The Economic Impact of Shellfish Aquaculture in Washington, Oregon and California

Prepared for

Pacific Shellfish Institute

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Prepared by

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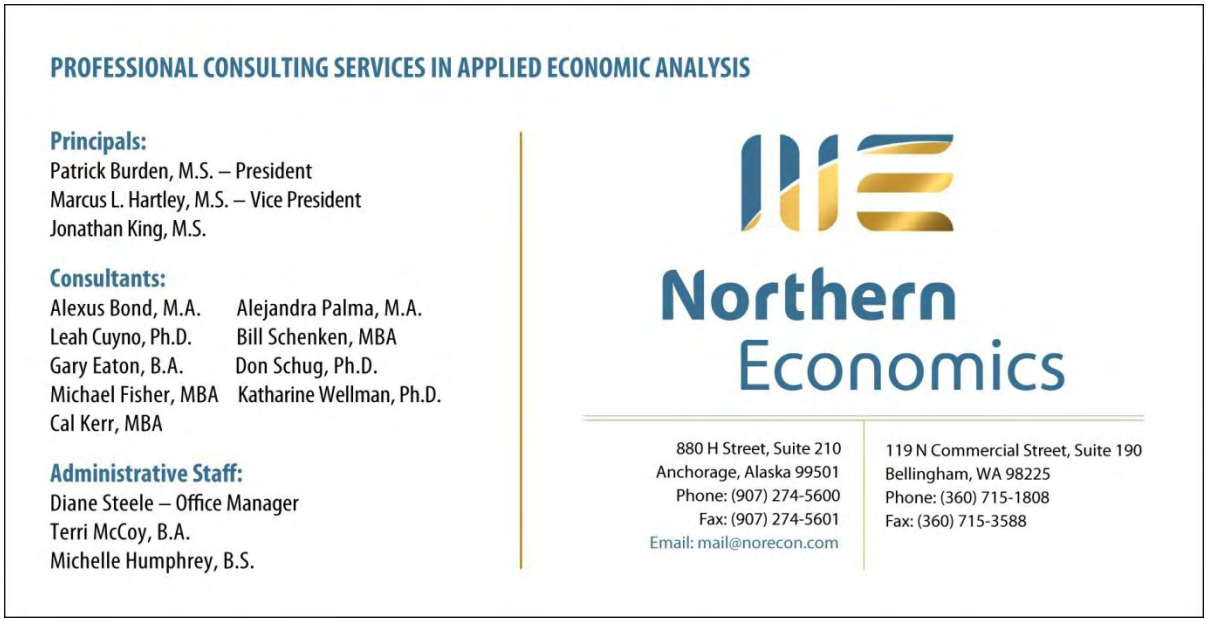

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Abbreviations

CDFW	California Department of Fish and Wildlife
I-O	Input-Output
NSSP	National Shellfish Sanitation Program
PSI	Pacific Shellfish Institute
WDFW	Washington Department of Fish and Wildlife

Executive Summary

The objective of this analysis was to assess the economic impact of shellfish aquaculture production in the states of Washington, Oregon and California. Our intent was to explicitly identify the production function of the industry through detailed interviews with key informants and a general survey of producers. The motivation for doing this research was to develop reliable economic information for policy makers managing local marine resources and global issues such as eutrophication of estuaries and effects of ocean acidification. The species covered include Pacific, Kumamoto, Eastern, European Flats, and Olympia Oysters, Manila, littleneck and geoduck clams, and Blue and Mediterranean mussels. These species are grown out on the ground, on the ground in bags or racked bags, and long line culture and are harvested using methods that include high pressure hoses, hand picking, and dredging.

To assess the economic impact of shellfish aquaculture in Washington, Oregon and California, Northern Economics implemented a survey of shellfish growers and conducted an Input-Output (I-O) analysis. I-O analysis is a modeling tool used to measure the economic effects of a project or industry using a matrix that tracks the flow of money between the industries within a specified economic region of interest. For the purpose of our analysis, the regions of interest were the states of Washington, Oregon and California. The model measures how many times a dollar is re-spent in, or "ripples" through, each of these states' economies before it leaks out. Indirect impacts quantify the effect of spending within the study region on supplies, services, labor, and taxes. Induced impacts measure the money re-spent in the study area as a result of spending by labor. Direct, indirect, and induced impacts sum to the total economic impacts of a project or industry. This analysis presents total impacts as economic output, jobs created, and labor income generated within the study area.

The study team used IMPLAN™ software to estimate economic impacts to the Washington, Oregon and California economies. IMPLAN is a software tool which uses information sourced from local and census sources to produce region-specific economic impact models. IMPLAN uses specific data on what inputs are needed to produce the goods or services for over 440 economic sectors, and county-specific data on what industries are available locally from which to purchase those inputs. This analysis used IMPLAN 2010 data. The limitation to most (not all) of the shellfish economic impact studies reviewed in the literature is that estimates are based on data which are not refined enough to develop an actual production function for the industry or use multipliers not directly reflective of the shellfish industry's' spending patterns. This study attempts to account for these limitations by collecting detailed expenditure data by type and location of each business. Table ES-1 outlines the summary statistics used to generate final results.

Table ES-1. Summary Statistics

	WA	CA	OR
Acres Reported	22,502	6,201	3043
Farmed Acres Reported (%)	62%	12%	32%
Total State Acres	29,663	6,201	5,011
Employment	1,266	204	0
Revenues/Sales ($)	90,296,206	25,856,668	9,313,300

Expenditures/Acre ($)	4,880	1,912	n/a
Reported Production (lbs)	19,009,588	1,792,795	n/a

n/a = not available

The study team estimates that the shellfish aquaculture industry in Washington spent approximately $101.4 million in the Washington economy in 2010, which in turn generated $184 million, or 1.8 times the activity. Shellfish farmers were responsible for approximately 1,900 direct jobs in 2010. They also generated an additional 810 jobs through indirect and induced activity, for a total of 2,710 jobs. Finally, shellfish farmers paid approximately $37 million in wages in 2010. Their economic activity generated additional labor income of $39.9 million, for a total of $77.1 million in labor income in the state of Washington.

The California shellfish aquaculture industry spent approximately $11.9 million in that state's economy in 2010, which in turn generated $23.3 million or 1.9 times the activity. Shellfish farmers were responsible for approximately 200 direct jobs in 2010. They also generated an additional 80 jobs through indirect and induced activity, for a total of 280 jobs. And, finally, shellfish farmers paid approximately $5.4 million in wages in 2010. Their economic activity generated additional labor income of $4.6 million, for a total of $10 million in labor income.

The study was unable to assess the complete range of economic impacts for Oregon due to data limitations. For Washington State and California, we were able to estimate direct, indirect, and induced impacts as well as identify related multipliers. The study team calculated the economic impacts differently for Washington and California, however, again due to different levels of detailed expenditure data collected. Since the team was able to collect detailed expenditure data for Washington, we were able to calculate the expenditures going to each supporting industry and whether those expenditures remained in the study area. The expenditure data reported through the general survey implemented in California demonstrated a pattern similar to that of Washington. As a result, the study team assumed the spending in the "other" category of expense was the same as in Washington and that expenditures remained in the study area. Because of the diverse nature of the data sets for each state, comparison of economic impacts between states is not meaningful. However, in general, the statistics generated in this study enhance our knowledge about the west coast shellfish aquaculture industry and can be used to inform management and policy decision making.

As noted in the study the results of our analysis apply specifically to commercial shellfish growers. Our analysis is not representative of the entire shellfish industry as wild and tribal harvest and shellfish bed restoration are not included. The study team believes tribal growers and harvesters, wild harvesters, and shellfish restoration activities have unique production and expenditure patterns and warrant further investigation. Finally, our study focuses on the economic impacts of the production of cultured shellfish only and did not include sales trends and demand factors. Another area of potential future research is the economic impacts of shellfish consumption. Residents and tourists of west coast communities all enjoy and benefit from the supply of fresh shellfish provided by the aquaculture industry. People purchase shellfish through retail markets, consume shellfish in restaurants, and enjoy local seafood fare at fundraisers and events. An investigation into the revenue generated through these types of shellfish sales could serve as a means to quantify additional economic impacts of the shellfish aquaculture industry.

1 Introduction

As the shellfish aquaculture industry grows on the west coast of the United States and around the world, growers and policymakers strive for a deeper understanding of the industry's economic impact on local regions. Assessing an industry's economic impact is a way to gain a deeper understanding of the role that industry plays in the local economy, thereby helping industry representatives and local policy makers to make informed decisions. This analysis of shellfish aquaculture extends from basic statistics such as total revenue and employment to more detailed information such as tax payments and employee wage rates. Even more telling is the industry's connection to the other industries that supply it with inputs. This last area of analysis helps explain shellfish aquaculture's broader impacts on other industries.

Several studies have attempted to estimate the economic impact of shellfish aquaculture in the United States. A study from the NOAA Fisheries Office of Habitat Conservation used an input-output model, to estimate that oysters worth $1 million in dockside value in Chesapeake Bay generate an estimated $36.4 million in total sales, $21.8 million in income, and 932 person-years of employment (NOAA undated). Gardner Pinfold Consulting Economists Ltd. (2003) and O'Hara et al. (2003) estimated the economic impacts of shellfish aquaculture in Maine, while Philippakos et al. (2001) utilized an input-output methodology to estimate the direct, indirect, and induced economic impacts of the cultured clam industry in Florida. Burrage et al. (1990) examined the regional economic impacts of a project intended to revitalize the northern Gulf Coast oyster industry by relaying oysters (moving oysters from leases under compromised water quality to leases in cleaner, approved waters before final harvest). Adams et al. (2009) report on the significant growth in economic impact of commercial cultured clams in Florida linked to strong demand for cultured shellfish, support by relevant agencies, and continued supply of high quality coastal water within the region. They estimated the economic impact to the Florida economy in 2007 to be $52 million. Note that these authors do not report where or how they derived the multipliers they used in their analyses. Koeger (2012) reports the economic impacts from two reef construction projects in Alabama and associated activities (reef monitoring and community workforce training) to be $8.4 million in local output, $2.8 million in earnings and 88 jobs created. The study estimates that these reef construction projects will inject $4.3 million into two local counties.

In Washington State, an early study by Bonacker and Cheney (1988) measured the direct economic impacts of shellfish culture in Willapa Bay. The study examined expenditure patterns of industry employees but did not calculate multiplier effects. According to a 1987 study of Washington's aquaculture industry conducted by the Washington State Department of Trade and Economic Development (Inveen 1987), the ratio of total jobs to direct jobs for the oyster industry was 1.17. That is to say, for every one job directly related to the industry, 0.17 additional indirect jobs were generated in other industries throughout the state. An economic impact analysis conducted in the early 1990s by Conway (1991) suggested that, on average, each job in Washington's oyster industry supported 1.13 additional jobs elsewhere in the state economy—this constitutes an employment multiplier for the oyster industry equal to 2.13. Wolf et al. (1987) of the Economic Development Council of Mason County estimated the economic impact of the County's oyster industry using the employment multiplier of 1.17 from the Washington State Department of Trade and Economic Development's 1987 study. The analysis was updated in

2002 using the same employment multiplier (Economic Development Council of Mason County 2002).

The limitation to most (not all) of the studies reviewed is that they estimate the economic impacts of projects related to shellfish aquaculture and restoration without gathering detailed expenditure data or with use of a multiplier not directly related to shellfish production. That is, much of the previous work did not collect the data necessary to generate a production function specific to shellfish aquaculture. This study attempts to account for these limitations.[1] The goal of this study was to collect the missing information needed to understand the economic impacts of the west coast shellfish aquaculture industry by gathering data directly from shellfish aquaculture growers. To that end, the study team surveyed growers in Washington, Oregon and California on their revenue, expenditures, and employment to measure industry levels of spending and employment in each state. The study team also gathered detailed expenditure data from seven Washington State shellfish growers to model the additional economic effects generated by shellfish growers in Washington and California.

1.1 Purpose

Knowledge of the economic impact of shellfish aquaculture is beneficial in several policy contexts. The economic model developed in this study can be applied to future shellfish aquaculture projects to understand their economic impacts. The quantification of the existing industry impacts demonstrates part of the economic loss that is possible from lost shellfish aquaculture production due to ocean acidification or water quality degradation. In addition, the economic impacts can illustrate the relative importance of shellfish aquaculture to other industries in the state.

Note that the economic impacts described in this report are only part of the total value of shellfish and shellfish production. Shellfish provide numerous benefits to society including food for human consumption and removal of nitrogen through bioextraction. The study *Washington State Shellfish Production & Restoration—Environmental and Economic Benefits and Costs* (http://pacshell.org/pdf/NMAIeconfinalreport.pdf) enumerates the full suite of these values and estimates a value for some of them in a series of memoranda. Northern Economics, Inc.'s 2010 report, *Assessment of Benefits and Cost Associated with Shellfish Production and Restoration in Puget Sound* (Northern Economics, 2010a) provides context for how economic impacts relate to the full valuation of shellfish production and restoration.

1.2 Report Organization

The following sections describe first the study methodology (Section 2), then the analysis of survey responses from Washington State (Section 3), Oregon (Section 4), and California (section 5). The final section discusses the study's conclusions (Section 6).

[1] The term 'shellfish aquaculture industry' in this report refers strictly to the cultivation of shellfish for market consumption or shellfish growers. We do not address the economic impacts of tribal, wild harvest, or restoration of shellfish beds.

2 Methodology

To assess the economic impact of shellfish aquaculture in Washington, Oregon and California, Northern Economics implemented a survey of shellfish growers and conducted an Input-Output (I-O) analysis. I-O analysis is a modeling tool used to measure the economic effects of a project or industry using a matrix that tracks the flow of money between the industries within a specified economic region of interest. For the purpose of our analysis, the regions of interest were the states of Washington, Oregon and California. The model measures how many times a dollar is re-spent in, or "ripples" through, each of these states' economies before it leaks out.

Expenditure data form the basis of an I-O analysis. For this analysis, the team collected shellfish aquaculture industry spending data through a major survey effort. This section of the report describes the data gathering effort (Section 2.1) and the study team's I-O approach (Section 2.2).

2.1 Surveys and Key Respondent Interviews

The development of the survey instrument for this study began with an NEI 2010 pilot study for this analysis. In this study, Northern Economics worked with one shellfish grower, going through their 2009 line-item expenditures to determine the sectors where shellfish growers make their largest purchases. We used the expenditure data to develop a pilot survey that two other growers completed. While the results of this work were never fed into an I-O analysis, Northern Economics gained insight into grower activities and documented other lessons learned.

Northern Economics, with input from the study team members and the Pacific Coast Shellfish Growers Association, developed this more recent project's survey. For the purposes of this study we used a hybrid approach.[2] Those respondents willing to share more detailed expenditure data would be interviewed and become "key respondents." Those willing to participate, but only prepared to share less-detailed information would be asked to complete a more general survey. All respondents were asked to report on 2010 production.

2.1.1 Key Respondent Interviews

The key respondent interviews were exhaustive, and provided the detailed data necessary to determine the shellfish aquaculture industry's spending patterns. Pacific Shellfish Institute (PSI) research biologist Bobbi Hudson conducted the key respondent interviews from May 2011to August 2012. For these interviews, PSI received complete expenditure data for 2010 from respondents in addition to the general survey data. The key respondent interviews provided the critical information that allowed for the proper coding of the industry and location of each supplier, and data for determining the purchasing patterns of each state's aquaculture industry, described in section 2.2.1.

The seven key respondents were all from Washington, and represented $27 million in expenditures, or 37 percent of the $72 million total Washington aquaculture industry expenditures estimated by this study. Key respondent interviews were not possible in Oregon

[2] We recognized that gathering detailed data from all growers would not be possible due to the hesitancy of some growers to provide sensitive business-related information.

and California. As a result, the study team generated I-O results for California using general responses and sector data spending patterns from Washington. Data collected in Oregon were insufficient for conducting an I-O analysis.

2.1.2 General Surveys

The general survey was easy for respondents to complete and provided the bulk of the data for gauging total industry spending. The study team developed slightly different general surveys for Washington, Oregon and California in order to accommodate their unique characteristics (please see Appendix A for a copy of each survey). Generally, the surveys provided the following information:

- Acres leased, owned, and under production
- Expenditures by category (payroll, capital purchases, fuel purchases, payments to government, etc.)
- Production by species and product type
- Gross sales

Bobbi Hudson administered the general survey to shellfish aquaculture producers between May and August 2012. A paper copy and cover letter were mailed to every certified shellfish "entity" in Washington (330), Oregon (42), and California (30). Licensed shellfish contact lists were obtained from the appropriate state agencies. Shellfish production data was established through the FDA's National Shellfish Sanitation Program (NSSP) (http://www.fda.gov/Foodfoodsafety/Product-SpecificInformation/Seafood/FederalStatesPrograms/NationalShellfish Sanitation portal/state permitting shelflish aq.pdf). NSSP dictates a license structure to protect human health and each state has a designated manager required to maintain monthly updated lists of licensed producers (Washington Department of Health, Oregon Department of Agriculture, and California Department of Fish and Wildlife respectively). Due to the license structure in each state, not all shellfish "entities" were a match for our target audience—shellfish growers with 2010 production numbers. In Washington "harvesters" were included because some harvesters maintain their own tidelands for commercial production. In Oregon there are so few "growers" (23); surveys were also mailed to "shellstock shippers" and "shellstock producers." In California, registered "aquatic farmers" included non-bivalves such as abalone and algae producers, which were eliminated from the survey. In Washington, the team also had email addresses for nearly all of the DOH registered shellfish producers, so non-respondents were emailed an additional request to fill out the survey with a link to an online copy. In Oregon, David Landkamer of Oregon Sea Grant called non-respondents to solicit responses. Ted Kuiper (formerly of Kuiper Mariculture) of California called or met with each grower to complete the survey, as well as followed up with several Oregon growers. All responses were mailed to Bobbi Hudson of PSI for input into Excel spreadsheets

2.2 Input-Output Analysis

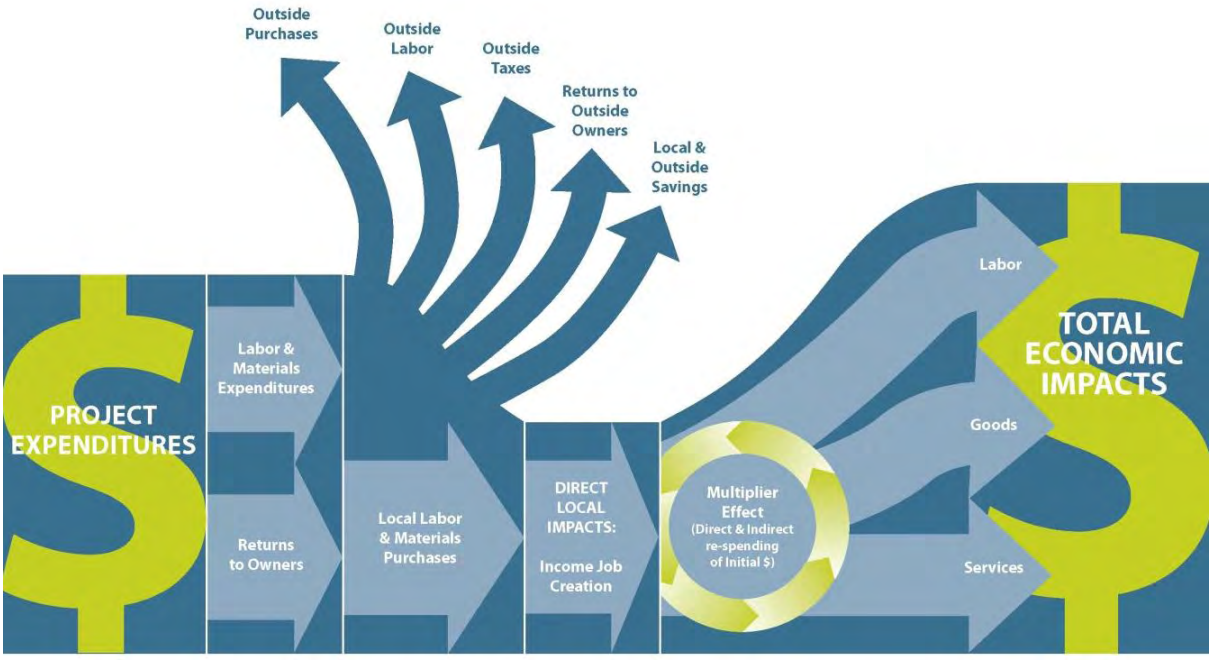
Economies are complex networks of relationships among businesses and people. I-O analysis is a modeling approach that economists use to map these complex relationships. An I-O model portrays an economy as a matrix of inputs and outputs; it allows economists to understand and

quantify how regional industries interact with one another. For the purpose of our analysis, I-O allows us to estimate what impact shellfish aquaculture has on the Washington, Oregon and California economies.

Figure 1 illustrates conceptually how an I-O analysis calculates economic impacts. The dollar sign on the left represents project or industry expenditures; in our case, this is the money that is spent by the shellfish aquaculture industry. This money is either spent on labor and materials or distributed as returns to owners. Only a portion of this spending is retained within the I-O framework; as indicated by the upward arrows, money distributed outside of the study area is considered a leakage. The I-O framework only uses the purchase of local labor and materials to calculate direct local impacts.

Once the study team determines direct local impacts, they can use an I-O model to estimate how this spending affects other businesses within the study area economy. Like a rock tossed into a pond, the direct expenditures produce rings of additional activity, referred to as indirect and induced impacts. Indirect impacts quantify the effect of spending within the study region on supplies, services, labor, and taxes. Induced impacts measure the money re-spent in the study area as a result of the indirect impacts. Direct, indirect, and induced impacts sum to the total economic impacts of a project or industry. This analysis presents total impacts as economic output, jobs created, and labor income generated within the study area.

Figure 1. Framework for Evaluating the Total Economic Effects or Impacts of Local Spending



Source: Northern Economics, Inc. 2011.

The study team used IMPLAN™ software to estimate economic impacts to the Washington, Oregon and California economies. IMPLAN is a software tool which uses information sourced from local and census sources to produce region-specific economic impact models. IMPLAN uses specific data on what inputs are needed to produce the goods or services for over 440 economic

sectors, and county-specific data on what industries are available locally from which to purchase those inputs. This analysis used IMPLAN 2010 data.

2.2.1 Shellfish Aquaculture Industry Multipliers

Developing an accurate sector profile requires knowledge of the purchasing patterns of the industry being analyzed. The 440 sectors within IMPLAN are an aggregation of the many more industries which make up the U.S. economy. Each of the sectors of the national economy is assigned to a North American Industry Classification System (NAICS) code. The thousands of available NAICS codes are condensed into the 440 IMPLAN sectors. For example, IMPLAN maps NAICS codes beginning with 1122-1129 (which includes raising hogs and pigs, sheep and goat farming and animal aquaculture) to IMPLAN sector 14 – Animal Production, except cattle, poultry, and eggs.

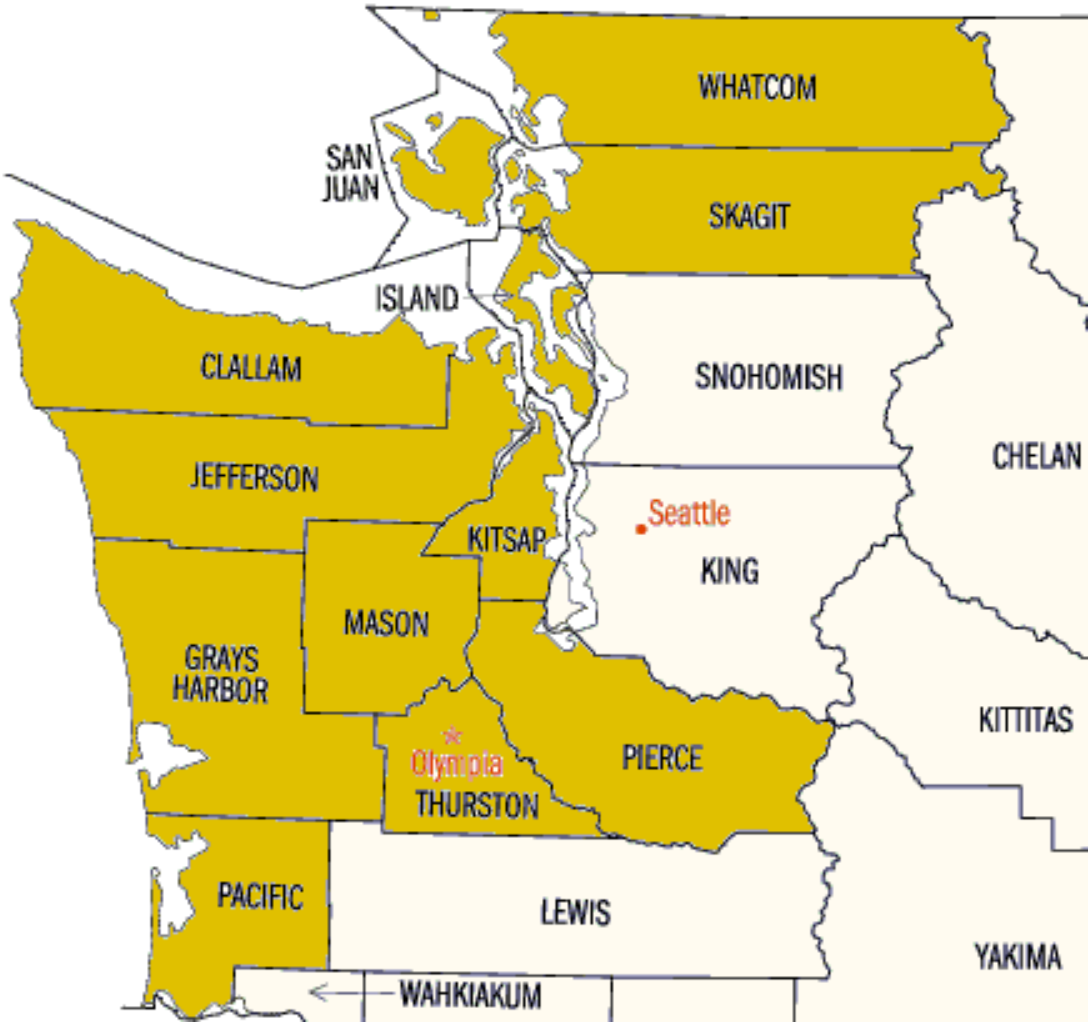
Rather than simply use IMPLAN sector 14, the study team sought a more accurate sector profile for shellfish aquaculture. To this end, the study team identified the spending patterns unique to shellfish aquaculture growers using the information obtained through the survey effort. The shellfish aquaculture purchasing pattern tells us which industries the shellfish industry purchases inputs from and the location of those suppliers. The study team then mapped this spending pattern to IMPLAN support sectors, generating the I-O multipliers used to calculate the indirect and induced effects on jobs, income, and business sales/output generated per dollar of spending on various types of goods and services in the study area[3].

[3] It is worth noting that the 'other' spending category required use of the Washington detailed survey responses for both Washington and California. The study team assumes that general spending categories for 'other' spending are similar in both states, however, California results are generated using California multipliers.

3 Washington State Analysis

Shellfish aquaculture in Washington takes place in 12 of the 39 counties in the state. Figure 2 highlights these counties.

Figure 2. Washington Counties with Shellfish Aquaculture Activity



Source: Adapted from U.S. Census Bureau 2012

This section summarizes survey responses, highlights the acreage and expenditure data that formed the basis of the Washington shellfish aquaculture I-O analysis, and presents statewide economic impacts, with an estimate of contribution of impact by county.

3.1 Survey Results

Of the approximately 330 commercial[4] shellfish growers in the state of Washington, a total of 43, or 13 percent, responded to the survey. However, these respondents accounted for 76 percent of the total permitted acreage in the state (Table 1). Seven of these firms submitted detailed expenditure data, while the remaining 36 submitted responses to the more general survey. It is worth noting, however, that only 32 of the 43 total respondents reported acreage and expenditure data, two elements critical to our study. The metrics presented in the tables and figures below are based primarily on these 32 responses.

Table 1 summarizes the survey response rate as a percentage of commercially farmed acres by county. Again, the numbers shown include only responses which included both acreage and expenditure data.

Table 1. Survey Response Rate by Acreage and County

County	Survey Acreage	Total Acreage	Response Rate (%)
Grays Harbor	3,278	2,288	143*
Island	55	87	63
Jefferson	666	1,155	58
Kitsap	25	485	5
Mason	814	4,079	20
Pacific	14,681	17,288	85
Pierce	39	138	28
Skagit	2,233	3,018	74
Thurston	710	1,037	68
Other	-	88	0
Total	**22,502**	**29,663**	**76**

Note: Total acreage by county was supplied to Northern Economics, Inc. by PSI.
*Acreage reported for Grays Harbor by survey respondents exceeds total acreage in Washington Department of Health database. PSI confirmed with respondents that the survey total is likely correct and the difference is due to inaccuracies in the WDFW database.
Source: Northern Economics, Inc. using survey data provided by PSI.

3.1.1 Employment

Survey respondents[5] reported 1,266 direct jobs in Washington. Responses from individual firms ranged from a low of 0 to more than 400 employees. The study team believes that the majority of non-responses to the question stem from self-employed farmers who do not employ additional staff and failed to include themselves when reporting. The breakdown of firm size (as measured by employment) is illustrated in Table 2.

[4] It is worth noting that the 330 non-tribal commercial shellfish growers include harvest license holders who are not necessarily shellfish growers. Consequently the 330 total overstates the actual number of shellfish aquaculture farmers.

[5] Only respondents who reported acreage, employment and expenditures are included.

Table 2. Count of Washington Respondents by Number of Employees, 2010

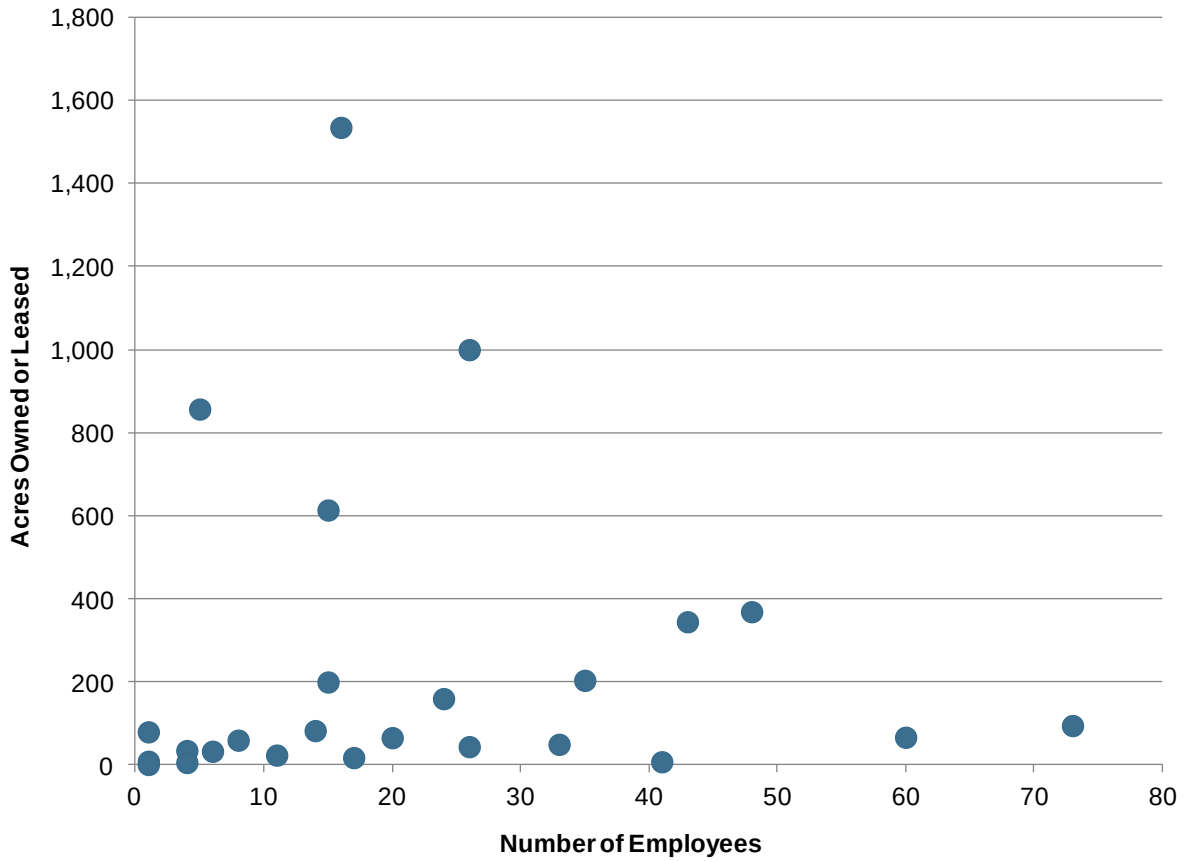
Size of Business	Count of Firms[6]	Percent of Total
No Employment Reported	14	33
1 to 10 Employees	9	21
11 to 30 Employees	10	23
31 to 50 Employees	5	12
>50 Employees	5	12
Total	**43**	**100**

Source: Northern Economics, Inc. using survey data provided by PSI.

Employment numbers reported by shellfish growers vary significantly by operation type. As shown in Figure 3, the number of employees reported by an individual firm varies across farm size. Of those survey respondents who provided employment and acreage information, minimum employment was .01 persons per farmed acre (or 1 person per 100 farmed acres) while maximum employment is reported as 5 people per farmed acre (or 500 people per 100 acres). On average, Washington growers employ a total of 1 person per farmed acre. Assuming the lowest employment ratio reported, we estimate a total of 1,840 direct jobs statewide (1 employee per 100 farmed acres).

[6] This 14 count is a minimum. Additional employment was reported for the aquaculture industry, but related to processing, so omitted from the data summary.

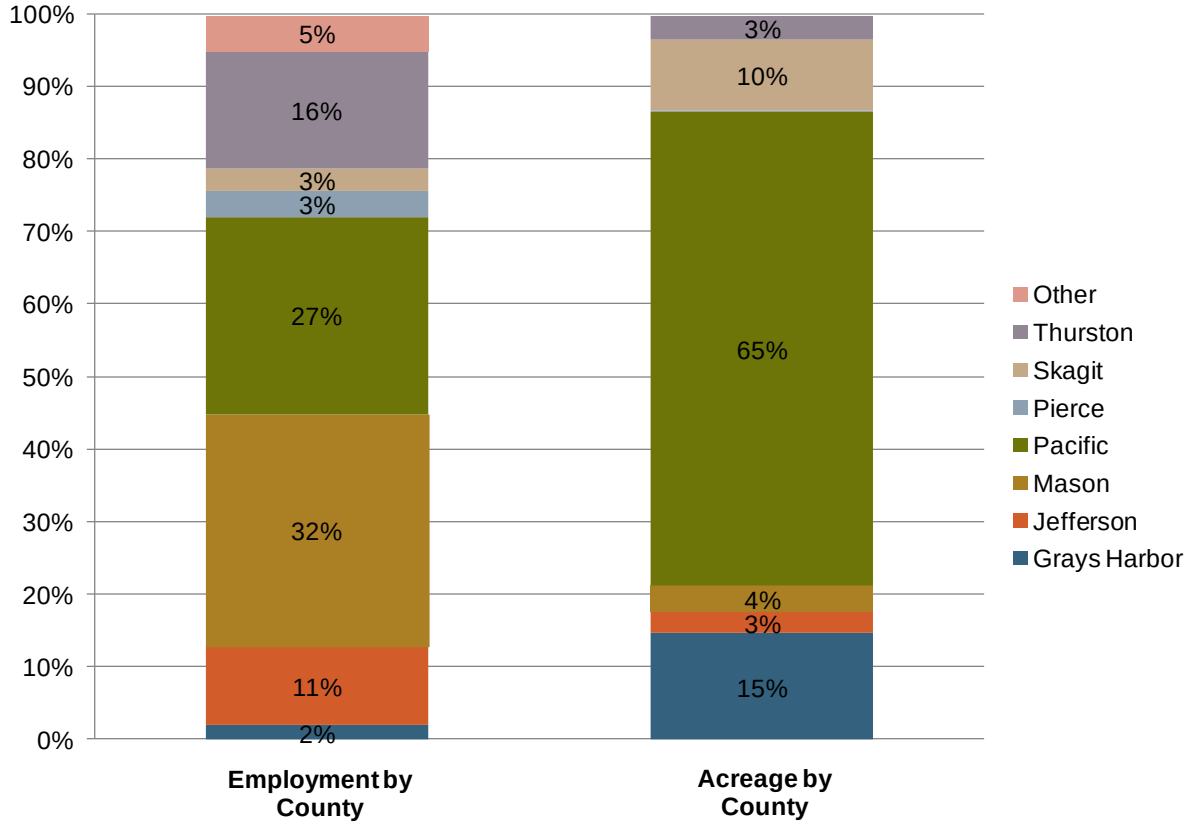
Figure 3. WA Shellfish Aquaculture Employment and Farmed Acreage, 2010



Note: Two survey respondents are omitted from this figure to avoid identification. Only respondents who reported both employment and acreage are included.
Source: Northern Economics, Inc. using survey data provided by PSI.

The majority of the leased or owned acreage of survey respondents was held in Pacific, Grays Harbor, and Skagit Counties; however, employment at these shellfish farms was not restricted to the county in which the leases are held. For example, only 4 percent of the acreage reported by survey respondents was held in Mason County, but 32 percent of the employees were reported to be residents of Mason County. Survey respondents also reported having employees in non-shellfish producing counties (grouped below as 'Other'). This confirms that employment activity generated by shellfish aquaculture farms impacts surrounding counties.

Figure 4. WA Surveyed Shellfish Aquaculture Acreage and Employment by County, 2010



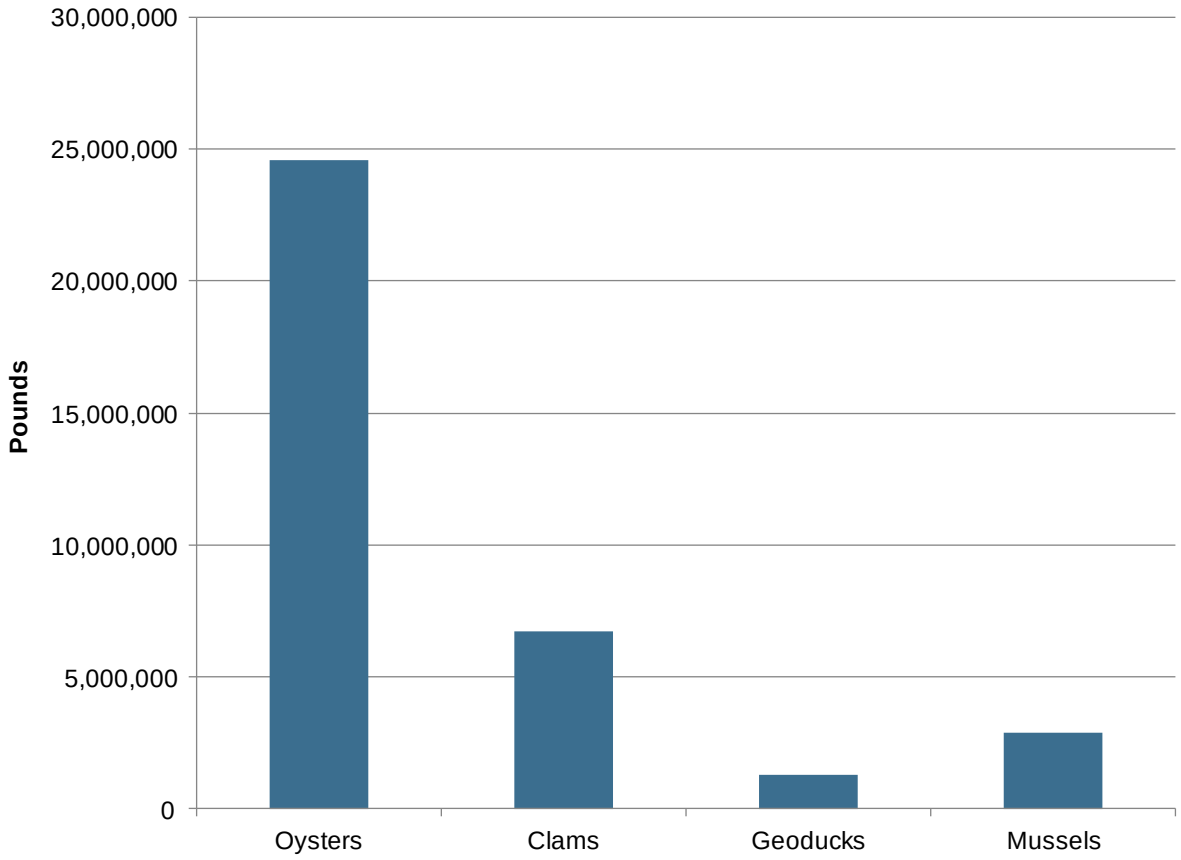
Source: Northern Economics, Inc. using survey data provided by PSI.

3.1.2 Production and Revenues

Respondents reported 2011 shellfish production by species and product type. Of the 43 total respondents, 30 provided information on both revenues and production. The responses from the 30 survey respondents represented more than $90.3 million dollars in total revenue and $89.4 million worth of shellfish sales. While survey respondents did not attribute sales to species types, they did supply total production volumes, summarized in Figure 5. Data were reported in round pounds, dozens, bushels and gallons. The study team standardized responses using pounds of meat weight for oysters[7] and round pounds for other shellfish species.

[7] Per the Washington Department of Fish and Wildlife: 1 dozen oysters assumed to weigh .546 pounds (meat weight). 1 gallon of oyster meat is assumed equivalent to 1 bushel of shell-on oysters; both weigh 8.75 pounds in meat weight.

Figure 5. WA Survey Response Production Volumes, 2010



Source: Northern Economics, Inc. using survey data provided by PSI.

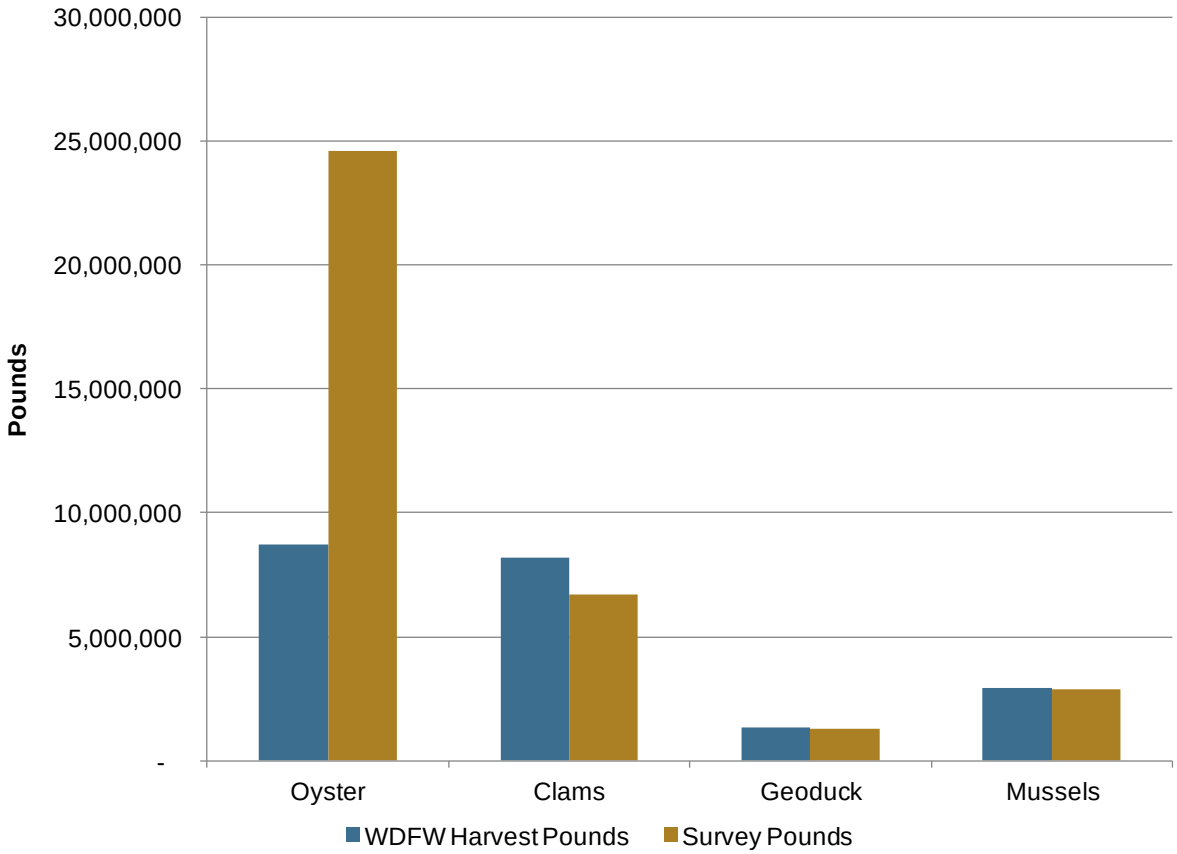
Washington Department of Fish and Wildlife (WDFW) maintains a database of shellfish harvest and production. Until recently, reporting production was voluntary. Table 3 and Figure 6 summarize reported survey production volumes and WDFW recorded production volumes. Of significant note is the difference in oyster volumes, which suggests that the state data omit a large portion of annual production.

Table 3. WDFW 2010 Shellfish Aquaculture Data

Species	WDFW Harvest Pounds (2010)	Survey Pounds (2010)	Reported Survey Volumes as a Percent of WDFW Recorded Volumes
Oyster	8,736,978	8,115,126	93
Clams	8,207,220	6,728,674	82
Geoduck	1,351,310	1,297,814	96
Mussels	2,947,456	2,867,974	97
Total	**21,242,964**	**19,009,588**	**89**

Source: Northern Economics, Inc. using survey data provided by PSI and WDFW 2010

Figure 6. WA Survey Response Production Volumes and WDFW Recorded Volumes, 2010



Source: Northern Economics, Inc. using survey data provided by PSI and WDFW 2010

3.1.3 Acreage and Expenditures

The study team estimated the total economic impact of the shellfish aquaculture industry in Washington using estimates of acreage and expenditures. The Washington Department of Health tracks statewide tideland acres permitted for shellfish aquaculture. Using their database, PSI filtered leased acres for duplicate permits, wild catch areas and tribal acres to derive the estimates of total commercially permitted acres by county (Table 4).

Table 4. Non-Tribal Permitted Acres (Excluding Wild Catch)

County	Acres	Species Cultured
Grays Harbor	2,288	oyster, clams
Island	87	oyster, clams
Jefferson	1,155	oyster, clams, geoduck
Kitsap	485	oyster, clams, geoduck
Mason	4,079	oyster, clams, geoduck
Pacific	17,288	oyster, clams
Pierce	138	oyster, clams, geoduck
Skagit	3,018	oyster, clams
Thurston	1,037	oyster, clams, geoduck
Clallam	86	oyster, clams
King	-	
Snohomish	-	
Whatcom	2	
Grand Total	**29,663**	

Source: PSI using DOH 2008

As previously noted, survey respondents who supplied both acreage and expenditure data accounted for 22,500 acres or 76 percent of the 29,663permitted acres in Washington State. The shellfish aquaculture growers that either own or lease these acres spent a total of $69.8 million in 2010. Of this total, approximately 81.1 percent[8] or $56.6 million were spent in the State of Washington. The remainder was paid to firms or individuals out of state. Expenditures by firm varied significantly, as shown in Table 5.

Table 5. Washington Survey Respondents by Scale of Operations

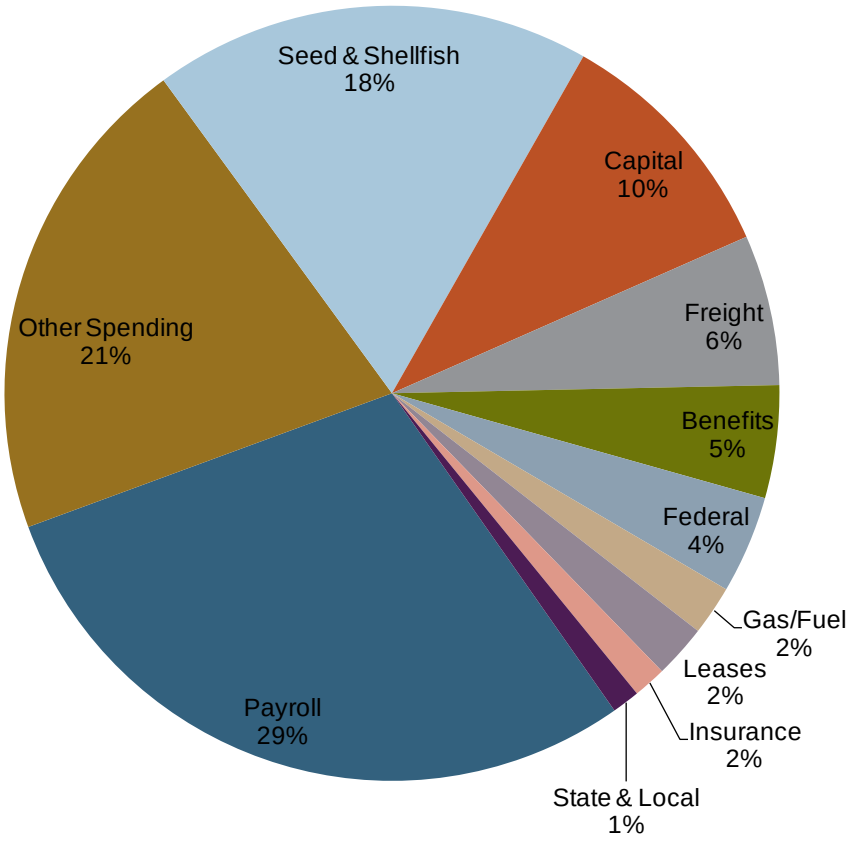
Scale of Operations (Spending Levels)	Number	Percent
Greater than $10 M	3	8
Between $1 to $10 M	7	19
Between $500 K and $1 M	9	25
Between $100 K and $500 K	7	19
Between $50 K and $100 K	3	8
Less than $25 K	7	19
Total	**36**	**100**

Source: Northern Economics, Inc. using survey data provided by PSI

[8] Based on key respondent data

The majority of firms' expenditures are payroll, intermediate inputs (seed and shellfish) and capital purchases. Figure 7 illustrates the general spending pattern of Washington State shellfish aquaculture firms.

Figure 7. Washington Shellfish Aquaculture Expenditures by Type, 2010



Source: Northern Economics, Inc. using PSI Survey responses, 2012

Using acreage and expenditure data reported, the study team derived metrics for expenditures per acre. On average, shellfish aquaculture firms spend approximately $3,100 for every acre that they own or lease. Given that 37.8 percent of tidelands are left unfarmed in any given year, this dollar amount becomes $4,988 for every farmed acre. It should be noted that given 81.1 percent of non-payroll expenditures are spent directly in Washington,[9] we calculated an estimate of $4,880 per farmed acre.

3.2 Economic Impact in Washington State

In order to assess the economic impact of Washington's shellfish aquaculture industry, the study team estimated the industry's total expenditures, including those growers that did not respond

[9] This is based on the assumption that 100 percent of payroll was paid locally (employees worked in Washington). Nineteen percent of non-payroll expenditures were spent out of state (only 81% of non-payroll was spent locally).

to the survey. Using PSI's estimates of total acreage under cultivation, the study team extrapolated the Washington expenditures per farmed acre ($4,880) to those acres not accounted for by survey responses. The results of these calculations are shown in Table 6.

Table 6. Estimates of Spending by Acre

County	Total Acreage	Survey Acreage	Missing Acres	Missing Productive Acres	Washington Dollars Missing from Survey Responses
Grays Harbor	2,288	3,278	n/a	0	0
Island	87	55	32	20	97,076
Jefferson	1,155	666	489	304	1,483,438
Kitsap	485	25	460	286	1,395,463
Mason	4,079	814	3,265	2,029	9,904,481
Pacific	17,288	14,681	2,607	1,620	7,908,059
Pierce	138	39	99	61	299,994
Skagit	3,018	2,233	785	488	2,380,478
Thurston	1,037	710	327	203	991,203
Other	86	-	88	55	266,958
Total	**29,663**	**22,502**	**8,151**	**5,067**	**24,727,150**

Source: Northern Economics, Inc. using survey and acreage data provided by PSI

The extrapolated expenditures for non-survey respondents were distributed according to the spending pattern shown in Figure 7. The most recent (2010) IMPLAN data for all the economic sectors within the state were applied, generating the estimated output, employment, and labor income shown in Table 7.

Table 7. Economic Impacts of Non-Survey Respondents

Total Impacts	Output	Employment	Labor Income
Direct	24,727,200	580	7,100,000
Indirect	9,670,300	90	4,400,500
Induced	13,813,300	90	4,012,200
Total	**48,210,800**	**760**	**15,512,700**

Note: Labor Income is a subset of Output.
Source: Northern Economics, Inc. using survey and acreage data provided by PSI and IMPLAN

The spending impacts generated by survey respondents are shown in Table 8.

Table 8. Economic Impacts of Respondents

Total Impacts	Output	Employment	Labor Income
Direct	76,690,900	1,320	30,190,600
Indirect	28,562,400	300	16,793,900
Induced	30,961,587	330	14,625,400
Total	**136,214,887**	**1,950**	**61,609,900**

Note: Labor Income is a subset of Output.
Source: Northern Economics, Inc. using survey and acreage data provided by PSI and IMPLAN

Combining estimated impacts of survey and non-survey respondents' results in the total economic impacts of shellfish aquaculture to Washington State as illustrated in Table 9.

Table 9. Economic Impact of Shellfish Aquaculture in Washington, 2010

Multipliers per dollar	Output	Employment	Labor Income
Direct	101,418,100	1,900	37,290,600
Indirect	38,232,700	390	21,194,400
Induced	44,774,900	420	18,637,600
Total	**184,425,700**	**2,710**	**77,122,600**

Note: Labor Income is a subset of Output.
Source: Northern Economics, Inc. using survey and acreage data provided by PSI and IMPLAN

In summary:

- The study team estimates that the shellfish aquaculture industry in Washington spent approximately $101.4 million in the Washington economy in 2010, which in turn generated $184 million, or 1.8 times the activity.
- Shellfish farmers were responsible for approximately 1,900 direct jobs in 2010. They also generated an additional 810 jobs through indirect and induced activity, for a total of 2,710 jobs in Washington State.
- Shellfish farmers paid approximately $37.3 million in wages in 2010. Their economic activity generated additional labor income of $39.9 million, for a total of $77.2 million in labor income in the state of Washington.

The economic multipliers generated through industry spending are summarized in Table 10. For every dollar spent by the industry, a total of $1.82worth of economic activity is generated in Washington. In addition, every $1 spent by the industry in Washington generates $0.76 in wages in the state. For every $1 million worth of spending by the industry, nearly 27 jobs are generated.

Table 10. Washington Shellfish Aquaculture Multipliers

	Output (per $)	Employment (per $ Million)	Labor Income (per $)
Multiplier	1.82	26.72	0.76

Source: Northern Economics, Inc. using survey data provided by PSI and IMPLAN

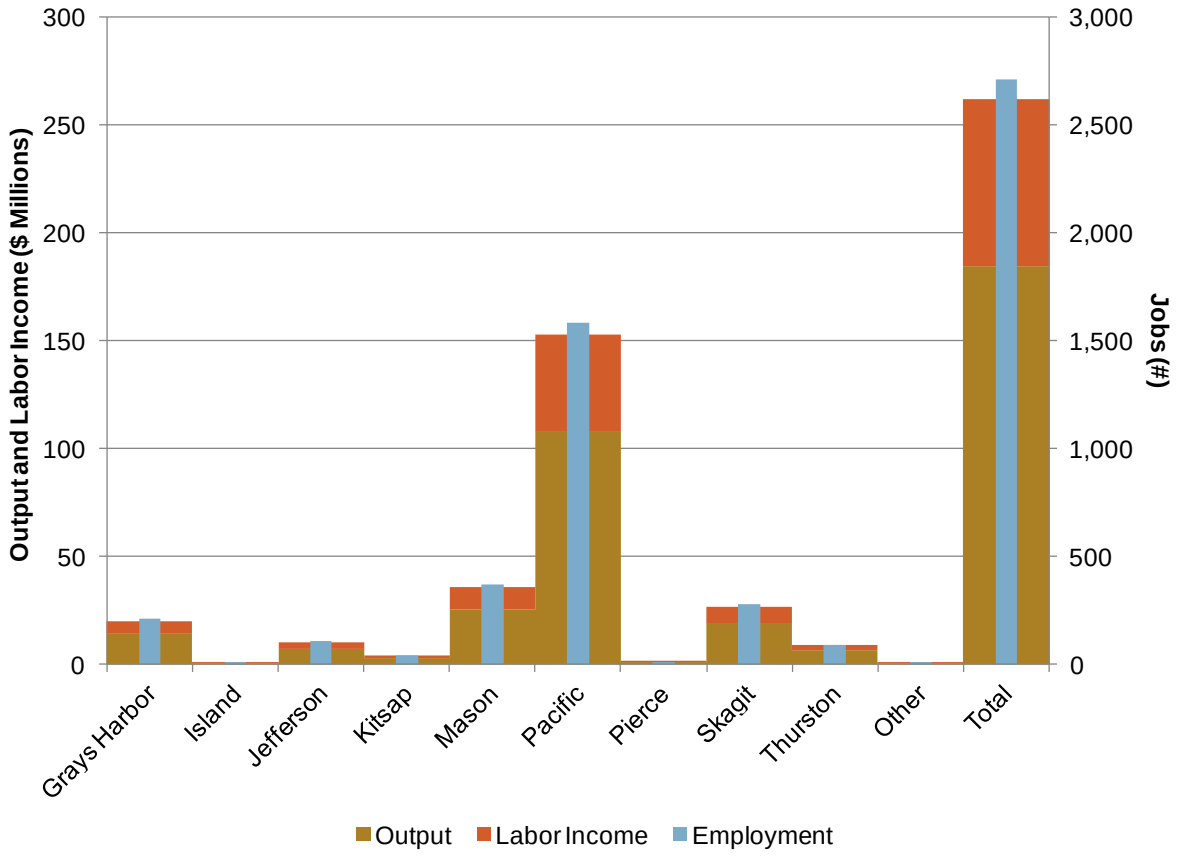
Assuming that output, employment, and labor income are generated in proportion to acreage of leased tidelands, the following table highlights the economic contribution that each county would make toward the statewide impact.

Table 11. Economic Impact of Shellfish Aquaculture, by County, 2010

County	Percent of Acres	Output	Employment	Labor Income
Grays Harbor	7.7%	11,966,300	210	5,957,500
Island	0.3%	455,000	10	226,500
Jefferson	3.9%	6,432,900	110	3,007,400
Kitsap	1.6%	2,536,600	40	1,262,800
Mason	13.8%	22,452,500	370	10,621,000
Pacific	58.3%	90,416,800	1,580	45,014,700
Pierce	0.5%	721,700	10	359,300
Skagit	10.2%	16,045,700	280	7,858,300
Thurston	3.5%	5,423,500	90	2,700,200
Other	0.3%	460,200	10	229,100
Total	**100**	**156,911,400**	**2,710**	**77,236,900**

Note: Labor Income is a subset of Output.
Source: Northern Economics, Inc. using survey and acreage data provided by PSI and IMPLAN

Figure 8. Economic Impact of Shellfish Aquaculture, by County, 2010



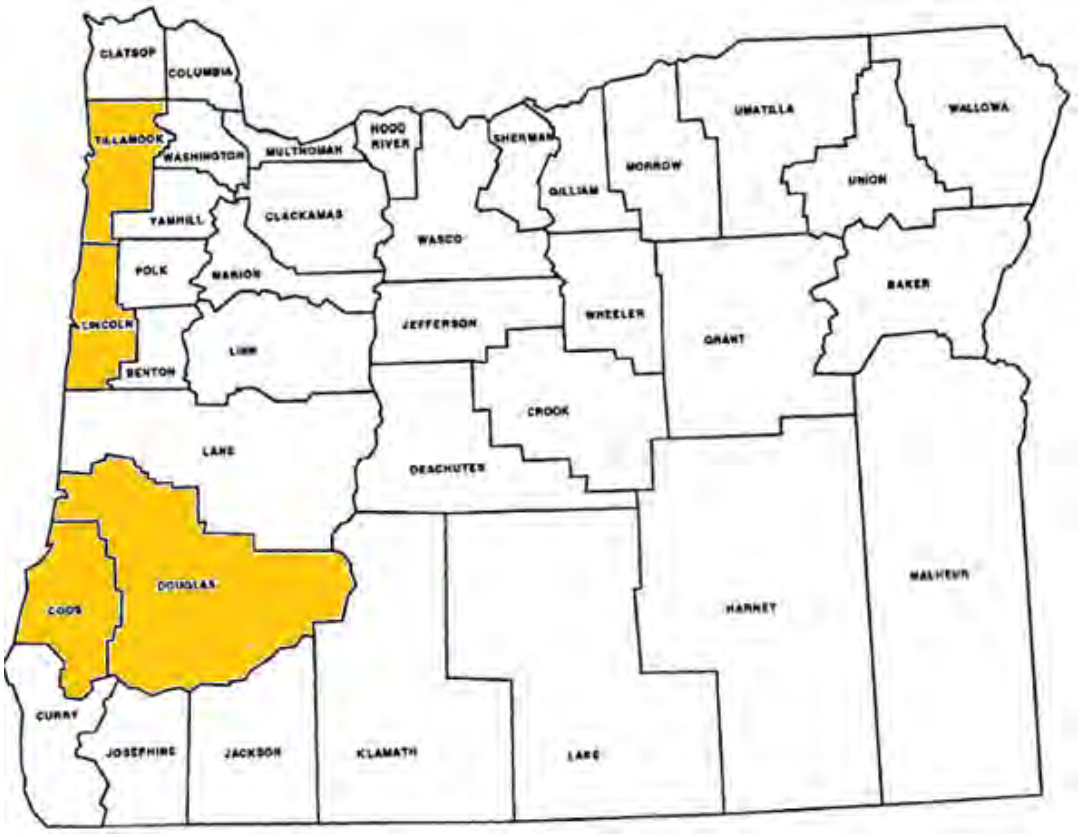
Note: Labor Income is a subset of Output.
Source: Northern Economics, Inc. using survey and acreage data provided by PSI and IMPLAN

By way of comparison to these results, the economic impacts of the nursery and landscaping industry in Washington State show a total (direct and indirect) impact of $2.4 billion in output (sales) and 43,000 total jobs (Holland and Bhattacharjee, 2006). The fruit tree industry in Washington State provides $5.6 billion in total output impacts and $2.8 billion in total income impacts (Jensen, 2004). Radtke (2011) illustrates a range of values from the literature. The economic contribution from the Washington State commercial fishing industry ranges from $60million to $3.48 billion while number of jobs generated ranges from 3,520 to 14,572. Finally, the total economic impact of the petroleum refining industry to Washington State is 26,000 jobs and $1.7 billion in personal income (Washington Research Council, 2012)

4 Oregon State Analysis

Shellfish aquaculture is more limited along the coast of Oregon than in Washington with a total of only 23 current producers. Due to the limited number of survey responses received in Oregon, the study team decided that a statewide economic impact analysis would not provide meaningful or robust information. Instead, the study team summarized the survey data they did receive in the following section to provide a glimpse of the Oregon shellfish aquaculture industry.

Figure 9. Oregon Counties with Shellfish Aquaculture Activity



Source: Adapted from State of Oregon Health Authority, 2013

4.1 Survey Results

Survey response rates in Oregon were lower than those in Washington and California as only eight of 23 shellfish growers responded to the general survey. Of the eight shellfish grower responses, only four reported useable expenditure data. Table 13 summarizes the grower-reported commercially farmed and not-farmed acres by county.

Table 12. Oregon Survey Response Rate by Acreage and County

County	Reported Acres	Not Farmed Acres	Farmed Acres	Farmed Acres (%)
Tillamook	2,860	2,025	835	29
Coos	123	40	83	67
Douglas	60	0	60	100
Total	**3,043**	**2,065**	**978**	**32**

Source: Northern Economics, Inc. using survey data provided by PSI.

Only 32 percent of the acres reported by survey respondents are actually under shellfish cultivation. In the following section we describe the employment, production, revenues, and expenses associated with these acres.

4.1.1 Employment

Employment reported by survey respondents equaled 107 direct jobs. Responses from individual firms ranged from a low of 0 (self-employed) to a high of 85

Of the survey respondents who reported both employment and acreage, there was approximately one employee reported per 23 acres of tideland under cultivation, or .04 people per acre. This rate is much lower than that reported by both Washington and California growers, and may be the product of the limited survey and data response.

4.1.2 Production and Revenues

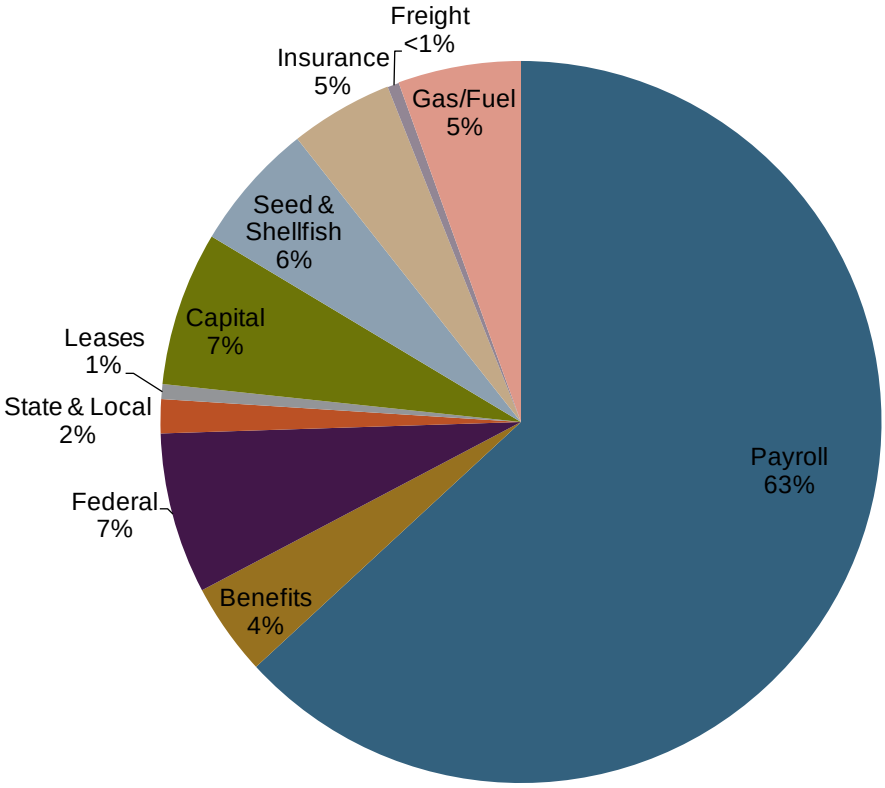
Survey respondents reported $9.7 million worth of total revenue and $9.3 million worth of revenue from shellfish sales respectively in 2011. Survey respondents did not attribute sales to species types, and many did not report sales volumes. Therefore, a summary of total production volumes cannot be derived.

4.1.1 Acreage and Expenditures

Only four growers responded to the survey with useable expenditure estimates. Total spending reported by these growers amounted to $377,000 in 2011.[10] More than half of operating funds were spent on payroll (63 percent). Unlike respondents from other states, Oregon survey respondents reported a relatively small expenditure on intermediate inputs; seed and shellfish accounted for only seven percent of total expenditures. Figure 1410 illustrates the general spending pattern of Oregon shellfish aquaculture firms.

[10] Note that in this case several growers reported revenues but only a subset of total expenditures.

Figure 10. Oregon Shellfish Aquaculture Expenditures by Type, 2010



Source: Northern Economics, Inc. using PSI Survey responses

5 California State Analysis

Sixteen shellfish aquaculture farmers in California participated in the study according to PSI and a local industry expert.[11] These 16 respondents represent the industry in its entirety or a 100 percent response rate. Shellfish aquaculture in California takes place in 7 of the state's 15 counties bordering the Pacific Ocean.

Figure 11. California Counties with Shellfish Aquaculture Activity

Source: Adapted from California Secretary of State's Office 2013

[11] Ted Kuiper formerly of Kuiper Mariculture

5.1 Survey Results

The survey effort in California was similar to that in Washington with the exception that all growers responded to the general survey; no detailed responses were obtained. Surveyed firms included both shellfish growers and seed producers, but excluded abalone-only growers. Table 13 summarizes the reported commercially farmed and not-farmed acres by county.

Table 13. Survey Response Rate by Acreage and County

County	Reported Acres	Not Farmed Acres	Farmed Acres	Farmed Acres (%)
Marin	1,413	1,071	342	24
Santa Barbara	70	35	35	50
San Luis Obisbo	135	120	15	11
Humboldt	4,577	4,234	343	7
Other	6.036	0	6	100
Total	**6,201**	**5,460**	**740**	**12**

Source: Northern Economics, Inc. using survey data provided by PSI.

According to the responses received, only 12 percent of the permitted tidelands in California are actually under shellfish cultivation. In the following section we describe the employment, production, revenues, and expenses associated with these acres.

5.1.1 Employment

Employment reported by survey respondents represented 204 direct jobs in California. Responses from individual firms ranged from a low of 1 to a high of 60. One respondent listed zero employees; as in Washington, the study team believes this to be a self-employed farmer who did not employ additional staff and failed to include themselves when reporting. The breakdown of firm size (as measured by employment) is shown in Table 14.

Table 14. Count of California Respondents by Number of Employees, 2010

Size of Business	Count of Firms	Percent of Total
No Employment Reported	1	6
1 to 10 Employees	10	63
11 to 30 Employees	3	19
31 to 50 Employees	1	6
>50 Employees	1	6
Total	**16**	**100**

Source: Northern Economics, Inc. using survey data provided by PSI.

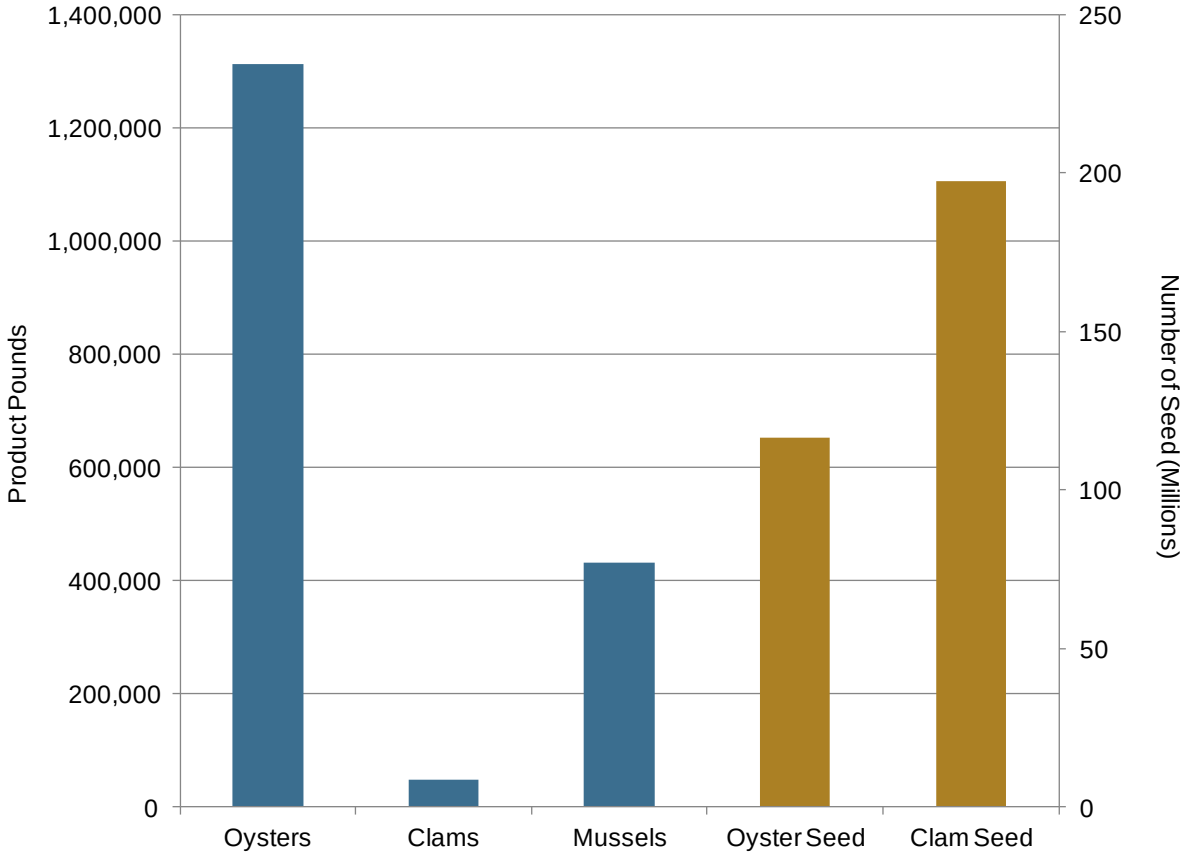
On average, California growers employ four people for every acre of tideland under cultivation; this is nearly four times the rate reported for Washington. Survey respondents note a minimum employment of .03 persons per farmed acre (or three people per 100 acres) and a maximum employment of 6 people per farmed acre (or 600 people per 100 acres).

California survey respondents reported total employment for the state; a breakdown of jobs by county is unavailable.

5.1.2 Production and Revenues

Survey respondents reported $25.9 million worth of total revenue and $23.9 million worth of revenue from shellfish sales in 2011. While survey respondents did not attribute sales to species types, they did supply total production volumes, summarized in Figure 12. Data were reported in round pounds, dozens, singles and gallons. The study team standardized responses using pounds of meat weight for oysters[12] and round pounds for other species.

Figure 12. CA Survey Response Production Volumes, 2010



Source: Northern Economics, Inc. using survey data provided by PSI.

California shellfish aquaculture production data are gathered by the California Department of Fish and Wildlife. According to the state's records, total production of oysters, clams, and mussels amounted to 34 million pounds in 2011. There is great variation between survey and state reported data due to differences in means by which data are compiled and the conversion used from count to pounds.

[12] 1 dozen oysters is assumed to weigh .546 pounds (meat weight). 1 gallon of oyster meat is assumed equivalent to 1 bushel of shell-on oysters; both weigh 8.75 pounds in meat weight.

Table 15 summarizes reported survey production volumes and CDFW recorded production volumes.

Table 15. CDFW 2011 Shellfish Aquaculture Data

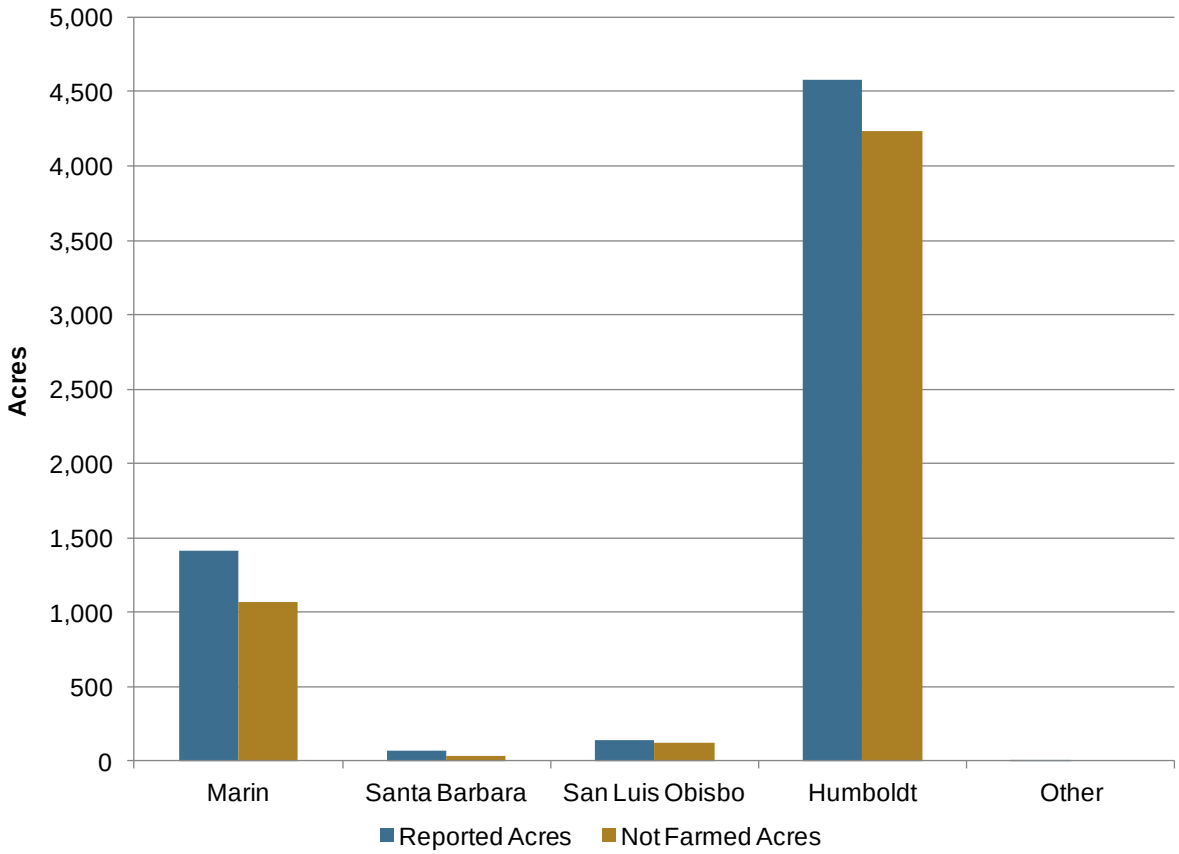
Species	CDFW Harvest Pounds (2011)	Survey Pounds (2011)	Reported Survey Volumes as a Percent of CDFW Recorded Volumes
Oyster	31,434,304	1,312,353	4
Clams	1,333,440	48,407	4
Geoduck	--	--	--
Mussels	1,350,280	432,035	32
Total	34,118,024	1,792,795	5

Source: Northern Economics, Inc. using survey data provided by PSI and CDFW 2011

5.1.3 Acreage and Expenditures

The study team estimated the total economic impact of the shellfish aquaculture industry in California using acreage and expenditures reported by survey respondents. Humboldt and Marin counties have the largest volumes of permitted tidelands (Figure 13), and are estimated to have the most significant economic impact on the state.

Figure 13. California Survey Reported Tideland Acreage by County, 2010



Source: Northern Economics, Inc. using survey data provided by PSI

Firms in California tend to be relatively small or relatively large. 31 percent of respondents report spending less than $50,000 a year on operations, while 44 percent report spending more than $1 million on operations in 2011. No firms reported spending more than $10 million (Table 16).

Table 16. California Survey Respondents by Scale of Operations

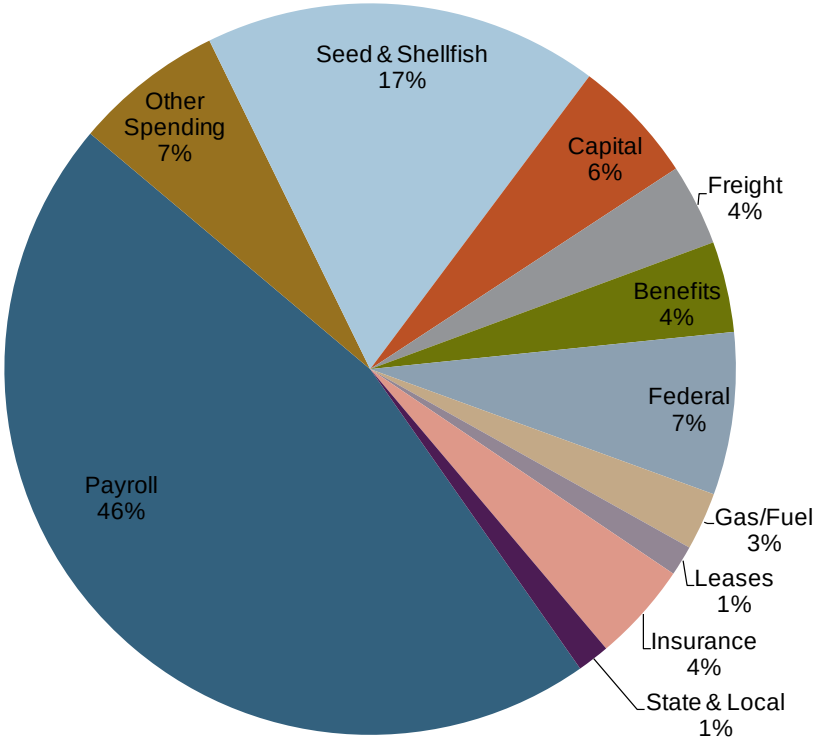
Scale of Operations (Spending Levels)	Number	Percent
Greater than $10 M	0	0
Between $1 to $10 M	4	25
Between $500 K and $1 M	3	19
Between $100 K and $500 K	3	19
Between $50 K and $100 K	1	6
Less than $50 K	5	31
Total	**16**	**100**

Source: Northern Economics, Inc. using survey data provided by PSI and WDFW 2010

Total spending for California growers amounted to $11.9 million in 2011. Almost half of operating funds were spent on payroll (46 percent). Another large cost item is intermediate

inputs; seed and shellfish accounted for 17 percent of total expenditures. Figure 14 illustrates the general spending pattern of California shellfish aquaculture firms.

Figure 14. California Shellfish Aquaculture Expenditures by Type, 2010



Source: Northern Economics, Inc. using PSI Survey responses[13]

On average, California shellfish aquaculture firms spend approximately $1,912 for every acre that they own or lease. Given that 88.1 percent of tidelands are left unfarmed in any given year, this dollar amount jumps to $16,017 for every farmed acre ($11.9 million / 740 farmed acres). While there are likely expenditures made to firms outside of California, the general survey responses are not sufficient to accurately estimate this leakage.

5.2 Economic Impact Analysis

In order to assess the economic impact of the California shellfish aquaculture industry, the study team used the expenditures reported by survey respondents to estimate the output, employment and labor income generated by the shellfish aquaculture industry. The results of our analysis are summarized in Table 17.

[13] In the case of California, some firms buy shellfish from other firms and then sell it. This is grouped with the seed expenditure category as an intermediate input from the same industry.

Table 17. Economic Impact of Shellfish Aquaculture in California, 2010

Multipliers per dollar	Output	Employment	Labor Income
Direct	11,859,800	200	5,440,000
Indirect	3,586,600	30	2,194,700
Induced	7,863,900	50	2,405,200
Total	**23,310,300**	**280**	**10,039,900**

Note: Labor Income is a subset of Output.
Source: Northern Economics, Inc. using survey and acreage data provided by PSI and IMPLAN

In summary:

- The study team estimates that the shellfish aquaculture industry in California spent approximately $11.9 million in the California economy in 2010, which in turn generated $23.3 million or 1.9 times the activity.
- Shellfish farmers were responsible for approximately 200 direct jobs in 2010. They also generated an additional 80 jobs through indirect and induced activity, for a total of 280 jobs in California.
- Shellfish farmers paid approximately $5.4 million in wages in 2010. Their economic activity generated additional labor income of $4.6 million, for a total of $10 million in labor income in California.

The economic multipliers generated through industry spending are summarized in Table 18. For every dollar spent by the industry in California, a total of $1.97 worth of economic activity is generated. In addition, every $1 spent by the industry in California generates $0.85 in wages in the state. For every $1 million worth of spending by the industry, nearly 24 jobs are generated.

Table 18. California Shellfish Aquaculture Multipliers

	Output (per $)	Employment (per $ Million)	Labor Income (per $)
Multiplier	1.96	24	0.85

Source: Northern Economics, Inc. using survey and acreage data provided by PSI and IMPLAN

6 Conclusions and Recommendations

This study assesses the economic impacts associated with non-tribal shellfish aquaculture in Washington, Oregon and California. As indicated in our analysis we were unable to assess the complete range of economic impacts for Oregon due to data limitations. For Washington State and California we were able to estimate direct, indirect, and induced impacts as well as identify related multipliers. The study team calculated the economic impacts differently for Washington and California, however, again due to different levels of detailed expenditure data collected. Since the team was able to collect detailed expenditure data for Washington, we were able to calculate the expenditures going to each supporting industry and whether those expenditures remained in the study area. The expenditure data reported through the general survey implemented in California demonstrated a pattern similar to that of Washington. As a result, the study team assumed the spending in the "other" category of expense was the same as in Washington and that expenditures remained in the study area. Because of the diverse nature of the data sets for each state, comparison of economic impacts between states is not meaningful. However, in general, the statistics generated in this study enhance our knowledge about the west coast shellfish aquaculture industry and can be used to inform management and policy decision making.

This study is the first complete analysis of the economic impact of Washington State shellfish aquaculture production (by county), and the first study to report the spending patterns (the production function) for the shellfish aquaculture industry in any region of the United States. The Washington industry spending pattern data provided in this report will allow analysts to estimate the economic impact of developments in the aquaculture industry in the future.

This study illustrates the inconsistencies in data collection in the shellfish aquaculture industry. Note that our analysis is based on estimates of total acres of shellfish beds in production. Because of uncertainties in these data, our results may under or overestimate economic impacts. In addition, it should be noted that mapping expenditures to IMPLAN support industries was a particularly difficult task given the range of businesses that supply shellfish growers. The study team used business license records and internet searches to determine the appropriate industries to assign to businesses. Where business types were unclear, we worked with respondents to determine what goods or services they received from the specific vendor. Consequently, some businesses may be coded sub-optimally, despite our best efforts.

The results of the analysis presented here apply specifically to commercial shellfish growers. Our analysis is not representative of the entire shellfish industry as wild and tribal harvest and shellfish bed restoration are not included.[14] The study team believes tribal growers and harvesters, wild harvesters, and shellfish restoration activities have unique production and expenditure patterns and warrant further investigation. Finally, our study focuses on the economic impacts of the production of cultured shellfish only and did not include sales trends and demand factors. Another area of potential future research is the economic impacts of shellfish consumption. Residents and tourists of west coast communities all enjoy and benefit from the supply of fresh shellfish provided by the aquaculture industry. People purchase shellfish

[14] The study team contacted regional tribes as part of the survey effort. However, responses from these groups were not received.

through retail markets, consume shellfish in restaurants, and enjoy local seafood fare at fundraisers and events. An investigation into the revenue generated through these types of shellfish sales could serve as a means to quantify additional economic impacts of the shellfish aquaculture industry.

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Appendix A: Shellfish Grower Expense and Revenue Surveys

***Please complete by*: April 1, 2012**

Shellfish Aquaculture Expenses Survey

Tidelands permitted for aquaculture and under your control (owned, leased, etc.)

Location (County)					
Size (Acres)					
Species cultured					
Of the total tidelands listed above, how many acres were not under cultivation in 2010?					**acres**
In a typical year, what percentage of your tidelands are not under cultivation?					**%**

Expenses for the 2010 Calendar Year

Total Expenses	**$**	*Likely more than the sum of categories listed below*
Labor Expenses		
Total Payroll (wages)	**$**	*Owners and employees*
Total Non-Wage Benefits	**$**	*Include medical, bonuses, etc.*
Payments to Government		
Federal	**$**	*Include payroll taxes, income taxes, etc.*
State & Local	**$**	*Include permit and license fees, property taxes, etc.*
Other Expense Categories		
Tideland Leases	**$**	*Lease payments for tidelands, but not permit fees*
Capital Expenditures	**$**	*Include vessels, buildings & heavy machinery > $10K*
Seed & Shellfish	**$**	*Payments for seed or shellfish for grow-out or resale*
Insurance Carriers	**$**	*Total payments to insurance companies*
Freight	**$**	*Expenses paid to freight companies (ground & air)*
Gas/Fuel	**$**	*Expenses paid to fueling stations or fuel deliveries*

Shellfish Production Volume harvested and sold from tidelands listed above. Please be sure to include *units* (gallons, pounds or dozens) and write in the species for any "Other" shellfish.

	Total volume	Fresh Whole	Fresh Shucked	Frozen	Other	Seed or larvae
Oysters						
Clams						
Geoducks						
Mussels						
Other 1:						
Other 2:						
Other 3:						

Number of Employees by County of Residence (where employees *live*, refer to W-4 forms if necessary)

Jefferson	Clallam	Grays Harbor	Pacific	Mason	Thurston	Pierce	Kitsap	San Juan	Snohomish	Skagit	Whatcom	Other

Continue to page 2

Revenue for the 2010 Calendar Year

Gross sales (wholesale and retail)	**$**

Revenue from Shellfish Products

Estimated gross sales of shellfish	**$**
Estimated % of gross sales not farmed by you	**%**

Answer Yes or No to the following. **Does your company…**	**Yes/No**
Buy market sized aquacultured shellfish products from other growers?	
Buy market sized shellfish from wild harvesters? *Example: DNR managed geoduck in WA*	
Operate a retail store?	
Operate another tourist attraction, such farm tours offered on a regular basis?	
Export shellfish outside the U.S.?	
If you export, estimate the percentage of shellfish exported (by volume, not revenue):	**%**

Comments Please provide any additional information you deem necessary to explain the information you have provided above, and/or any comments or concerns about this survey. Please indicate if you would like us to follow up with you about your comments.

Return this survey to our secure, private post office box:

Pacific Shellfish Institute
Attn: Aquaculture Survey
120 State Ave. NE #1056
Olympia, WA 98501

Alternately, you may access and submit this survey electronically at www.pacshell.org/survey.html

For *tracking purposes only*, please provide the following:

Business name			
Dept. of Health permit #			
Survey completed by			
Phone #		**Email address**	

***Please complete by*: April 1, 2012**

Shellfish Aquaculture Expenses Survey

Tidelands permitted for aquaculture and under your control (owned, leased, etc.)

Location (County)					
Size (Acres)					
Species cultured					
Of the total tidelands listed above, how many acres were not under cultivation in 2010?					**acres**
In a typical year, what percentage of your tidelands are not under cultivation?					**%**

Expenses for the 2010 Calendar Year

Total Expenses	**$**	*Likely more than the sum of categories listed below*
Labor Expenses		
Total Payroll (wages)	**$**	*Owners and employees*
Total Non-Wage Benefits	**$**	*Include medical, bonuses, etc.*
Payments to Government		
Federal	**$**	*Include payroll taxes, income taxes, etc.*
State & Local	**$**	*Include permit and license fees, property taxes, etc.*
Other Expense Categories		
Tideland Leases	**$**	*Lease payments for tidelands, but not permit fees*
Capital Expenditures	**$**	*Include vessels, buildings & heavy machinery > $10K*
Seed & Shellfish	**$**	*Payments for seed or shellfish for grow-out or resale*
Insurance Carriers	**$**	*Total payments to insurance companies*
Freight	**$**	*Expenses paid to freight companies (ground & air)*
Gas/Fuel	**$**	*Expenses paid to fueling stations or fuel deliveries*

Shellfish Production Volume harvested and sold from tidelands listed above. Please be sure to include *units* (gallons, pounds or dozens) and write in the species for any "Other" shellfish.

	Total volume	Fresh Whole	Fresh Shucked	Frozen	Other	Seed or larvae
Oysters						
Clams						
Geoducks						
Mussels						
Other 1:						
Other 2:						
Other 3:						

Number of Employees (where employees *live*, refer to W-4 forms if necessary)

OR	Outside OR

Continue to page 2

Revenue for the 2010 Calendar Year

Gross sales (wholesale and retail)	**$**

Revenue from Shellfish Products

Estimated gross sales of shellfish	**$**
Estimated % of gross sales not farmed by you	**%**

Answer Yes or No to the following. **Does your company…**	**Yes/No**
Buy market sized aquacultured shellfish products from other growers?	
Buy market sized shellfish from wild harvesters? *Example: DNR managed geoduck in WA*	
Operate a retail store?	
Operate another tourist attraction, such farm tours offered on a regular basis?	
Export shellfish outside the U.S.?	
If you export, estimate the percentage of shellfish exported (by volume, not revenue):	**%**

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For *tracking purposes only*, please provide the following:

Business name			
Dept. of Ag. permit #			
Survey completed by			
Phone #		**Email address**	

***Please complete by*: April 1, 2012**

Shellfish Aquaculture Expenses Survey

Tidelands permitted for aquaculture and under your control (owned, leased, etc.)

Location (County)					
Size (Acres)					
Species cultured					
Of the total tidelands listed above, how many acres were not under cultivation in 2010?					**acres**
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Expenses for the 2010 Calendar Year

Total Expenses	**$**	*Likely more than the sum of categories listed below*
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Total Payroll (wages)	**$**	*Owners and employees*
Total Non-Wage Benefits	**$**	*Include medical, bonuses, etc.*
Payments to Government		
Federal	**$**	*Include payroll taxes, income taxes, etc.*
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	Total volume	Fresh Whole	Fresh Shucked	Frozen	Other	Seed or larvae
Oysters						
Clams						
Geoducks						
Mussels						
Other 1:						
Other 2:						
Other 3:						

Number of Employees (where employees *live*, refer to W-4 forms if necessary)

CA	Outside CA

Continue to page 2

Revenue for the 2010 Calendar Year

Gross sales (wholesale and retail)	**$**

Revenue from Shellfish Products

Estimated gross sales of shellfish	**$**
Estimated % of gross sales not farmed by you	**%**

Answer Yes or No to the following. **Does your company…**	**Yes/No**
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