SUPPORTING STATEMENT
U.S. Department of Commerce
National Oceanic & Atmospheric Administration
Estimating the Economic Burden of *Vibrio parahaemolyticus* in Washington State Aquaculture
OMB Control No. 0648-xxxx

PART B

COLLECTIONS OF INFORMATION EMPLOYING STATISTICAL METHODS

1. **Describe (including numerical estimate) the potential respondent universe and any sampling or other respondent selection methods to be used. Data on the number of entities (e.g., establishments, State and local government units, households, or persons) in the universe covered by the collection and in the corresponding sample are to be provided in the tabular form for the universe as a whole and for each of the strata in the proposed sample. Indicate expected response rates for the collection as a whole. If the collection had been conducted previously, include the actual response rates achieved during the last collection.**

   From our project partners, we have developed a contact list of 90 growers, 18 managers (including project partners), and 20 restaurants. This is all oyster growers registered with either or both Pacific Coast Shellfish Growers Association or the Department of Natural Resources, all managers that deal with Vibrio as part of their job description, and all restaurants who have had Vibrio traceback investigations in the last year. We plan to include the whole respondent universe, and expect a 75% response rate based on previous interviews and surveys with a similar population (studies by Jonathan van Senten and Stephanie Moore, as described in part A, question 4). The universe will be divided as follows:

Managers	Washington State agencies	4 individuals, 2 agencies
	County agencies	14 individuals, 6 counties
Growers	X-small (<10 acres)	55 individuals
	Small (10 to <100 acres)	25 individuals
	Medium (100 to <500 acres)	8 individuals
	Large (>= 500 acres)	2 individuals
Restaurants/Retail		20 individuals

2. **Describe the procedures for the collection of information including:**
   - **Statistical methodology for stratification and sample selection**
   - **Estimation procedure**
   - **Degree of accuracy needed for the purpose described in the justification**
   - **Unusual problems requiring specialized sampling procedures, and**
   - **Any use of periodic (less frequent than annual) data collection cycles to reduce burden**

   This collection will be a census because the overall target population is well-defined and small and a census rather than sampling will reduce sample bias.

The strata listed in question 1 mirror work by Jonathan van Senten and will be used to contextualize our findings in other regulatory and industry costs calculated as part of his study. The count per category among growers will also be confirmed by the first question in the interview, as farm size is under-reported in official documentation. This is also mirrors the Van Senten study, and was recommended by the Pacific Shellfish Growers Association as a preferred methodology. The strata also correspond to industry-relevant thresholds, each of which represents a scale of business requiring more training, equipment, and staff, which has implications for the costs associated with dealing with Vibrio. For example, an extra-small operation will have a single boat and is generally a two-person, household-based business, so costs would be restricted to a smaller set of possible purchases.

We understand that there are other ways that nonresponse bias may be introduced but it is the one we are choosing to control for because the larger businesses are likely to have many more ways of responding to Vibrio. For example, they may have more equipment at hand to choose from, multiple oyster leases on which to place their crop or relay infected oysters in order to avoid bacterial growth, or enough distributors to choose from that one case won't disrupt the product chain. Given our relatively small sample size, it is only practical to stratify along one metric in order to have enough respondents per category. We will follow up with nonresponders or ask at the time of refusal their business size and why they chose not to participate to detect potential nonresponse bias (e.g. if farms dealing with Vibrio tracebacks state they do not have time to participate).

3. **Describe methods to maximize response rates and to deal with issues of non-response. The accuracy and reliability of information collected must be shown to be adequate for intended uses. For collections based on sampling, a special justification must be provided for any collections that will not yield "reliable" data that can be generalized to the universe studied.** In order to maximize response rates, we are offering phone or in-person options for participation, which members of the respondent pool have told us are the preferred form of contact, so that they can continue with daily activities while answering questions. This flexibility has been shown to boost response rates in a variety of settings[1]. In addition, we will tell respondents the topics of the questions and that we will be asking about expenses so that they can adequately prepare beforehand, either by referencing purchase records or taking time to remember.

   We are planning a census of the relevant population. For unit non-response cases, we will impute the average cost of their sampling strata. For example, if a medium-sized farmer does not participate, we will calculate that farm's expenses based on the average costs for each expense category in the other medium-sized farms. For item non-response (where a respondent skips a question), we will use multiple imputation[2], taking into account the answers that the respondent did give to estimate the missing value.

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[1] De Leeuw, E. 2005. To Mix or Not to Mix Data Collection Modes in Surveys. *Journal of Official Statistics* 21(2): 233-255.

[2] Multiple Imputation in a Nutshell. [available online: https://www.theanalysisfactor.com/multiple-imputation-in-a-nutshell/]

4. **Describe any tests of procedures or methods to be undertaken. Testing is encouraged as an effective means of refining collection of information to minimize burden and improve utility. Tests must be approved if they call for answers to identical questions from 10 or more respondents. A proposed test or set of tests may be submitted for approval separately or in combination with the main collection of information.**
   We consulted with someone for each of the modules who works in that field as part of the interview guide creation process, performing the interview and then asking for feedback after completion. Two staff from the Phillips Wharf Environmental Center (who are part of a grower's education program), one restaurant manager from a seafood restaurant, one former restaurant supplier, and one member of a surveillance program laboratory all reviewed the interview guide. Each suggested minor wording changes to the relevant portion of the interview guide, confirmed the timing was reasonable, and that the topic was relevant to current concerns.

5. **Provide the names and telephone number of individuals consulted on statistical aspects of the design and the name of the agency unit, contractor(s), grantee(s), or other person(s) who will actually collect and/or analyze the information for the agency.**
   Our conceptual model of costs of Vibrio was thoroughly reviewed during a workshop at the 2018 Pacific Coast Shellfish Growers Association. We used a conceptual modeling approach because it is a good way for stakeholders from multiple sectors to put their ideas in a shared model[3]. The model parallels the calculation of health costs using a causal chain established by USDA scientists[4] with factors included in economic studies of the HACCP regulations for food safety[5]. Workshop attendees then amended the model to fit the oyster industry of Washington and more recent regulatory context. The workshop was attended by about 40 people, including shellfish managers, growers, distributors, and researchers. We provided a draft model and facilitated a participatory model-building exercise to add components to the model and restructure it according to their perceptions of how costs are laid out. They suggested a two-part model to be able to compare the costs of a successful year of Vibrio management (i.e., no cases reported) with the costs of a year where a consumer gets sick with Vibrio. These completed models are shown in Figures 1 and 2; these are additive models.

Figure 1 Cost model part A: daily prevention practices and expenses. Colors represent respondent pools: green is managers, orange is growers, dark blue is restaurants (each of which has a corresponding module in the interview guide). Numbers in each bubble correspond to the question number that will collect data for that piece of the supply chain impacts.

[3] Freitag, A., H. Townsend, J. Vasslides. 2019. Are you thinking what I'm thinking? A conceptual modeling approach to understand stakeholders' assessment of the fate of Chesapeake Oysters. *Marine Policy* 99: 99-110.
[4] Hoffman, S., B. Maculloch, M. Batz. 2015. Economic Burden of Major Foodborne Illnesses Acquired in the United States, EIB-140, US Department of Agriculture, Economic Research Service, May 2015.
[5] Cato, J. 1998. Economic values associated with seafood safety and implementation of seafood Hazard Analysis Critical Control Point (HACCP) programmes. *FAO Fisheries Technical Paper* No 381. Rome, FAO. 70p.

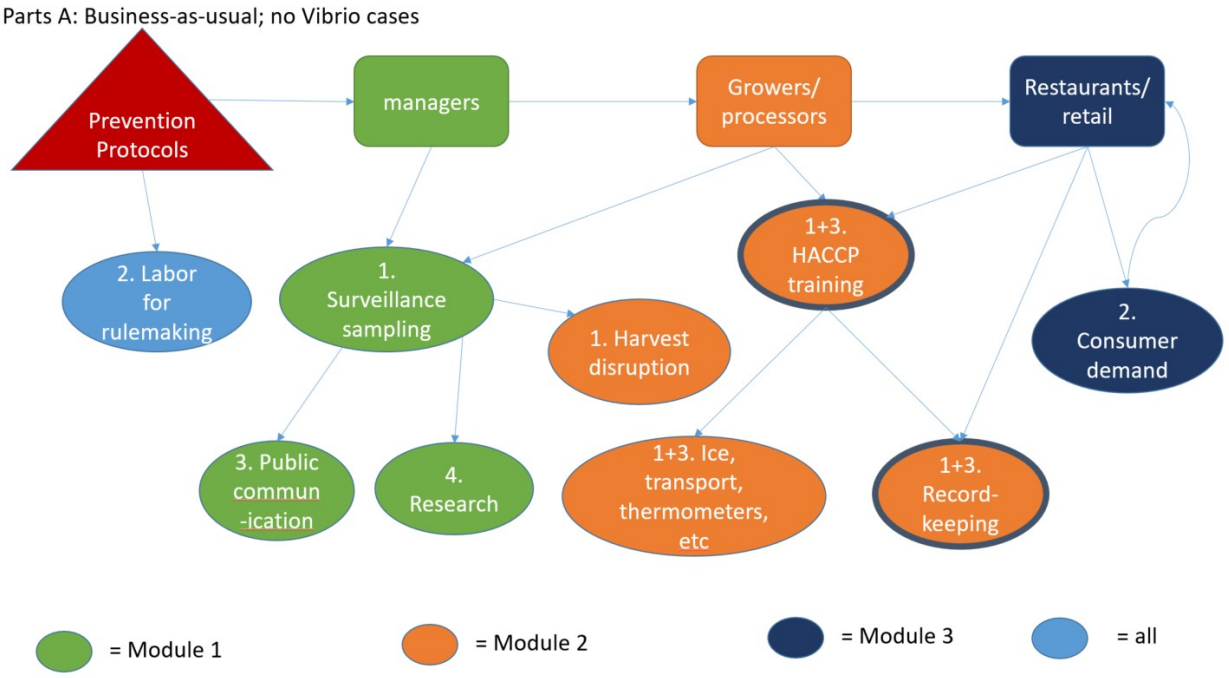
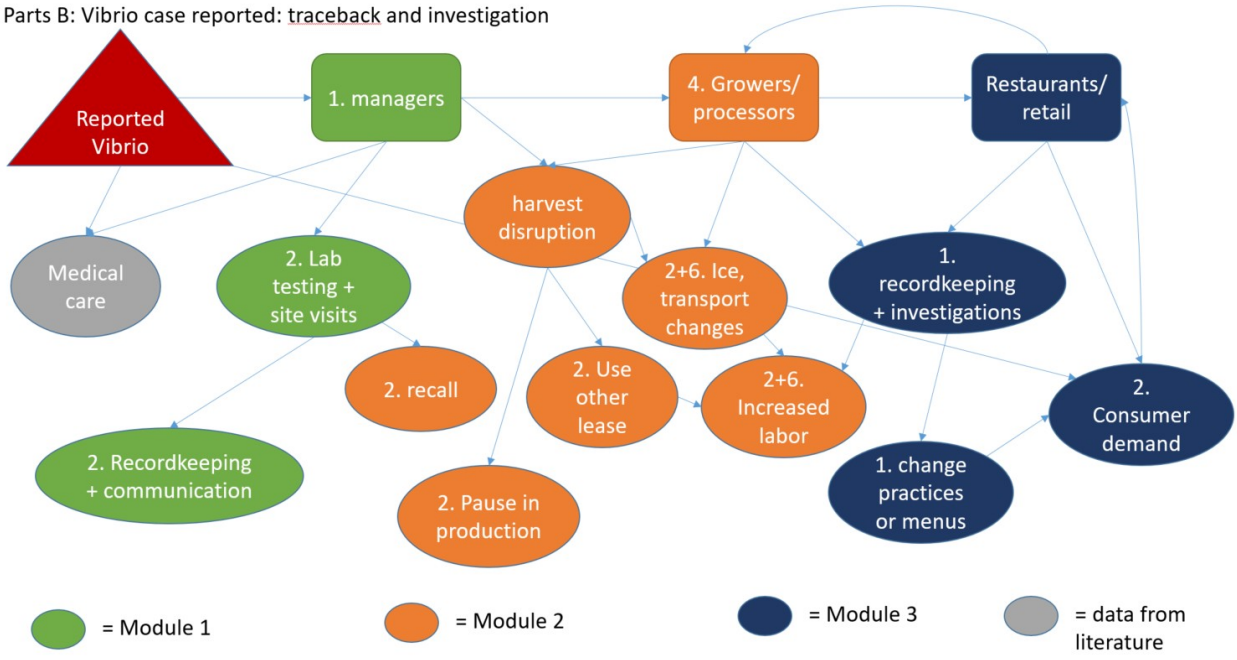


Figure 2 Cost model part 2: traceback and investigation when a Vibrio case reported (each of which has a corresponding module in the interview guide). Numbers in each bubble correspond to the question number that will collect data for that piece of the supply chain impacts.



We had a number of NOAA project partners and social science team members each review the interview guide, conceptual model, and analytical methods, including Leif Anderson, PhD (Northwest Fisheries Science Center), Chloe Fleming (NCCOS), Seann Regan (NCCOS), Jarrod

Loerzel (NCCOS), Matt Gorstein (NCCOS), and Sarah Gonyo (NCCOS). Each suggested minor wording changes to questions, and splitting a few of the questions for easier understanding.

We also requested external review of the draft interview guide and this supporting statement by to methods experts. Jonathan van Senten, PhD (Virginia Tech, jvansenten@vt.edu) has direct experience with our desired respondent pool, as he has conducted a survey in the region on the economic burden of regulation. His review suggested a number of wording changes to help with specificity of answers as well as emphasizing the importance of the flexibility in the question order in order to accommodate non-sequential lines of thought. The second reviewer, Luke Fairbanks, PhD (Colorado State University, 774-644-1425), has a research portfolio focusing on aquaculture policy and economic development. His biggest overall comment was about the level of recall required for a few of the questions, and that a heads up that we'll be asking such things might be useful in the invitation so they can be prepared. Other comments were about question specificity and possibly breaking them apart to be several, shorter, questions rather than one bigger one. Both thought expected burden seemed reasonable, given options for response format and promises of confidentiality.

The interviews will be conducted by the project team:

- John Jacobs, PhD: NCCOS, Cooperative Oxford Laboratory
- Amy Freitag, PhD: NCCOS, Biogeography Branch, CSS Inc.
- Leif Anderson, PhD: Northwest Fisheries Science Center
- TBD student under Leif Anderson, Northwest Fisheries Science Center

In order to ensure consistency across interviewers, we will follow the training protocol of the Northwest Fisheries Science Center (author Stephanie Moore) and have regular team check-ins to address issues as they arise and ensure consistent methodology over the course of the project. Leif will be the local point-person for questions that need addressing between check-ins. This same team will analyze the data, bringing in project partner Erika Atherly (Washington Department of Health).

Appendix 1: Literature review of economic burden of Vibrio parahaemolyticus, by topic.

authors	year	journal	supply chain economics	health losses	care costs	infection rates	genetics	ecology	medical	climate change	legal	gear/product testing	economics in shrimp	not about Vibrio	recognizes Vibrio health costs but no numbers	cost of prevention justification for research
Scharff	2012	Journal of food protection		1												
Kubota et al	2008	Foodborne Pathogens and Disease				1										
Hoffman et al	2015	Economic Information Bulletin		1	1	1										
Hoffman et al	2012	Journal of food protection		1												
Buzby and Roberts	1997	World health statistics quarterly													1	
Chen et al	2017	Frontiers in Microbiology													1	1
Todd	1989	Journal of food protection		1	1	1										
Hossain et al	2013	Journal of applied microbiology													1	1
Larsen et al	2015	International journal of food microbiology						1								1
Majowicz	2010	Clinical infectious disease												1		
Archer and Kvenberg	1985	Journal of food protection		1		1										1
Chen et al	2012	Epidemiology and Infection								1				1		
Kubota et al	2011	Journal of food protection		1	1											
Sockett	1993	Food Policy												1	1	
Lee et al	2007	Journal of pediatrics and child health												1		
Ralston	2011	Journal of water and health		1	1	1										
Christou	2011	Clinical Microbiology and Infection				1										
Thomas et al	2013	Foodborne Pathogens and Disease				1										
Han et al	2015	Frontiers in Microbiology					1								1	
Di Pinto et al	2012	Letters in applied microbiology					1									
Minor et al	2015	Risk Analysis			1	1										

Kinsey et al	2015	Journal of food protection						1								
WHO	2015	WHO publications				1										
Batz et al	2014	Foodborne Pathogens and Disease		1	1	1										
Aji et al	2013	International journal of environmental research												1		
Okeke et al	2005	Lancet												1		
Snowdon et al	2002	Foodborne Diseases (book)												1		
Epstein and Mills	2005	Climate change futures: health, ecological and economic dimensions (book)												1		
Lafferty et al	2015	Annual review of marine science														1
Weaver and Ehrenkranz	1975	Archives of internal medicine			1				1						1	
Aranda et al	2015	Foodborne Pathogens and Disease						1								1
Stewart and Elliott	2015	Trends in food science and technology								1					1	1
Ebi	2009	Current Opinion in Environmental Sustainability								1					1	
Wesley	2009	Microbiologically safe foods													1	1
Muth et al	2000	Research Triangle Institute Project 7466.000	1									1				
Legat et al	2016	Journal of the Marine Biological Association of the United Kingdom						1								1
Riewpaiboon et al	2008	Journal of health, population, and nutrition			1											
Grodner and Land	1991	FL Sea Grant Program										1				
Henson et al	2000															1
Pal	2005	Indian Journal of Animal Sciences													1	1
Fening and Edoh	2009	International Journal of Epidemiology							1							
Paranjype et al	2015	FEMS Microbiology						1		1						
Bartsch et al	2018	Public Health Reports	1											1		1
Glasgow et al	2013	Journal of health, population, and nutrition				1										

Akhtar et al	2014	Critical reviews in microbiology													1	1
Cato	1998	Seafood safety: economics of hazard analysis and critical control point (HACCP) programs (book)	1									1				1
Buzby and Frenzen	1999	Food Policy									1					
Bonnin-Jusserand et al	2019	Critical reviews in food science and nutrition					1									
Odeyemi and Sani	2016	Future Science				1			1							
Henson et al	2004	Agriculture and the New Trade Agenda: Creating a Global Trading Environment for Development (book)														1
Leyton et al	2011	Marine drugs										1				
Shinn et al	2018	Asian Fisheries							1			1				
WHO	2003	Foodborne Disease in OECD Countries Present State and Economic Costs (book)		1	1	1										1
Scallan et al	2011	Emerging Infectious Diseases				1				1						
Toyofuku	2014	Elsevier journal (Japanese)				1										
Campa-Cordova et al	2017	Journal of fish diseases						1				1				
Gonzalez-Escalona et al	2005	Emerging Infectious Diseases					1		1							
Henson et al	2003	FAO ESA Working Paper No 03-19													1	1
On and Rahayu	2017	Asia_Pacific Journal of Food Safety and Security		1	1	1										
Hua and Apun	2013	Research Journal of Microbiology						1				1				
Shinn et al	2018	Asian Fisheries Science S											1			
Chae	2007	Low-temperature post-harvest processing for reducing Vibrio parahaemolyticus and Vibrio vulnificus in raw oysters (dissertation)										1				1

Minguez-Rodriguez	2010	Vibrios in the environment Biloxi, Mississippi, USA (book)					1	1								
Caminade et al	2010	Annals of the New York Academy of Sciences								1						
Capalbo et al	2010	The Oregon Climate Assessment Report (book)								1						
Stentiford et al	2017	PLoS								1			1			
Red and Coast	2000	A Practical Guide for Materials Managers and Supply Chain Managers to Reduce Costs and Improve Environmental Performance. (book)												1		
Forsythe	2011	The microbiology of safe food (book)				1										
Supakankunti et al	2001	Valuing Health and Economic Costs of Water Pollution in Thailand (report)		1	1	1										
Praveen et al	2013	Applied Environmental Microbiology												1		
Provincial et al	2013	International journal of food microbiology										1				
Groner et al	2016	Transactions of the Royal Society B								1			1			
Lin	2006	Chinese Journal of Public Health Management												1		
Wang et al	2015	Frontiers in Microbiology					1									
Reddington et al	2014	Biomolecular detection and quantification					1		1							
Jones	2011	US Patent 7905154										1				
Molins et al	2001	Food control										1				1
Wright et al	2009	Current Opinion in Biotechnology										1				1
Sanchez-Ortega et al	2014	The Scientific World Journal										1				
Bondad-Reantaso et al	2001	Report of a Workshop held in Bangkok, Thailand.						1								
Morin et al	2018	Current Environmental Health Reports						1		1						
Sudershan et al	2014	Epidemiology Research International				1										

Blintsis	2017	AIMS microbiology							1							
Semensza et al	2012	Critical reviews in environmental science and technology								1						
Lang and Sothea	2016	Addressing Acute Hepatopancreatic Necrosis Disease (AHPND) and Other Transboundary Diseases for Improved Aquatic Animal Health in Southeast Asia (book)											1			
Mateus et al	2014	Aquaculture										1				
Bagshaw et al	2018	Future Medicine												1		
Roland	1979	JAMA			1	1										
Batz et al	2011	University of Florida							1							
Coly et al	2013	Foodborne Pathogens and Disease				1					1	1				
Guthrie	1976	JAMA							1							
Spinu et al	2018	InTech							1	1						
Allnutt et al	2018	Frontiers in Microbiology					1									
Zheng et al	2013	Zhejian Journal of Preventive Medicine				1										
Hall	2002	Protecting the US food supply in a global economy: an expert gap analysis (book)													1	1
Cashin et al	2002	ABT Technical Report			1											
Lavilla-Pitogo	1991	Fisheries Research Society of the Phillipines						1					1			
Khan et al	2001	Public Health Reports							1		1					
totals			**3**	**11**	**13**	**22**	**8**	**11**	**11**	**12**	**3**	**15**	**5**	**13**	**13**	**21**