R. Engle and J. van Senten. 2019. Regulatory costs on U.S. trout farms. Middle Snake Regional Water Resource Commission. Twin Falls, ID. June 19, 2019.

van Senten, J. and C.R. Engle. 2019. Regulatory effects on the value of shellfish aquaculture, Jan. 19, 2019. East Coast Commercial Fisherman's & Aquaculture Trade Exposition. (*January 19, 2019*).

van Senten, J. and C.R. Engle. 2019. Final version of the trout economic study. Colorado Aquaculture Association Annual Meeting, Colorado. (*February 1, 2019*).

Engle, C. and J. van Senten. 2019. Cost of trout regulation update. Aquaculture America 2019. New Orleans, LA. (*March 9, 2019*).

van Senten, J. and C.R. Engle. 2019. Regulatory compliance costs on West Coast shellfish farms. Abstract. Aquaculture America 2019. New Orleans, LA. (*March 11, 2019*).

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Engle, C.R. and J. van Senten. 2018. The regulatory cost burden on U.S. aquaculture farms. Aqua 2018, World Aquaculture Society, Montpellier, France. (*August 27, 2018*).

van Senten, J. and C.R. Engle. 2018. The farm level effects of regulations on U.S. trout producers. 2018 Annual Meeting, Idaho Aquaculture Association. (*June 2, 2018*).

van Senten, J. and C.R. Engle. 2018. The effects of the regulatory environment on U.S. aquaculture producers. USDA Economic Research Service Seminar, Washington, D.C. (*April 9, 2018*).

Engle, C.R. and J. van Senten. 2018. Why are U.S. aquaculture producers so concerned about regulations? Inter-Agency Working Group on Aquaculture, Washington, D.C. (*April 9, 2018*).

van Senten, J. and C.R. Engle. 2018. The effects of the regulatory environment on U.S. aquaculture producers. ISS, Maryland, March 26, 2018. 2018 Interstate Seafood Seminar, Rehoboth Beach, Del. (*March 27-29, 2018*).

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