

# WASHINGTON STATE MARITIME CLUSTER



## Economic Impact Study

**November 2013**



Economic Development Council  
of Seattle and King County

prepared for



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# EXECUTIVE SUMMARY

## Cluster Overview

Washington State's Maritime industry is rooted in the State's rich history of timber production, its location as a trade hub, and its proximity to some of the world's most productive fisheries. The Maritime Cluster includes core sectors Passenger Water Transportation; Ship and Boat Building; Maintenance and Repair; Maritime Logistics and Shipping; Fishing and Seafood Processing; and Military and Federal Operations. Companies in the cluster range from owner-operated boatbuilding firms, to Fortune 500 global logistics companies employing thousands in Washington and elsewhere.

Ship and Boat Building, Maintenance and Repair, Fishing and Seafood Processing, and Maritime Logistics and Shipping are the oldest and most established sectors in the state. The region's competitive advantage in both sectors stems from Washington's geographical location. As a trading hub linking the rest of the U.S. to Alaska, Canada, and Asia, Washington's Maritime Logistics and Shipping sector moves goods across the globe efficiently. Additionally, Washington's natural resources have supported the success of Washington's economy throughout the history of the State.

Despite the maturity of the industry, newer areas of the cluster, such as the cruise industry, have only just begun to take advantage of the region's strengths for their businesses. Innovation drives growth in each sector of Washington's Maritime. Research and resource management has transformed Washington and Alaska's fisheries from endangered to some of the best managed in the world. Technological advances have allowed commercial seafood processors to more efficiently use and capitalize total catch of fish – in the words of one company, they now make two fish out of one. Lighter building materials (first aluminum, now composites) have enabled boat and ship builders to construct stronger, cheaper, and safer vessels for their customers.

The Maritime Cluster relies on a robust and concentrated support system to fuel its growth. This includes everything from fueling operations to research, naval architects, marinas, accountants, Maritime lawyers, cold storage, boat dealers, and Public Ports. Maritime Support Services industries facilitate global movement of export goods and maintain and create new distribution channels. Each company in the cluster benefits from the agglomeration of close-by Maritime Support Services firms.

Federal Government spending in the form of contracts to Naval shipyards accounts for much of Ship and Boat Building, Maintenance and Repair in Washington – nearly one quarter of all Maritime jobs in the state are located in Kitsap County, home to Puget Sound Naval Shipyard. The Coast Guard and NOAA have a significant footprint in Washington, and they are substantial buyers of goods and services related to Ship and Boat Building, Maintenance and Repair in Washington.

## Measures and Impacts

### Direct Impacts

In 2012 Washington's Maritime Cluster employed more than 57,700 people directly in the state, and was responsible for \$15.2 billion in gross business income in 2012

(**Exhibit E1**). Maritime Logistics and Shipping was the largest Maritime employer in the state in 2012; the sector accounted for some 29% of Maritime employment. Boat and Ship Building, Repair, and Maintenance was close behind, employing 28.6% of the total for the cluster. The third largest sector in terms of employment was Fishing and Seafood Products, with 27% of total employment.

Fishing and Seafood Processing accounted for nearly 60% of total revenues, and Maritime Logistics and Shipping was the second largest contributor, at nearly 25% of total revenues. Revenues cluster-wide have grown an average of 6.4% per year, while Maritime Logistics and Shipping saw the highest growth rate of 10.2%.

### **Indirect and Induced Impacts**

Indirect and induced Maritime jobs account for another 90,000 jobs, for a total impact of 148,000 Washington jobs. The direct contribution of Maritime's \$15.2 billion in gross business income generates another \$14.8 billion in induced and indirect output, for a total contribution effect of \$30 billion to Washington's economy.

### **Wages**

The Maritime Cluster paid a total of over \$4 billion in wages in 2012 (**Exhibit E1**). The three largest contributors were Boat and Ship Building, Repair, and Maintenance; Fishing and Seafood Products; and Logistics and Shipping; all contributing nearly 30% to the cluster total.

### **Maritime Subsectors**

The Maritime Cluster consists of core activities in Passenger Water Transportation; Boat and Ship Building, Repair, and Maintenance; Maritime Logistics and Shipping; Fishing and Seafood Products; and Maritime Support Services.

#### **Passenger Water Transportation**

Passenger Water Transportation includes recreational cruise lines, Washington State Ferries and other ferries, water taxis, and recreational fishing, sailing, and diving charters. A Port of Seattle Study found that cruise ship passengers were responsible for \$145 million in direct output in 2007, and that Washington's ferries served 12 million passengers.

#### **Boat and Ship Building, Repair, and Maintenance**

Boat and Ship Building, Repair, and Maintenance includes new construction of commercial, recreation, and military vessels, maintenance, refurbishment and overhaul, and modernization. While commercial companies in the sector tend to be larger but smaller in number, companies serving the recreational sector are smaller but more

numerous. Included in this subsector are more than 11,000 civilian jobs at the Puget Sound Naval Shipyards in Bremerton.

### **Exhibit E1. Summary of Maritime Impacts, Washington State, 2012**

<b>Core Sectors</b>	<b>Employer Establishments</b>	<b>Wages (\$ millions)<sup>1</sup></b>	<b>Jobs<sup>2</sup></b>	<b>Gross Business Income (\$millions)</b>
Passenger Water Transportation	130	\$262.8	4,500	\$544.5
Boat and Ship Building, Repair, and Maintenance	150	\$1,163.8	16,500	\$1,489.7
Maritime Support Services	300	\$387.7	4,600	\$864.2
Fishing and Seafood Processing	720	\$1,113.4	15,400	\$8,592.6
Maritime Logistics and Shipping	800	\$1,156.0	16,700	\$3,722.4
<b>Total</b>	<b>2,100</b>	<b>\$4,083.7</b>	<b>57,700</b>	<b>\$15,213.3</b>

Source: Bureau of Labor Statistics (2013), Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics, U.S. Census (2013). Includes covered private and public jobs, and sole proprietors.

#### **Maritime Logistics and Shipping**

Maritime Logistics and Shipping includes Port and harbor operations, deep and shallow water goods movement, inland water freight transport, and refrigerated warehousing and storage. This sector includes many support firms and services, such as Maritime construction firms who contract with the Ports, and longshoremen.

#### **Fishing and Seafood Products**

Fishing and Seafood Products includes commercial and recreational fishermen, seafood processing firms, aquaculture and fish farming, and wholesale and retail seafood markets. Alaska's distant-water commercial fishing fleet is home ported in Puget Sound, and the economic impact of this is very large; the sector is one of the largest single employers in the Maritime Cluster, despite a decline between 1990 and 2000. Since 2000, covered employment in the sector has remained very steady.

#### **Maritime Support Services**

These services include support for commercial, recreational, and defense-related Maritime, including boat dealers, marinas, fueling and lubricant businesses, to naval architects, engineers, parts suppliers, and construction, to professional services such as attorneys and accountants, and federally-funded support involving NOAA and the Army

<sup>1</sup> Does not include benefits.

<sup>2</sup> Employment contains self-employer data for which the latest year available is 2011. 2012 self-employment estimates are based on a five-year average by sector.

Corps of Engineers. The growth of the cluster depends on these suppliers for their services and goods.

### **Military and Federal Operations**

Military Operations includes activities related to defense, research, boat building, and water rescue undertaken by the Navy and Coast Guard. Puget Sound Naval Shipyard is the largest employer in the defense arena of this sector, with over 11,000 employees in 2013, and an even larger footprint of subcontractors.<sup>3</sup> The federal government drives significant demand for shipbuilding and maintenance, and of those agencies, the Navy is by far the largest employer, with 53,000 active duty employees, and a total payroll of nearly \$3 billion.

### **Workforce Concentration and Profile**

Retaining and recruiting workforce is a top priority for those in the cluster, according to stakeholders. Existing workers in the Fishing and Seafood Products, and Boat and Ship Building, Repair and Maintenance sectors have sometimes worked in their field or company for generations, and employers understand the importance of taking care of their personnel. Still, stakeholders spoke to the difficulty of recruitment in the cluster at all levels of education and training which they attributed to a lack of public knowledge of the industry. Unskilled jobs that used to be held by teenagers, such as seafood processing, are now being replaced by J-1 visa holders.

#### **Exhibit E2. Top Five Washington Maritime Occupations by Average Annual Openings, 2016-2021**

<b>Rank</b>	<b>Occupation</b>	<b>Openings</b>
1	Meat, Poultry, and Fish Cutters and Trimmers	173
2	Sailors and Marine Oilers	140
3	Fishers and Related Fishing Workers	123
4	Laborers and Freight, Stock, and Material Movers,	117
5	Captains, Mates, and Pilots of Water Vessels	108

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<sup>3</sup> Employment for Puget Sound Naval Shipyard is included in the Boat and Ship Building, Repair, and Maintenance sector.

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# INTRODUCTION

## Background and Purpose

Washington State has long held a presence in Maritime activities. This project serves as a quantitative and qualitative assessment of the Maritime Cluster in Washington State. The study illuminates the Cluster's strengths and growth potential, and supports targeted economic development policy and initiatives.

## Methods

The analysis relies on custom data analysis, interpretation of secondary data sources and perspectives and insights from local industry leaders gathered through individual interviews and small group discussions, including the Maritime Skills Working Group with the Workforce Development Council. Data reported and the sources of information are as follows:

- Information on Maritime firms, jobs, occupations and wages from Washington State Employment Security Department (ESD)'s Quarterly Census of Employment and Wage data (QCEW data), including custom data summaries provided by the Puget Sound Regional Council (PSRC) and data assembled from Hoovers establishment database.
- Business revenues and taxable retail sales from the Washington State Department of Revenue.
- Bureau of Labor Statistics Occupational Demand, unemployment claims from Washington State Employment Security Department (ESD), and Integrated Postsecondary Education Data System (IPEDS).

## Organization of Report

The report is organized as follows:

- **Cluster Overview.** A description of the Maritime Cluster, including a cluster map displaying graphically the far-reaching connections of the industry within the regional economy. A review of the history of Maritime in Washington and review of previous studies of the cluster in Washington.
- **Measures and Impacts.** A quantitative analysis of the Maritime Cluster, including estimates of jobs, retail sales, revenues, imports and state-wide economic impacts.
- **Maritime Subsectors.** More detailed discussion of each subsector, including subsector-specific metrics and company profiles.
- **Workforce Assessment and Talent Pipeline.** An overview of workforce trends and forecasts, as well as education and demographic characteristics.
- **Summary.** An interpretation of the overall significance of the cluster and implications for the future of the industry.

### CLUSTER OVERVIEW

Key events in the history of Washington's Maritime Cluster are shown in the Maritime timeline (**Exhibit 1**). The exhibit presents a chronology of major additions to Maritime activity in Washington State, many of which remain vibrant today, as featured in this report. The history stems from the Hudson's Bay Company and pioneering of the Columbia River, to construction of early 20<sup>th</sup> century industrial shipyards and historic infrastructure development in the Lake Washington Ship Canal, to the advent of Seafair, salmon and fishery management challenges, and finally, technological changes that define modern Maritime Cluster economic activity.

Today's Maritime Cluster can be segmented into six key subsectors, described as follows and illustrated in the Cluster Map in **Exhibit 2**.

**Ship and Boat Building, Maintenance and Repair.** This subsector includes activities related to the building of commercial and recreational vessels, and the maintenance and repair of existing vessels. Commercial ships include fishing and transport boats, tugs and barges. Recreational vessels include yachts and sailboats. Maintenance and repair can include work on vessel interiors and exteriors as well as mechanics and electrical.

**Maritime Logistics and Shipping.** This subsector includes activity related to the shipping of goods by water, including container and bulk shipping, trans-ocean, shoreline and river freighting as well as break bulk shipping of goods. Tug and barge services comprise another activity area within Maritime Logistics and Shipping. Storage and warehousing of goods as well as Ports are included in this subsector.

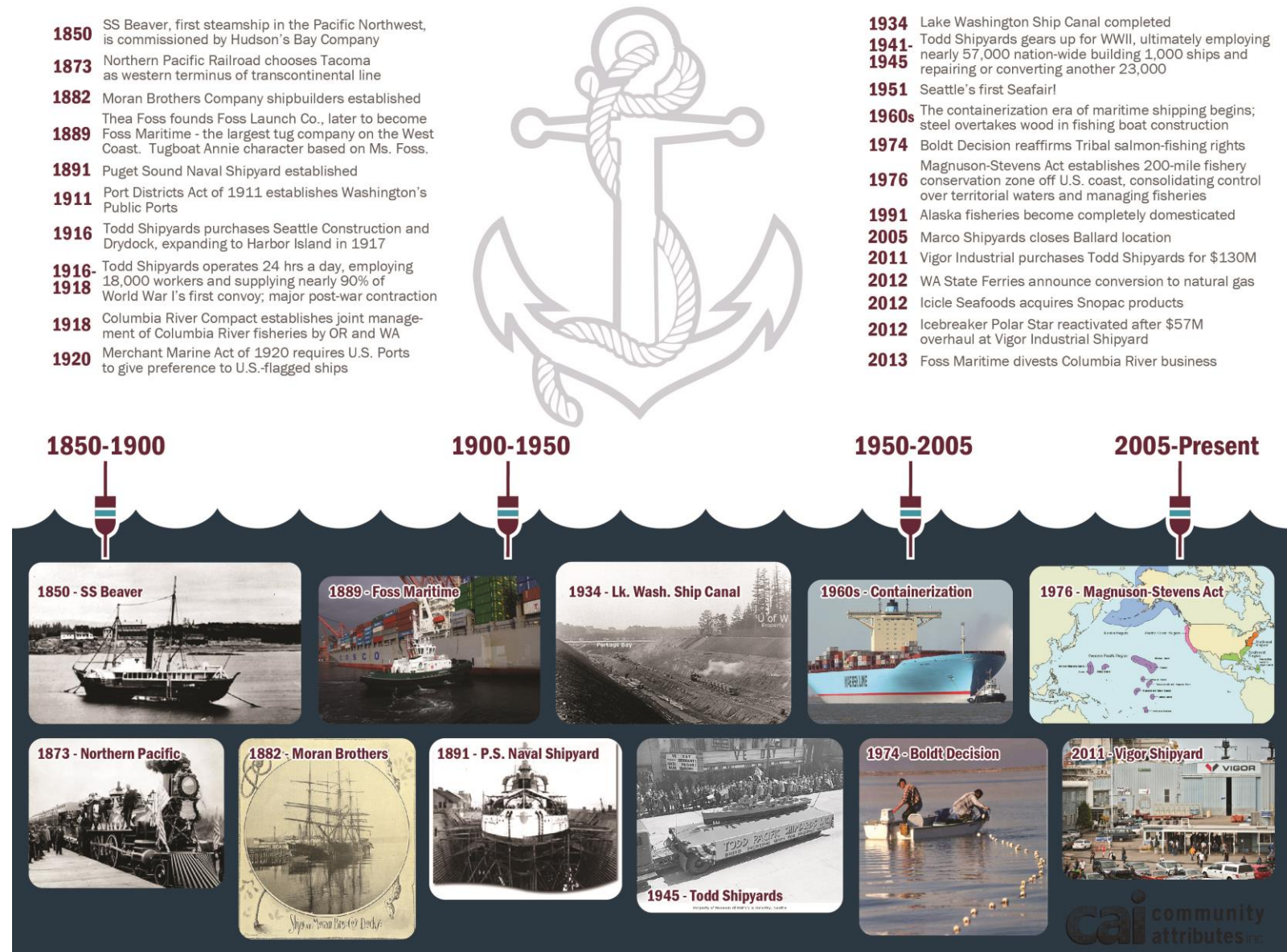
**Passenger Water Transportation.** This subsector includes activities related to the movement of people over water for transportation, including transportation for recreation. The Washington State Ferry system is included in this category, as is economic activity related to cruise ships, water-bound tours and other charter activity.

**Fishing and Seafood Processing.** The Fishing and Seafood Processing subsector includes all activity related to the catching and processing of fish including finfish and shellfish, as well as aquaculture and recreational fishing. This subsector captures Fishing and Seafood Processing activity that occurs in Alaska on Washington registered vessels by Washington pay rolled employees.

**Maritime Support Services.** Support Services includes technical and professional services, such as civil engineering firms that provide marine Terminal and Port design and construction, naval architecture, design, financial and legal services that support business activity in Maritime, as well as federally-funded Maritime support activities involving NOAA and the Army Corps of Engineers. Additional Support Services include supply and wholesaling in propulsion, electrical, hydraulic and safety systems, boat dealers and marinas, parts suppliers, interior builders, and fuelers.

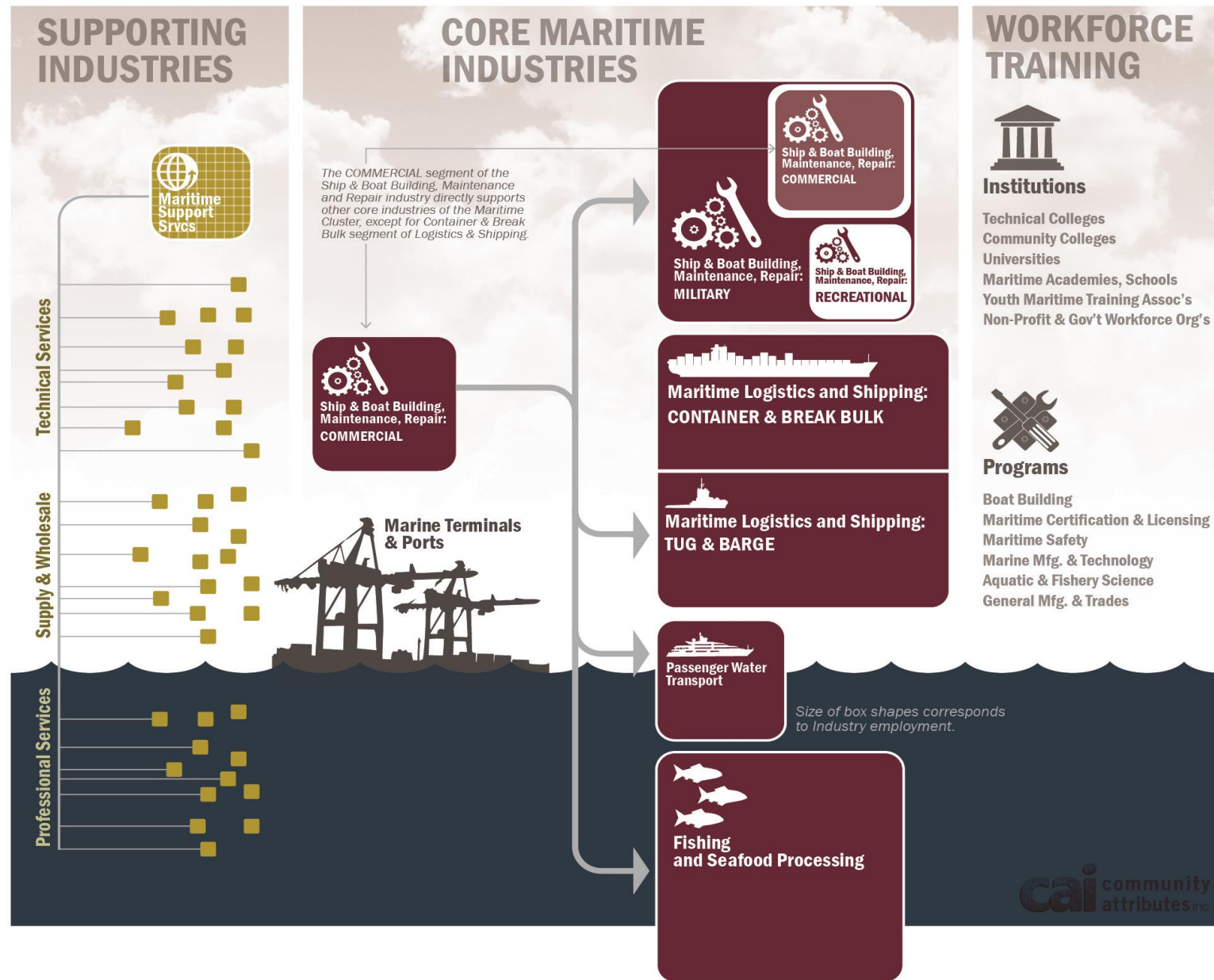
**Military Operations.** The Puget Sound Naval Shipyard in Bremerton leads federal employers in Washington State, including enlisted and civilian employees. Other military operations exist throughout the state, such as the U.S. Coast Guard, for example.

## Exhibit 1. Washington State Maritime Heritage, 1850 - 2013



## Exhibit 2. Maritime Cluster Map

## Cluster Overview



**Workforce Assessment and Talent Pipeline.** Workforce training and development activity includes public and private institutions, both accredited and non-accredited, which supply coursework, training and certification for careers and occupations in the Maritime sector. The Talent Pipeline combines potential supply of an occupation in Maritime with demand to better understand workforce for the sector.

### Industry Data Definitions

Measuring impacts using existing data require use of industry and occupations group codes established by government agencies and data providers. This report looks at the Cluster from industry leaders' perspectives and demonstrates the linkages that go beyond the rigid definitions provided by established economic codes.

While this study defines some sectors of Maritime relatively neatly and inclusively as a collection of NAICS codes, other sectors are not as easy to define this way. For example, Ship and Boat Building, Maintenance and Repair is fairly inclusively defined as two NAICS codes, Ship Building and Repairing, and Boat Building. Because of their NAICS definitions, this study assumes that all of the establishments, employees, and revenues reported for these NAICS are associated with Maritime activity in Washington. However, other sectors are more difficult to define in the same manner. One example is that of Professional Services. Accountants, attorneys, and engineers all support Maritime, and some firms are entirely dedicated to the industry, but not all these firms can be attributed to Maritime.

Rather than rely solely on NAICS codes, this study employs a variety of data sources to tell the story of each sector and its contribution to the industry. **Exhibit 3** presents a summary of how this study defines each Maritime sector. Some sectors are defined by a collection of NAICS codes while others include a combination of NAICS codes along with an inventory of establishments known to provide services to the Maritime sector. The sector of professional Maritime Support Services is defined by this study to comprise of an inventory of establishments known to provide services to the Maritime sector. While this study cannot include all establishments that exist in each sector, it does aim to include the great majority.

**Exhibit 3. Key Maritime Sectors and Basis of Definition**

<b>Sector</b>	<b>Basis of Definition</b>
Passenger Water Transportation	NAICS codes
Ship and Boat Building, Repair, and Maintenance	NAICS codes
Maritime Logistics and Shipping	NAICS codes
Fishing and Seafood Processing	NAICS codes
Maritime Support Services	NAICS codes, establishment-level data
Military and Federal Operations	Corps/Department-level data



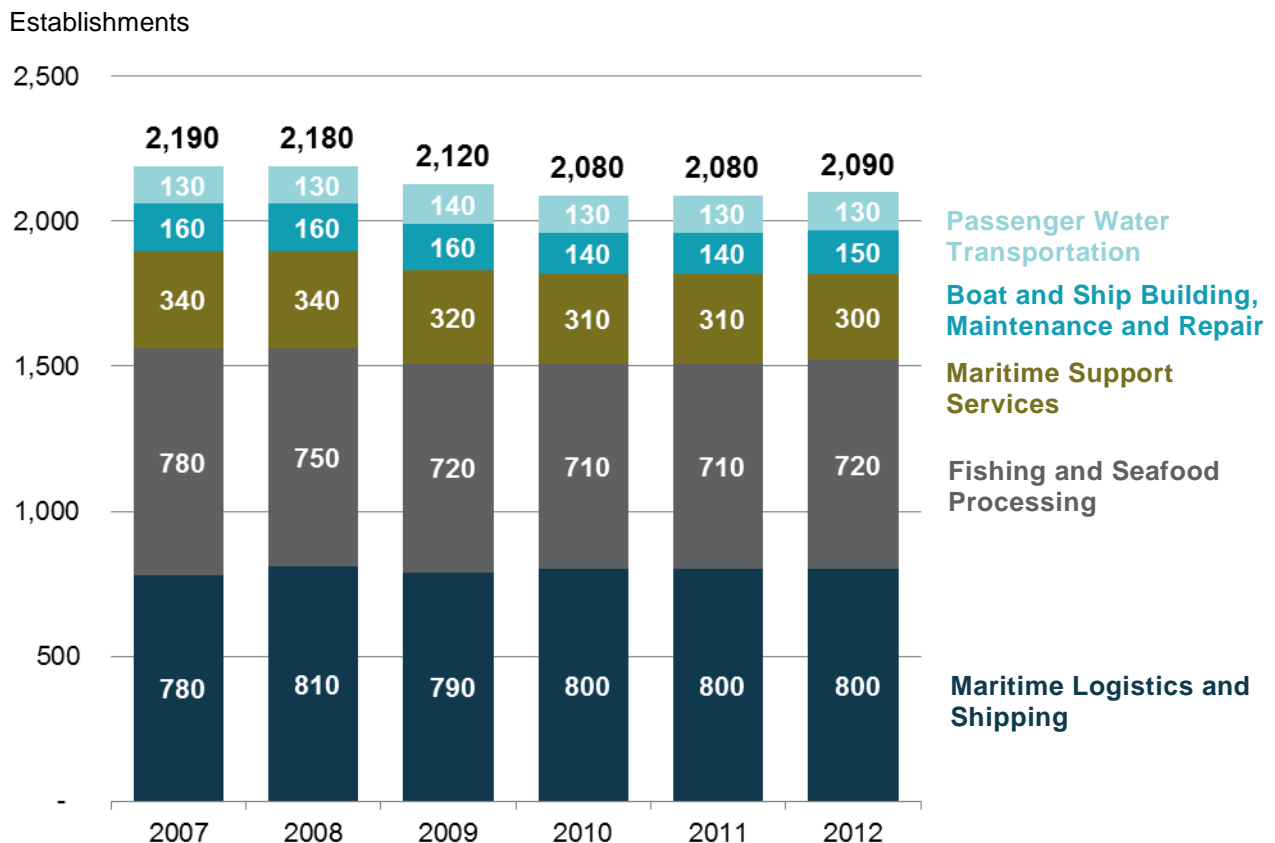
## MEASURES AND IMPACTS

The Maritime Cluster in Washington State is large, pays good wages, and drives economic development across the state. This section provides the measures and data necessary to understand the breadth and significance of the economic impact of Maritime activity in Washington.

### Establishments

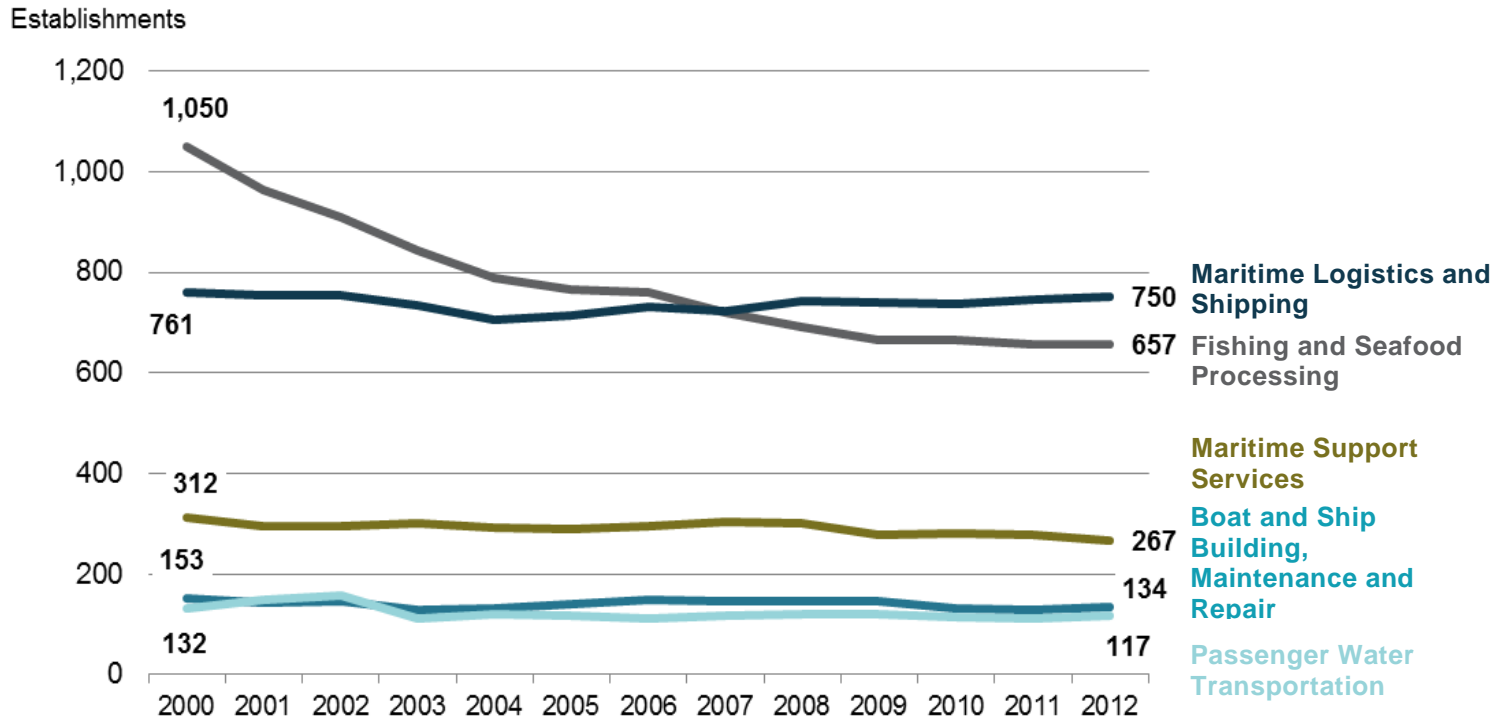
In 2012, there were 2,090 establishments with covered employment identified as belonging to the Maritime Cluster. Private sector establishments with covered employees totaled 1,930 in 2012. The largest number of establishments was in Maritime Logistics and Shipping (800), followed by Fishing and Seafood Processing (720). The private sector count is down from an estimated recent historic peak of 2,408 in 2000, though it has leveled off in recent years. **Exhibits 4 and 5** illustrate more recent trends in total establishment numbers in establishments and private sector establishment by subsector of Maritime.

**Exhibit 4. Maritime Employer Establishments, Washington State, 2007 – 2012**



Source: Community Attributes Inc.; Washington State Employment Security Department (2013). Excludes sole-proprietors.

**Exhibit 5. Private Sector Establishment Count by Category, Washington State, 2000 – 2012**



Sources: Community Attributes Inc., Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics (2013).<sup>4</sup>

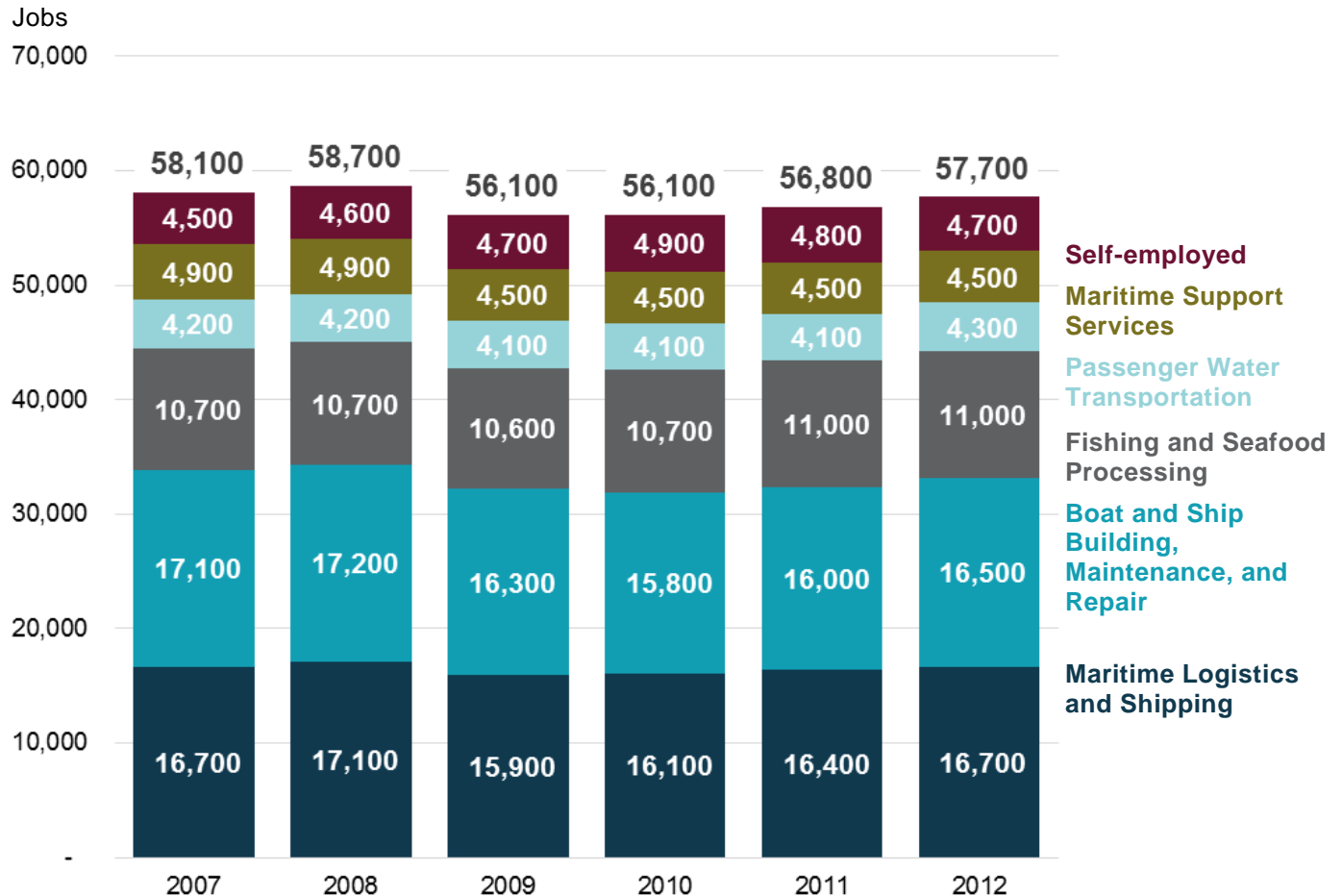
<sup>4</sup> Maritime Logistics and Shipping, Fishing and Seafood Processing, and Passenger Water Transportation contain imputed values. See individual sections of this report for more information on imputation.



## Jobs

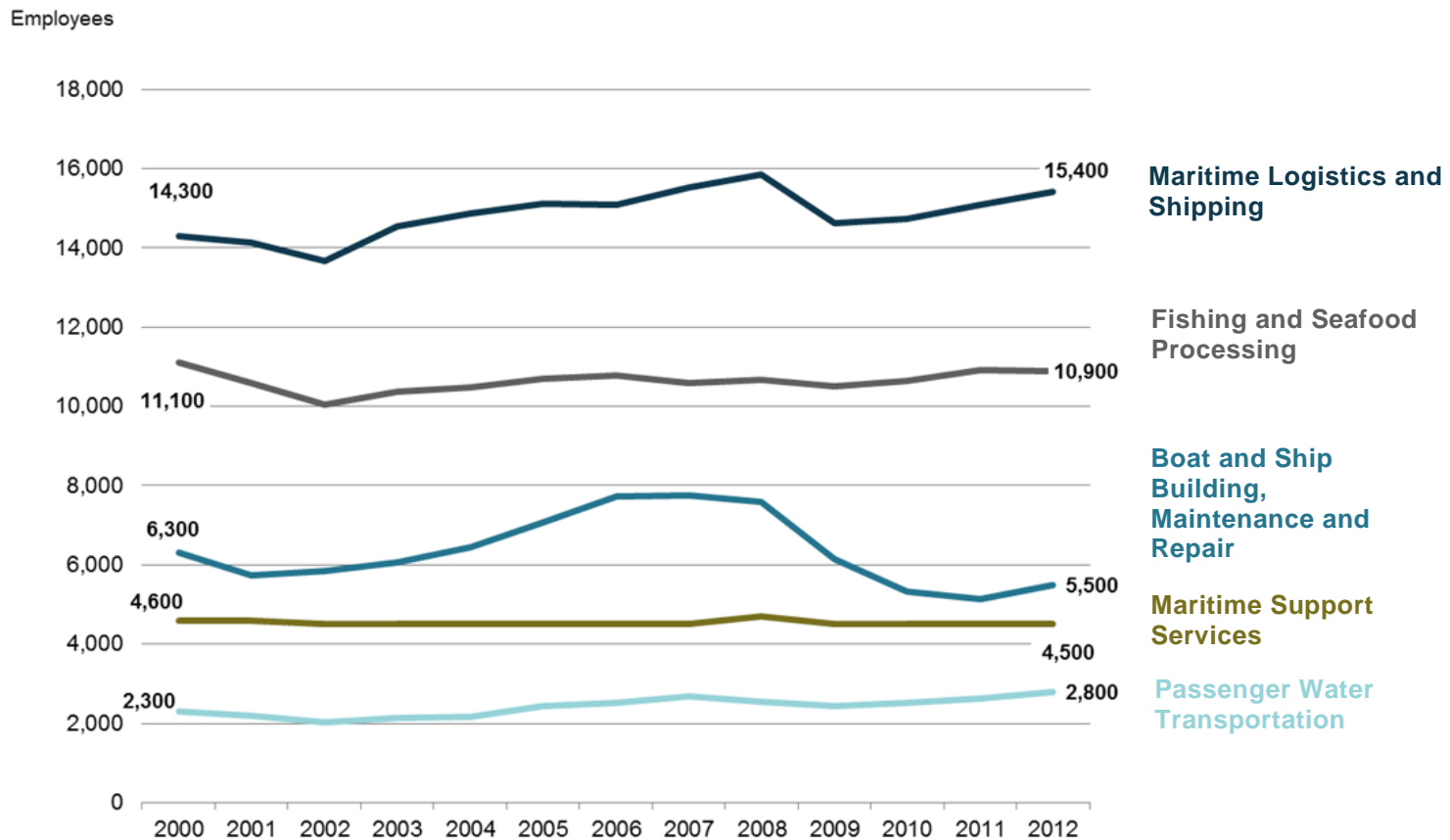
The Maritime Cluster directly employed 57,700 workers across the state in 2012, including private sector firms, sole proprietorships, and public sector entities (**Exhibit 6**). Of this, more than 16,700 workers were employed in Maritime Logistics and Shipping, followed by nearly 16,500 in Ship and Boat Building, Maintenance and Repair; the latter includes 5,480 workers in private sector firms across the state. Employment in private sector Maritime firms totaled more than 39,000 in 2012 (**Exhibit 7**).

**Exhibit 6. Maritime Jobs by Subsector, 2007 – 2012**



Source: Community Attributes Inc.; Washington State Employment Security Department (2013). Includes Public and Private sectors and Self-Employed workers.

**Exhibit 7. Private Sector Jobs by Subsector, Washington State, 2000 – 2012**



Sources: Community Attributes Inc., Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics (2013).<sup>5</sup>

Maritime Support Services employed at least 4,500 workers in 2012 (**Exhibit 7**). These activities include naval architecture firms, suppliers, boat dealers and marinas, parts wholesalers, direct engineering services, as well as law firms, accountants, and other professional services.

<sup>5</sup> Maritime Logistics and Shipping, Fishing and Seafood Processing, and Passenger Water Transportation contain imputed values. See individual sections of this report for more information on imputation.

Approximately 4,800 workers were self-employed in 2011, and thus not included in covered employment estimates. The overwhelming majority of these workers are described as in fishing activities—either for finfish or shellfish (**Exhibit 8**).

### Exhibit 8. Non-Employer Firms in Maritime Core Sectors, 2007- 2011

NAICS Code	Maritime Subsector	Activity Description	2007	2008	2009	2010	2011
1141	Fishing and Seafood Processing	Fishing	4,102	4,150	4,265	4,353	4,470
483	Transportation	Water transportation	208	207	209	392	187
441222	Passenger Water Transportation	Maritime Support Services	141	124	123	134	111
31171	Fishing and Seafood Processing	Seafood product preparation and packaging	63	44	47	39	37
44522	Fishing and Seafood Processing	Fish and seafood markets	32	33	42	30	34
<b>TOTAL</b>			<b>4,546</b>	<b>4,558</b>	<b>4,686</b>	<b>4,948</b>	<b>4,839</b>

Source: U.S. Census (2010).

### Wages by Subsector

Wage and salary disbursements in 2012 among Maritime establishments (covered and self-employed) totaled an estimated \$4.1 billion; scaling to include work-associated benefits, estimated total income totaled \$5.1 billion.

The average annual salary before benefits among Maritime workers was \$70,800 in 2012<sup>6</sup>, though this varied by activity area within the cluster. In 2012, federal employment in Ship Building and Repair activities across three sites in Washington State included 10,970 employees earning an average annual salary of more than \$79,000; more recent figures show employment at the Puget Sound Naval Shipyards to have reached more than 11,200 (as of August 2013). The estimated average annual wage among workers engaged in Fishing and Seafood Processing was \$72,300 in 2012, but this included an average annual wage of \$116,428 for finfish fishing (based on an annualized rate) compared with \$65,800 for shellfish fishing. Likewise, the average annual wage for covered workers in Ship and Boat Building, Maintenance and Repair was \$70,500, but among private sector employees the annual wage was less than \$53,600. More data on wages by occupation are presented in subsequent sections.

<sup>6</sup> This estimate is total wages divided by total jobs (**Exhibit E1**)

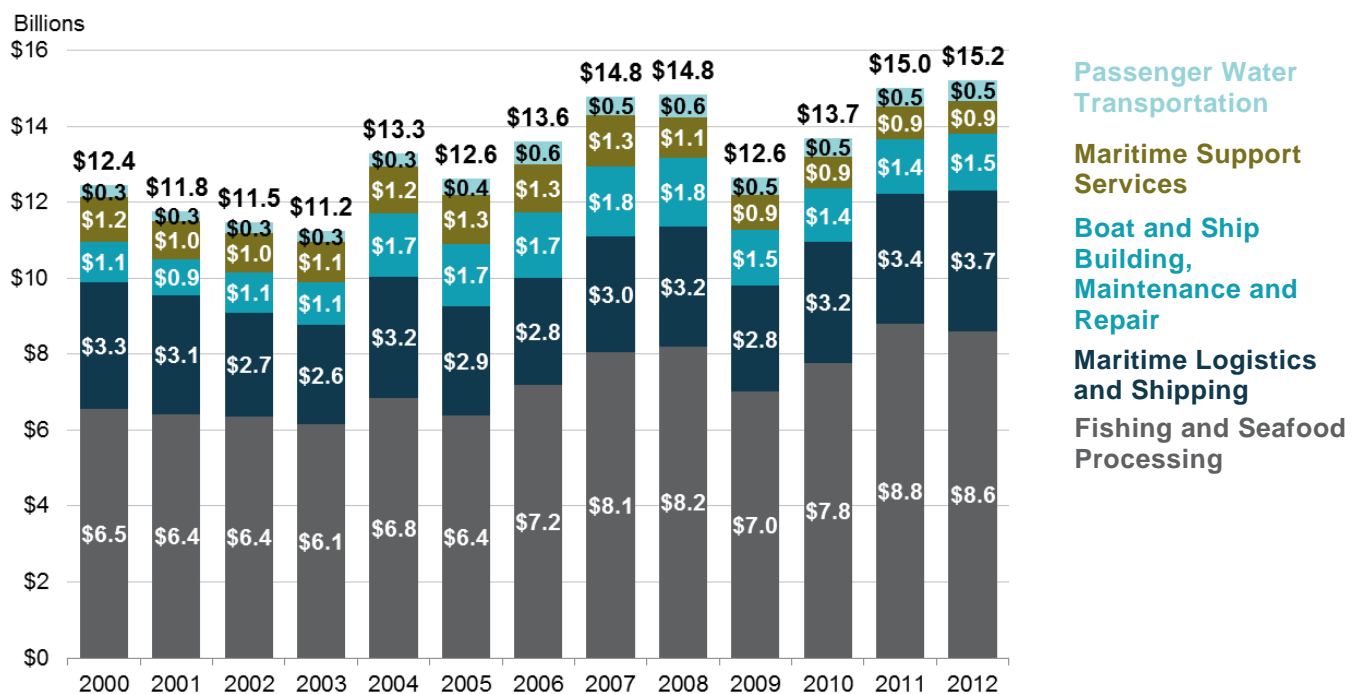
## Business Revenues

Maritime Cluster businesses generated directly more than \$15.2 billion in gross business income within Washington in 2012 (**Exhibit 9**), including nearly \$8.6 billion in Fishing and Seafood Processing (including direct fishing activities and value-added food processing and canning as well as product distribution).

Ship and Boat Building, Maintenance and Repair reported nearly \$1.5 billion in sales, including \$133 million in foreign exports in 2012. Added to these activities are those of other manufacturers, wholesalers, and engineering firms in support of Ship and Boat Building, Maintenance and Repair. For instance, on-shore engineering and construction firms, as part of Maritime Support Services, generated \$246.8 million in sales in 2012; these activities include port infrastructure design and construction.

Between 2009 and 2012, Maritime business revenues (adjusted for inflation) have grown on average 6.4% per year (based on a compound annual growth rate, or “CAGR”). During this period, Maritime Logistics and Shipping revenues grew at an annual rate of 10.2% (**Exhibit 9**).

**Exhibit 9. Maritime Gross Business Income,  
Washington State (in 2012 dollars), 2000 – 2012**



Sources: Community Attributes Inc.; Washington State Department of Revenue; U.S. Bureau of Economic Analysis.

### Indirect and Induced Impacts

The Maritime Cluster meets the definition of a *basic* industry, a term from economic base theory that means the majority of output by Maritime firms is sold as exports, either to other regions of the U.S. or abroad, and is thus a net importer of income into the state. Collectively, the Maritime Cluster supported—directly and through indirect and induced impacts—148,000 jobs,<sup>7</sup> representing a jobs multiplier of 2.6, shown in **Exhibit 10**. For every one Maritime job in Washington, an additional 1.6 additional jobs are supported by Maritime activities. Every million dollars of output generated among Maritime firms supported 9.7 jobs throughout the state economy.

Approximately 66,200 jobs were supported via induced impacts, for example, jobs resulting from the spending of new labor income associated with Maritime activities. Across Maritime activities, an estimated \$3.9 billion in direct purchases were made in 2012, equivalent to 26% of total output for Maritime activities. For each dollar of output generated by Maritime firms, an additional \$0.95 in output is supported elsewhere in Washington.<sup>8</sup>

Impacts vary by Maritime activity. For example, Fishing and Seafood Processing supported—directly and through indirect and induced effects—nearly 33,500 jobs across the state, representing a total jobs multiplier of 3.0. Overall, for every million dollars in output generated directly by Fishing and Seafood Processing, nearly 4 jobs are supported elsewhere throughout the state economy. Ship and Boat Building, Maintenance and Repair supported a total of nearly 30,000 jobs in 2012, while for every dollar of output in Maritime Support Services, 5.6 jobs were supported across the state.

Impacts also reflect port activities. For instance, Washington's ports contract with numerous construction, structural engineering, and geotechnical and environmental firms in support of new terminal construction and repair—between 2011 and 2013, at least 126 firms engaged in this kind of work for the Ports of Seattle and Tacoma.

The federal government likewise drives economic activity via its larger employment footprint and the purchasing of goods and services from Washington-based companies. The Puget Sound Naval Shipyards, based in Bremerton, awarded nearly \$200 million in maintenance and repair contracts for work performed in Washington, with the majority of these projects awarded to Washington-based businesses (and roughly 75% for technical assistance and services). The Navy and Coast Guard are also major purchasers

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<sup>7</sup> Total impacts in this study refer to indirect impacts associated with first round purchases, for example, impacts through suppliers, as well as induced impacts through labor income and additional jobs, income, and output resulting from the spending of this income within Washington State.

<sup>8</sup> Included in model estimates was a scaling up of wage and salary disbursements for 2012 by 25% to capture additional benefits associated with labor income in the input-output modeling process, for example, health insurance benefits. The 25% estimate is considered a conservative estimate of these additional income-associated benefits.

of Maritime hardware manufactured in Washington, including high performance aluminum boats manufactured by Bremerton-based Safe Boats International and Seattle-based Kvichak Marine Industries.

### Exhibit 10. Summary of Maritime Industry Economic Impacts, 2012

	<b>Jobs</b>	<b>Labor Income (billions USD)</b>	<b>Sales (billions USD)</b>
Direct	57,700	5.1	15.2
Indirect	24,100	1.2	4.7
Induced	66,200	3.4	10.1
Total	148,000	9.6	30.0

	<b>Multipliers</b>
Totals jobs/direct job in maritime	2.6
Total jobs per \$million direct output	9.7
Total income per \$ direct output	0.6
Total output per \$ direct output	2.0

Sources: Community Attributes Inc.; Washington State Office of Financial Management (2013).

### Fiscal Impacts

The economic activity generated by the Maritime Cluster also supports tax revenues. In 2012, Maritime firms directly contributed \$79.5 million in state tax payments, including \$29.0 million in business & occupation (B&O) taxes and \$36.1 million in remitted sales tax. Maritime logistics and shipping paid \$32.0 million in state taxes, followed by Maritime support services with \$20 million in payments.

Economy-wide, Maritime activities supported—via direct, indirect, and induced impacts—an estimated \$351.5 million in state tax revenues in 2012 (**Exhibit 11**). These revenues include an estimated \$179.2 million in sales tax revenues, \$119.0 million in business and occupation taxes (B&O), and \$53.3 million in other taxes.<sup>9</sup> Fishing and Seafood Processing alone contributed, directly and via indirect and induced effects, an estimated \$135.7 million in tax revenues to the state.

<sup>9</sup> In order to estimate business & occupation (B&O) taxes using estimated business output, the effective B&O tax rate was derived by comparing B&O tax payments by sector as a percentage of total output; a similar approach was applied to use taxes, fees, and sales tax. A more detailed explanation can be found in the Appendix.

## Exhibit 11. Maritime Cluster Fiscal Impacts, 2012 (millions USD)

	Direct Payments		Total Impact	
B&O	\$	29.0	\$	119.0
Sales Tax	\$	36.1	\$	179.2
Other tax revenues	\$	14.5	\$	53.3
Total	\$	79.5	\$	351.5

Source: Community Attributes Inc.; Washington State Office of Financial Management; Washington State Department of Revenue.

## Statewide Reach of Maritime

The largest concentration of Maritime activities (as of 2012) is within the Central Puget Sound region. Approximately 41% of all direct Maritime employment is located in King County, with another 24% in Kitsap and 8% in Pierce (**Exhibit 12**).<sup>10</sup>

Establishments are slightly more evenly distributed by county, with many smaller Maritime businesses operating in areas outside of King, Pierce, and Kitsap Counties. For instance, Snohomish and Whatcom Counties are home to 6% and 7%, respectively, of establishments statewide, while Skagit and Grays Harbor each have approximately 5%. Conversely, while Kitsap County is home to nearly one quarter of Maritime jobs in Washington State, the vast majority of these positions are with one employer, the Puget Sound Naval Shipyards. Roughly 40% of Maritime establishments are situated in King County, with another 9% in Pierce.

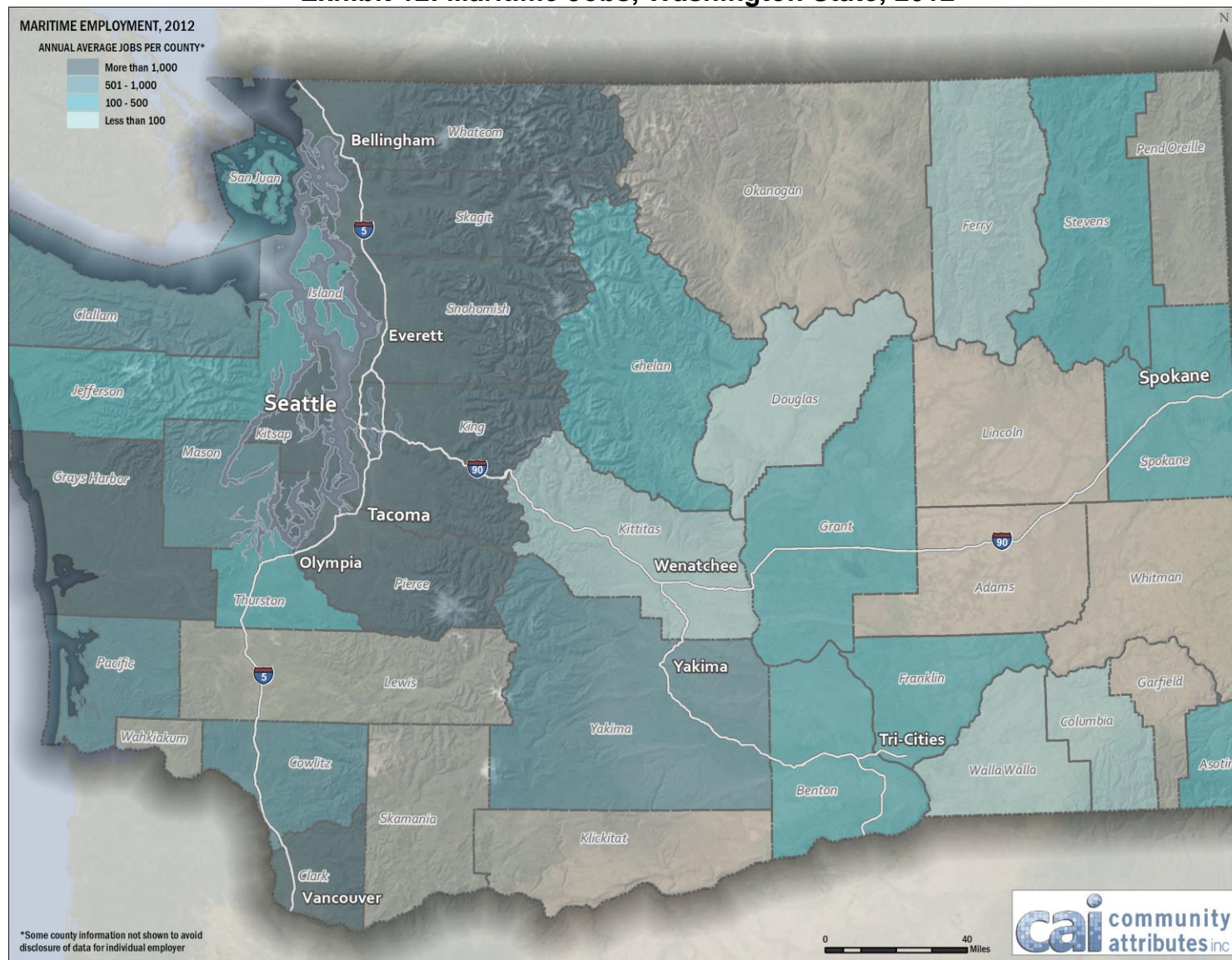
While Eastern Washington does not have direct access to the ocean and/or Puget Sound, there are a variety of activities along the Snake and Columbia Rivers and inland either directly engaged in or in support of Maritime Logistics and Shipping and boat manufacturing. In 2012, an estimated 139 such Maritime establishments employing more than 2,200 workers were located across eighteen of the twenty counties that constitute Eastern Washington.<sup>11</sup>

<sup>10</sup> Percentages are based on public and private sector employment by NAICS codes, and thus excludes self-employed workers and customized estimates for additional Maritime Support Services. The latter constitutes an estimated 2% of all covered employment, but is concentrated in King, Pierce, and Kitsap counties.

<sup>11</sup> Counties considered part of Eastern Washington are: Adams, Asotin, Benton, Chelan, Columbia, Douglas, Ferry, Franklin, Garfield, Grant, Kittitas, Klickitat, Lincoln, Okanogan, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman, and Yakima.



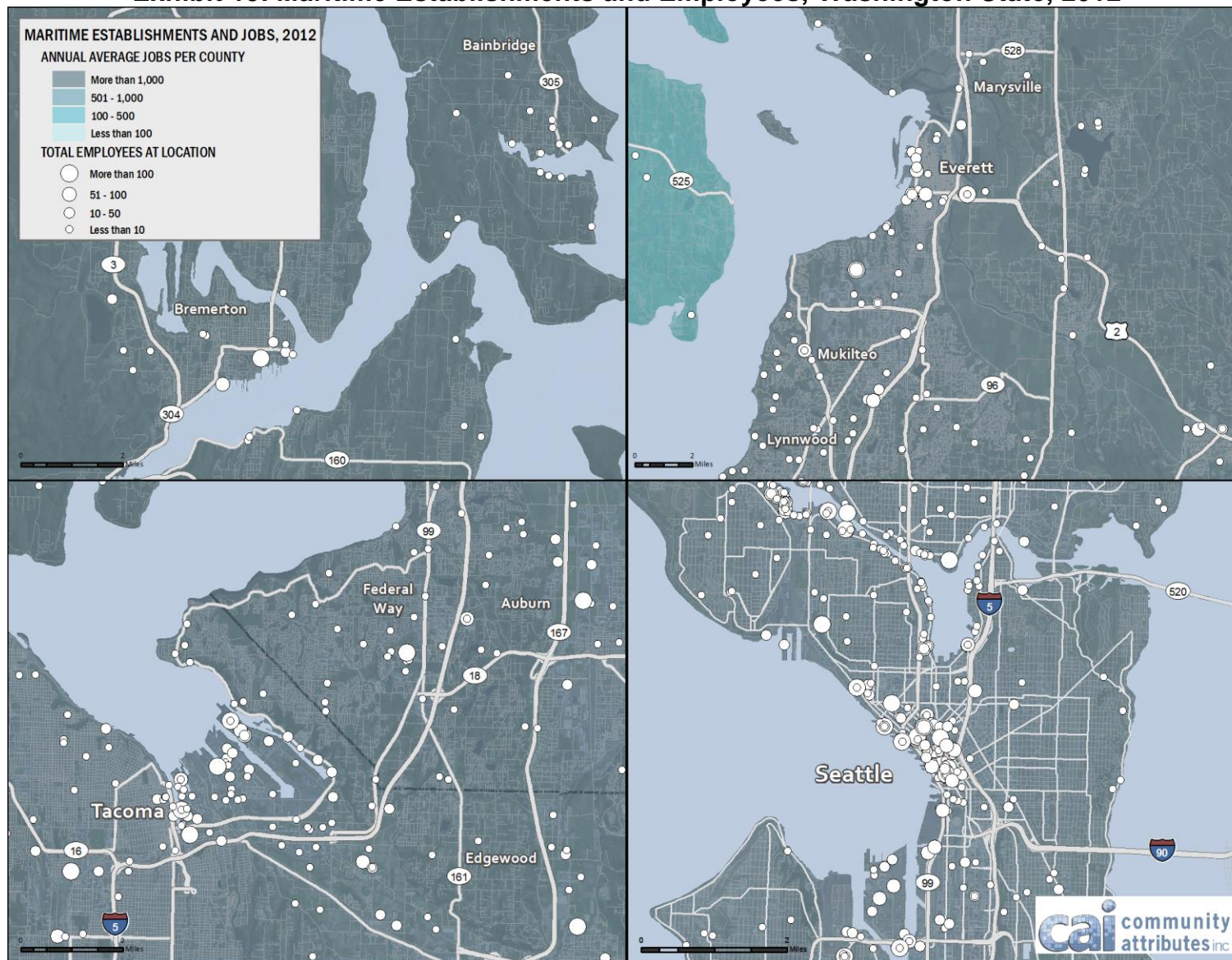
**Exhibit 12. Maritime Jobs, Washington State, 2012**



Sources: Community Attributes; Washington State Employment Security Department (2013).



**Exhibit 13. Maritime Establishments and Employees, Washington State, 2012**



Sources: Community Attributes; Washington State Employment Security Department (2013); Hoovers (2013).

## **MARITIME SUBSECTORS**

In this study, businesses and organizations belonging to the Maritime Cluster are defined as those engaged in at least one of the following: 1) Fishing and Seafood Processing; 2) Ship and Boat Building, Maintenance and Repair; 3) Maritime Shipping and Logistics; 4) Passenger Water Transportation; and 5) Maritime Support Services.

The linkages between each of these segments of the cluster help drive economic growth and the sustained strength of the cluster. For instance, ship and boat builders provide direct support to the commercial fishing fleet and ferry system through the manufacture, maintenance, upgrading, and repair of fishing boats. Likewise, the federal government procures patrol boats as well as technical services in support of activities at the Puget Sound Naval Shipyard in Bremerton. Naval architecture, structural design, and geotechnical engineering firms along with construction firms do significant contract work for the ports and boat builders.

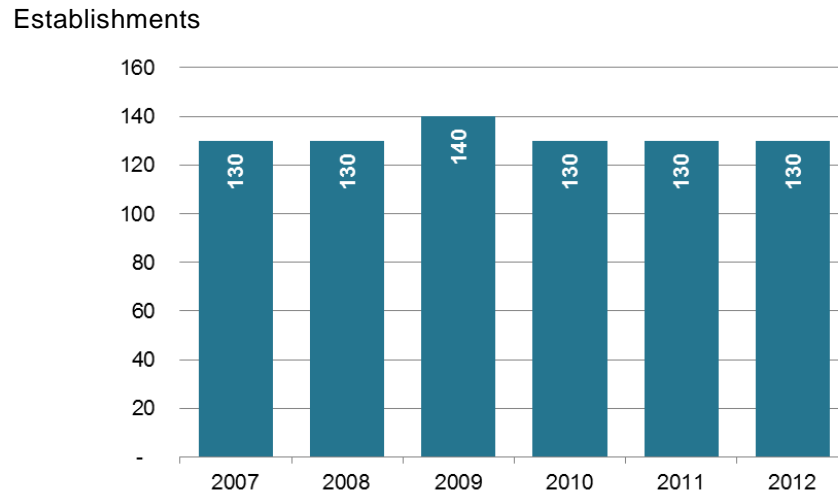
As shown in earlier sections, **Exhibit 2** demonstrates the breadth and scope of these forward, backward, and lateral linkages. In the sections below, each major segment of the Maritime Cluster in Washington is discussed in further detail, using both quantitative sources and qualitative information gathered from interviews and third party resources.

### **Passenger Water Transportation**

Passenger Water Transportation includes state ferry operations and private ferries, as well as private cruise industry operations based in Washington, for the purposes of this study. Examples of occupations included in the sector include ship engineers, sailors and marine oilers, laborers, general and operations managers, and captains, mates, and pilots of water vessels. The occupations are analyzed in a subsequent section on Workforce Assessment.

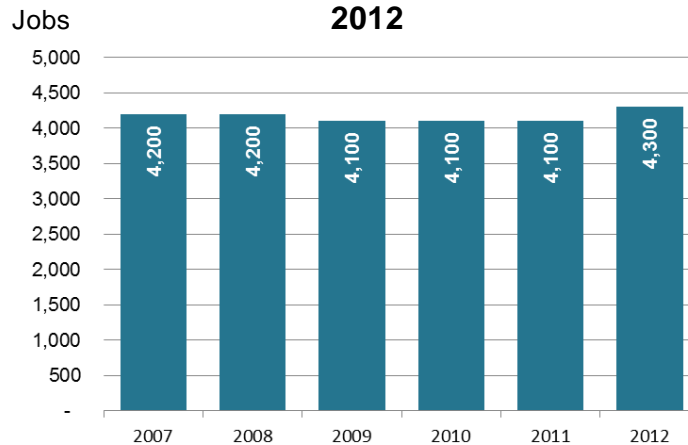
The number of Water Transportation Establishments, shown in **Exhibit 14**, have held steady at 130, with the exception of an increase to 140 in 2009. Jobs in Water Transportation are at a recent high point of 4,300 (**Exhibit 15**). In 2012, Washington had 4,300 jobs in Water Transportation. Gross business incomes are down in 2012 from their peak of \$607 million, as shown in **Exhibit 16**. Total gross business incomes were \$550 million in 2012.

**Exhibit 14. Passenger Water Transportation Establishments,  
Washington State, 2007 – 2012**



Source: Community Attributes, Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics (2013).<sup>12</sup>

**Exhibit 15. Passenger Water Transportation Jobs, Washington State, 2007 –  
2012**

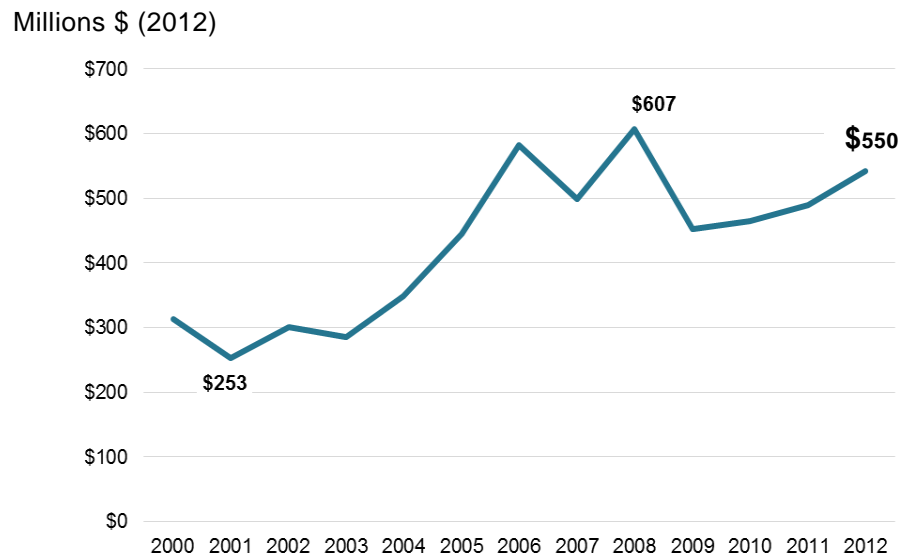


Source: Community Attributes, Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics (2013).<sup>13</sup>

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<sup>12</sup> Notes: 483114 is imputed for 1990-2002 using method #1; 483212 is imputed for 1990-2000 using method #3; 483112 is imputed for 2000-2008 using method #1 (see **Appendix B**).

**Exhibit 16. Gross Business Income in Water Transportation, Washington State, 2000 – 2012**



Sources: Community Attributes Inc.; Washington State Department of Revenue; U.S. Bureau of Economic Analysis.<sup>14</sup>

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<sup>13</sup> Notes: 483114 1990-2002 was imputed for 1990-2002 using method #3, for 2004 using method #2; 483212 was imputed for 1990-2000 using method #3; 483112 was imputed for 1990-2000, 2005-2007, & 2009-2012 using method #1. See **Appendix B** for more information on imputation.

<sup>14</sup> 483112 was imputed for 1994, 1996-2001, 2003, & 2012 using method #3. See **Appendix B** for more information on imputation.

## Maritime Subsectors: Passenger Water Transportation

### Washington State Ferries

Washington State is home to the largest passenger and vehicle ferry system in the United States. Twenty-two vessels carry an annual average of 12 million passengers between 20 ports of call (**Exhibit 17**). The ferry system carries passengers as far south as the Port of Tacoma and as far north as Sidney, British Columbia. Washington State Ferries employs more than 1,500 employees.

Ferry routes are administered by the Washington State Department of Transportation (WSDOT) as a marine highway system. The routes with the highest total annual ridership are Bainbridge Island-Seattle, Mukilteo-Clinton, and Edmonds-Kingston.

**Exhibit 17. Annual Total WSDOT Ferry Ridership, 2012**

<b>Ferry</b>	<b>Vehicles</b>	<b>Passengers</b>
Mukilteo-Clinton	2,090,426	1,744,541
Edmonds-Kingston	2,025,025	1,782,910
Seattle-Bainbridge Island	1,940,639	4,177,878
Fauntleroy-Vashon	1,105,064	822,742
Seattle-Bremerton	641,728	1,687,594
Fauntleroy-Southworth	478,004	319,578
Tahlequah-Pt. Defiance	383,224	266,594
Anacortes-Friday Harbor	328,436	458,156
Pt. Townsend-Keystone	323,192	360,752
Anacortes-Orcas	264,174	288,892
Anacortes-Lopez	151,312	144,580
Southworth-Vashon	91,100	69,978
Interisland	86,950	-
Anacortes-Sidney B.C.	42,581	72,683
Anacortes-Shaw	16,992	15,322
Interisland-Sidney	5,607	14,422
<b>Total</b>	<b>9,974,454</b>	<b>12,226,622</b>

Source: 2012 Annual Washington State Ferries Traffic Statistics.

## Maritime Subsectors: Passenger Water Transportation

### County Operated Ferries

Several public entities operate ferry service to transport passengers across Washington's bodies of water. The King County Ferry District was established in 2007 by the King County Council to expand transportation options for King County residents. It currently operates two passenger only routes as the King County Water Taxi. Routes transport passengers from Pier 50 in downtown Seattle to either Vashon Island or West Seattle. In 2012 ridership on the West Seattle route totaled over 249,000 passengers. The Vashon Island Route carried nearly 178,000 in the same year.

Skagit County operates the Guemes Island Ferry which transports an annual average of 400,000 people and 200,000 vehicles between Guemes Island and Anacortes. The ferry provides the only link to the mainland for the island's permanent and part-time residents. The run between Guemes Island and Anacortes is about 0.7 mile, and the crossing time is approximately five minutes. The M.V. Guemes was constructed in 1979, and has a capacity of 22 passenger vehicles and 102 passengers.

Pierce County operates the Steilacoom-Anderson Island Ferry. In 2012, nearly 88,000 passengers and over 95,000 vehicles travelled between Steilacoom and Ketron and Anderson Islands. The two vessels, the M/V Christine Anderson and M/V Steilacoom II, provide the only link to the mainland for the two islands' permanent and part-time residents. The run between Anderson Island and Steilacoom is 3.5 miles, and a round trip takes approximately one hour. There are 10 to 14 daily runs, with four daily runs on a triangular route run from Steilacoom to both Ketron and Anderson Islands. The M.V. Christine Anderson was built in 1994, and the M.V. Steilacoom II in 2006. Each has a capacity of 54 cars and 250-300 passengers.

Whatcom County operates the Lummi Island Ferry which provides passenger and vehicles transport between Gooseberry Point and Lummi Island. The ferry service provides the only link to the mainland for the island's permanent and part-time residents. In 2012 ridership totaled 182,000 passengers and 109,000 vehicles. The run between Gooseberry Point and Lummi Island is about 0.9 mile, and the crossing time is approximately five minutes. The M.V. Whatcom Chief was constructed in 1962, and has a capacity of 20 vehicles and 103 passengers.

Wahkiakim County operates the Wahkiakum County Ferry across the Columbia River, transporting an annual average of 100,000 passengers and 50,000 vehicles between Puget Island, Washington and Westport, Oregon. The Wahkiakum Ferry provides the only interstate connection across the Columbia River between the Astoria-Megler Bridge (43 miles to the west) and the Longview Bridge (26 miles to the east). The run between Puget Island and Westport, Oregon, is about 1.5 miles, and the crossing time is approximately ten minutes. The M.V. Wahkiakum was constructed in 1962, and has a capacity of 12 vehicles and 76 passengers.

### Other Ferries

The Colville Confederated Tribes operate the Gifford-Inchelium Ferry, which in 2009 transported 166,000 people across Roosevelt Lake on the upper Columbia River between Inchelium, Washington, and SR 25.

## Maritime Subsectors: Passenger Water Transportation

Kitsap Transit operates a passenger only ferry between Port Orchard and Bremerton. In 2012, the Kitsap Transit Foot Ferry carried over 437,000 passengers.

Washington State Department of Transportation operates a ferry across Roosevelt Lake on the Columbia River. This route, the Keller Ferry, represents the only WSDOT ferry operations east of the Cascade Mountains. This route connects the northern and southern segments of SR 21. In the summer of 2013 the Martha S. vessel was retired, with a month long suspension of ferry service until a new vessel, the Sanpoil, could replace it.

The privately owned and operated Lady of the Lake company operates year-round transportation on Lake Chelan serving Stehekin, Holden Village, the North Cascades National Park, and other points along Lake Chelan. These small communities are not accessible by road, and the Lady of the Lake provides the most consistent form of transportation and freight in and out of these areas.

### **Cruise Industry**

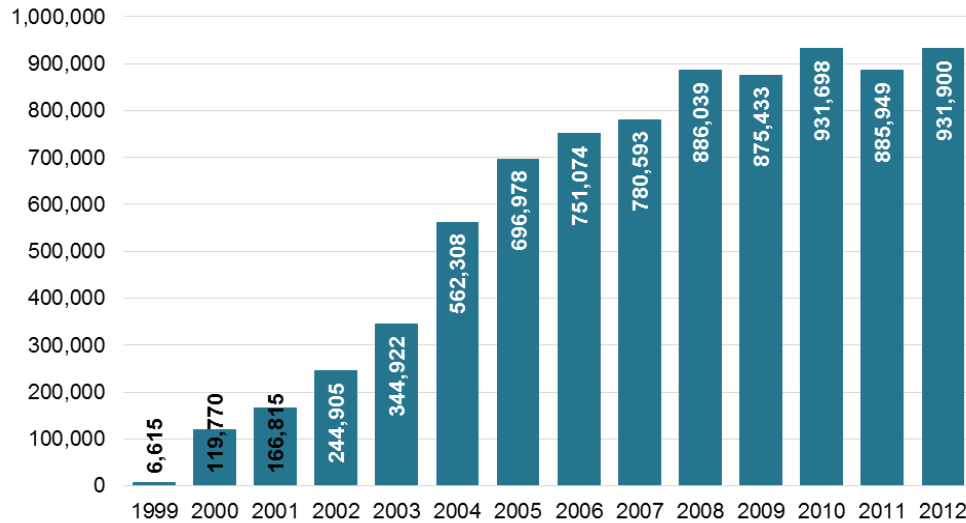
Cruise activity in Washington State is primarily centered in the Port of Seattle, where two piers provide berths for large cruise ships. The Bell Street Pier Cruise Terminal at Pier 66 is located in Seattle's downtown core and can accommodate vessels up to 1600 ft. in length. This pier is used by Norwegian Cruise Line and Oceania Cruises. Smith Cove Cruise Terminal at Pier 91, which opened in 2009, has two berths of 1200 ft. each and is home to Carnival Line, Celebrity Cruises, Holland America Line, Princess Cruises, and Royal Caribbean.

Cruise ship activity in Seattle is typified by seven-day cruises through Alaska's inside passage, and passenger boardings increased rapidly in the mid-2000s along with more ships visiting Seattle (**Exhibit 18**). Currently leading all U.S. cruise homeports on the West Coast in passenger volume and number of ship calls, the Port of Seattle calculates that the cruise business is responsible for more than 4,004 jobs, \$381 million in annual business revenue, and nearly \$16.8 million annually in state and local tax revenues (Port of Seattle, 2013). Each vessel call generates almost \$2.1 million for the local economy.



**Exhibit 18. Port of Seattle Cruise Ship Passengers Boardings,  
1999-2012**

Passengers



Source: Port of Seattle Cruise Folio, 2013.

Seven cruise companies make ports of call in Seattle. Of these, Holland America Line, a subsidiary of Carnival Corp., is headquartered in Seattle. Holland America Lines holds a fleet of 15 ships, and they offer 500 cruises to 320 ports worldwide (Holland America, 2013); their total fleet capacity accommodates over 23,000 passengers. In 2013 Holland America Lines will make 44 dockings in Seattle, comprising 23% of the total docking for the year. Holland America employs over 10,000 people worldwide, 1,300 of whom work at the Seattle headquarters.

The presence of cruise ships in Washington precedes statehood. Steamship lines operated passenger service for transport and recreation as early as 1867, following the purchase of Alaska from Russia. Service primarily transported passengers between the Port of Seattle and Alaska, as well as to the Far East. Anchored by the Pacific Steamship and Alaskan Steamship Companies, ships transported passengers on sightseeing cruises of Alaska's inland passage as well as workers bound for Alaska's booming fisheries and prospectors headed to the Yukon gold mining fields.

The City of Seattle Office of Economic Development estimated the direct output impact of cruise ship passenger spending to be \$145 million, with a total output impact of \$234 million in 2007. Regarding employment, they attributed 1,675 jobs to cruise ship passenger spending directly, with a total impact of 3,142 jobs (City of Seattle Office of Economic Development, 2009). The Port of Seattle estimated local purchases related to passenger activity at the Seattle Seaport net of airport impacts created by cruise passengers; they estimated that passengers generated \$33.4 million in local purchases in 2007 (Port of Seattle, 2009).



## Maritime Subsectors: Passenger Water Transportation

### Sight Seeing Cruises

Additional overnight cruising activity in Washington State includes itineraries that take passengers around the San Juan Islands, and Salish Sea, and up the rivers and waterways of inland Washington. Cruises up the Columbia and Snake Rivers, highlight the history of American westward expansion and pioneering, and many companies offer tours that provide opportunities to visit the Gorge's abundant wineries.

Single day sightseeing opportunities aboard ships abound in Washington State. Argosy Cruises offers day-trips through Elliot Bay, Lake Union, Lake Washington, the Hiram M. Chittenden Locks, and other destinations near the greater Seattle area. Single day excursions are available along the Washington Pacific Coast, throughout the Salish Sea, and along Washington's rivers. The San Juan Islands are a world renowned tourist destination, and opportunities for water-bound tourism flourish.

Whale watching tours are a particularly popular water-based tourism industry in Washington, operating throughout the Salish Sea and offering opportunities to view Orca and other whale populations as well as marine wildlife. A 2010 study on the economic impacts of whale watching in Washington estimated that 150,000 people took water-bound trips to whale watch in 2008. Approximately 30 companies operate water-bound tours for whale watching, ranging from larger motorized vessels to smaller sea kayaking trips.

### Other Passenger Water Transportation Activities in Washington State

- **Lake Chelan Recreation Inc.** Doing business as Lady of the Lake, the privately-held company operates year-round passenger transportation on Lake Chelan; serving Stehekin, Holden Village, the North Cascades National Park, and other points along Lake Chelan. These small communities are not accessible by road, and the Lady of the Lake provides the most consistent form of transportation and freight in and out of these areas.
- **Alaska Marine Highway.** Alaska Marine Highway System operates a route which transports passengers and vehicles between the Bellingham Cruise Terminal as far north as Skagway, Alaska. This service operates on a weekly schedule, with two arrivals and departures in the summer months. Between 2002 and 2011 this route transported an annual average of nearly 15,000 passengers. Headquartered in Ketchikan, Alaska, Alaska Marine Highways operates Washington services out of Bellingham.
- **Norseman Maritime Charters.** Norseman Maritime Charters provides vessel based research charters throughout the Pacific Ocean. Based in Mercer Island, Norseman Maritime Charters was founded in 2005 and operates two vessels designed to accommodate extensive research and expedition charters. Norseman Maritime Charters provides charters to private and public sector clients, including educational institutions. The company employs 11 people.

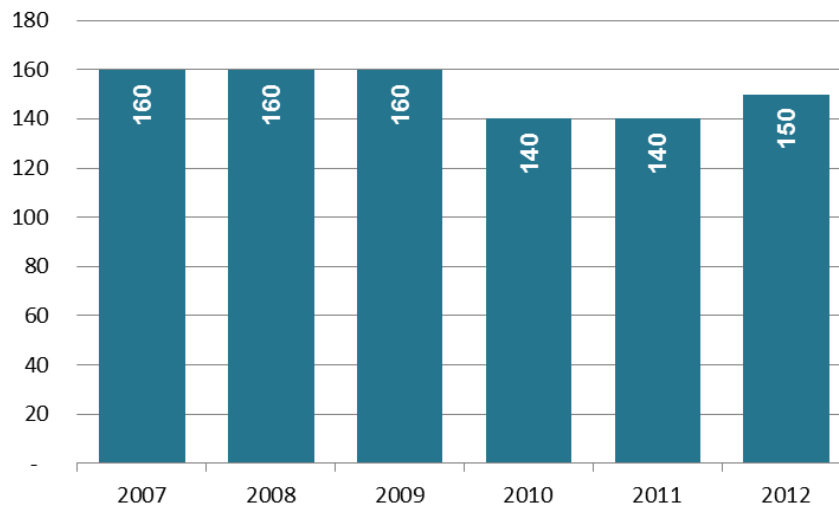
### Ship and Boat Building, Maintenance and Repair

Shipbuilding and repair has a long history in the state, capitalizing on the state's rich history in the timber industry. Initially Washington's natural harbors were utilized for timber transport, but as Seattle established itself as a trade and shipping center for Asia and the North Pacific, demand for shipbuilding soared (Seattle Municipal Archives). In 1873, the Northern Pacific Railroad chose Tacoma as the western terminus of its transcontinental line, which established Tacoma as a center for trade (Port of Tacoma, 2013). Soon, shipyards such as Martinolich Shipbuilding Company, Mojean Ericson Shipyard, and Moran Brothers Shipyard, and Puget Sound Bridge and Dredging Company had established themselves along the harbors of Puget Sound (Findlay, 2008).

**Exhibits 19, 20 and 21** show recent trends in this subsector, with the most volatility shown in business revenues (**Exhibit 21**). Recreational boatbuilding was the more volatile activity within this sector, which is more affected by shifts in the economy than commercial or military boatbuilding.

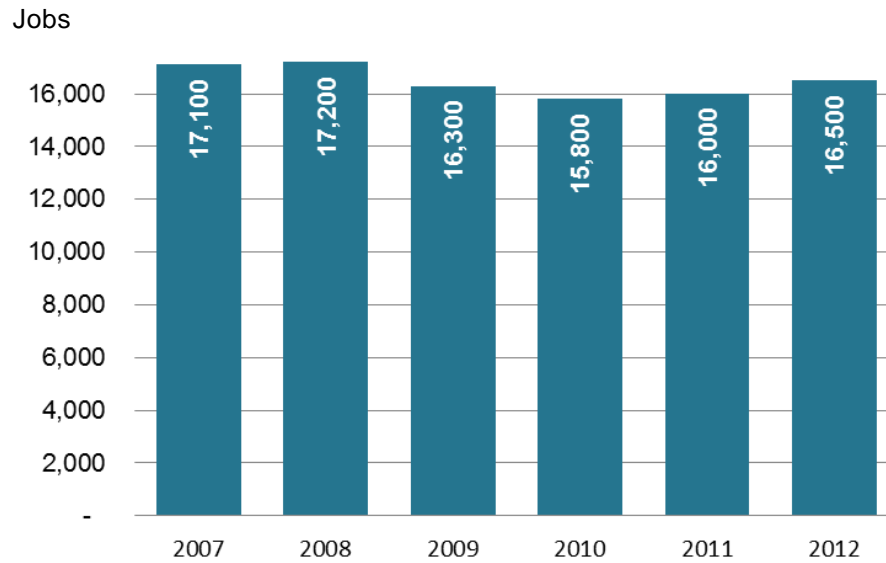
**Exhibit 19. Ship and Boat Building, Maintenance and Repair  
Establishments, Washington State, 2007 – 2012**

Establishments



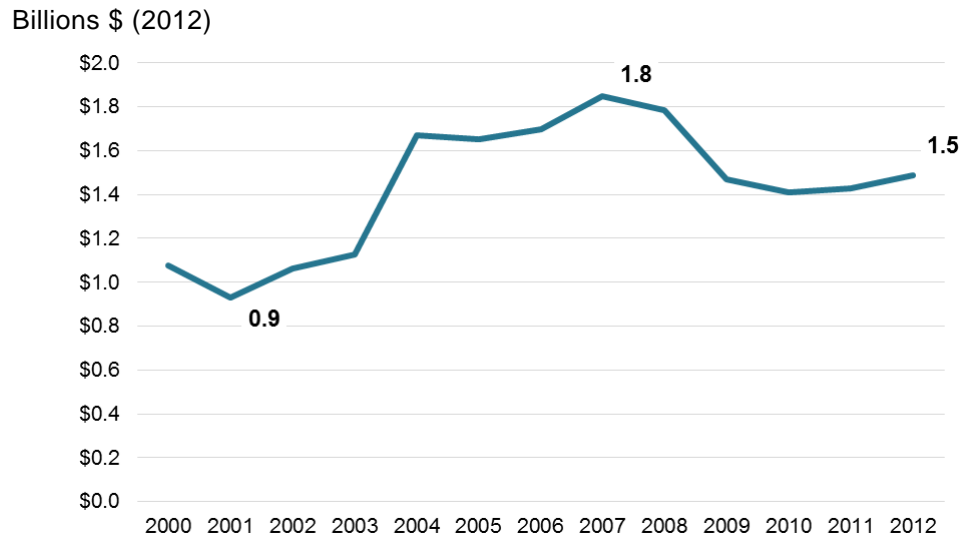
Source: Community Attributes, Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics (2013).

**Exhibit 20. Ship and Boat Building, Maintenance and Repair Jobs,  
Washington State, 2007 – 2012**



Source: Community Attributes, Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics (2013).

**Exhibit 21. Gross Business Income in Ship and Boat Building, Maintenance and Repair, Washington State, 2000 – 2012**



Sources: Community Attributes Inc.; Washington State Department of Revenue; U.S. Bureau of Economic Analysis.

**Commercial and Industrial Boatbuilding**

The largest boatbuilding activity in the State is at Puget Sound Naval Shipyard, located adjacent to the city of Bremerton on Sinclair Inlet, with 11,288 civilian employees reported in September 2013. Established in 1891, it was the first dry-dock and repair facility in the Northwest capable of handling large ships. The shipyard played a key part in the Allied war effort during World War I, it repaired Pacific Fleet warships damaged in battle during World War II, and it helped modernize aircraft carriers. Today, it is the largest and most diverse shipyard on the West Coast (McClary, 2003).

Todd Shipyards Corporation bought Seattle Construction and Dry Dock Company in 1916, and six months later expanded to Tacoma (Pelt, 2008). Though the company initially intended to focus on ship repair and not construction, WWI and WWII ensured that it was engaged in shipbuilding, with the Tacoma yard employing some 33,000 men and women. During WWI, Seattle's shipyards built 20 percent of the nation's wartime ship tonnage, and although the Depression of the 1930s saw a downturn in the industry, WWII sparked an economic rebound (Seattle Municipal Archives).

Prior to WWII, the area's many waterways necessitated a fleet of small, privately-operated steamers for transport, called the "Mosquito Fleet" (Washington State Department of Transportation). Additionally, the need for regular transport heralded the use of large, durable steam ships, many of which were built at Puget Sound shipyards (Findlay, 2008). World War II saw an enormous amount of shipbuilding for Puget Sound shipyards, as well as repair for battle-damaged ships (Warren, 1999).

## Maritime Subsectors: Ship and Boat Building

In non-wartime, shipbuilding demand declined, and Washington shipbuilders focused on repair instead. To accommodate demand for commercial fishing vessels operating in Alaska, in 1953, Peter Schmidt opened MARCO in Ballard, which typified the Seattle industry of marine construction and design. Across the canal, Pacific Fishermen Inc. was another builder of steel fishing boats, also known for their quality of construction (Sabella & Associates, 2003). Some of these shipyards are still in business today.

### *Examples of Ship and Boat Building, Maintenance and Repair Activity in Washington State*

- **Vigor Industrial.** Todd Shipyards was acquired by Vigor Industrial in 2011, and they continue their ship repair as a leading provider of ship repair, fabrication, modernization, as well as industrial fabrication and services. Vigor builds vessels of all types, including fishing vessels, tugs, ferries, barges, and even aircraft carriers. In addition to construction, Vigor has expertise in refits, repair, and modernization. Vigor recently expanded into Ketchikan, Alaska, with their acquisition of Alaska Ship & Drydock, and the company will open the country's largest drydock at their Portland, Oregon, facility in 2014. Vigor employs roughly 2,000 people, depending on the season.
- **Pacific Fishermen Shipyard** was founded in 1946 in Salmon Bay along Seattle's ship canal. They service tugboats, passenger cruise boats and yachts, as well as fishing vessels up to 300 feet. They have an in-house machine shop, pipe shop and shipwright shop and provide electrical servicing as well. The shipyard has 70 employees.
- **J. M. Martinac Shipbuilding Corporation.** Founded in 1924, Tacoma-based J.M. Martinac is a self-contained manufacturing facility. The firm specializes in the design and construction of vessels up to 250 feet long including fishing boats, tugs, trawlers, yachts, and even a research sailing vessel. Recently, the firm has built six tugs for the U.S. Navy. J.M. Martinac employs 125 people.
- **All American Marine.** Bellingham-based All American Marine was founded in 1987 and builds aluminum monohull and multi-hull boats, including survey and patrol boats, as well as passenger vessels like ferries and tour boats, and cruise boats. All American Marine employs 45 people.
- **Dakota Creek Industries** was founded in 1975 in Blaine, and moved to Anacortes in 1977. They build and repair both steel and aluminum boats, including tug boats, freezer vessels, fireboats, and ferries. The firm employs 600 people and is captured in the NAICS code 336611, Shipbuilding and repairing.
- **Harman Canoe** is located in Arlington, and builds wood canvas canoes and wooden boats up to 24 feet. All the boats and canoes from Harman are handmade to order. The firm also repairs other wooden boats and canoes.

## Maritime Subsectors: Ship and Boat Building

- **Ranger Tugs** is located in Kent, and was founded in 1958. The company designs, builds, and tests diesel-powered trawlers, from 21-31 feet. Each boat is trailable for portability. The company has two employees.
- **Nichols Brothers** is located in Freeland, Washington, and has been building boats since 1964. The firm builds a large variety of boats, including monohulls, catamarans, ferries, Navy transport ships, and paddle wheel boats. Currently, Nichols Brothers has partnered with Vigor Industrial to construct the second new 144-car Washington State ferry. Nichols Brothers has 265 employees.
- **Delta Marine** operates an 18-acre shipyard located in South Seattle. The company was founded in the 1960s, constructing high-speed pleasure boats as well as charter and commercial fishing craft. In the 1980s the company shifted their focus to luxury yachts. The company's new construction division has an in-house paint, cabinetry, and metal shop, as well as offering refit and repair services. The company has 300 employees.

### Recreational Boating

Washington is home to a robust and active recreational boating community as well as a commercial boating industry. The National Marine Manufacturers Association estimates that in 2013 the total annual economic impact of recreational boating in Washington was \$3.18 billion; they estimate that recreational boating is responsible for 12,615 jobs directly, with a total jobs impact of 25,585 jobs (National Marine Manufacturers Association, 2013).

There are more than 250,000 registered boats in Washington, and the purchase of a boat is only the beginning of an economic cycle for the recreational boat user. Purchases of accessories, repair and maintenance services, insurance, docking, and fueling are just some of the other ways recreational boaters contribute to Maritime in Washington.

One difference between recreational and commercial boating support services is that while commercial boating support firms are wholesale-oriented, recreational boating support tends to be more retail. Rather than a few large firms, recreational boating services are smaller and more dispersed across the state. Serving both commercial and recreational boaters can be beneficial for a maintenance or support firm, as they both tend to be cyclical in their activities. For instance, in the summer and fall, when recreational boating activity is at its peak, commercial fishing vessels are away in Alaska. The two subsectors are thus complimentary.

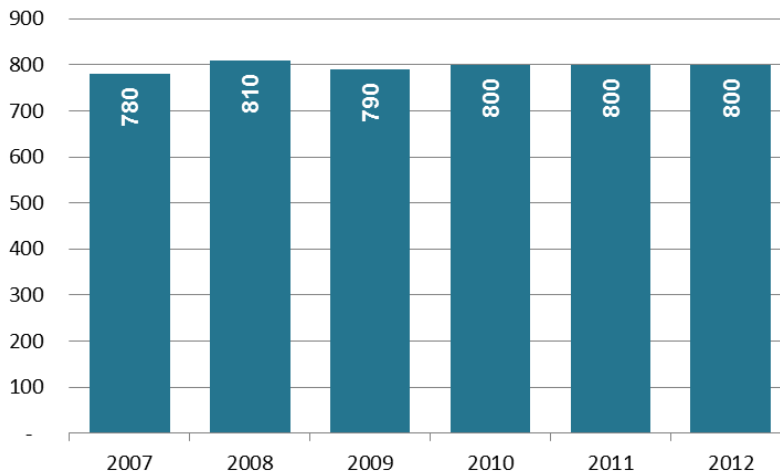
## Maritime Logistics and Shipping

From the earliest uses of the Columbia River to efficiently ship and trade goods, to the natural deep water ports used for today's container ships, the presence of Maritime Logistics and Shipping activity in Washington State has a long history. Washington State has 3,026 miles of coastline and 11 deep water ports useful for shipping goods. The geographic proximity to trading partners in Asia and other ports along the West Coast and Alaska lends Washington State an advantage as a center of Trans-Pacific and other water-bound shipping and trade. The Port of Seattle can accommodate ships as large as 10,000 TEUs (twenty-foot equivalent units) and has seven deep-water ports that can accommodate a fully laden Panamax ship.

**Exhibits 22, 23 and 24** show recent trends in Maritime Logistics and Shipping. The number of establishments increased in 2008, decreased from 2008-2009, and have held steady in recent years (**Exhibit 22**). Jobs have risen steadily since 2009 (**Exhibit 23**), along with business incomes (**Exhibit 24**).

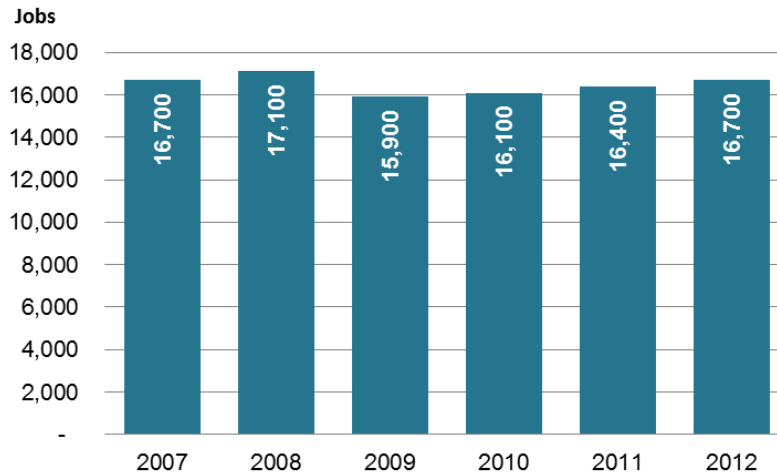
**Exhibit 22. Maritime Logistics and Shipping Establishments,  
Washington State, 2007 – 2012**

Establishments



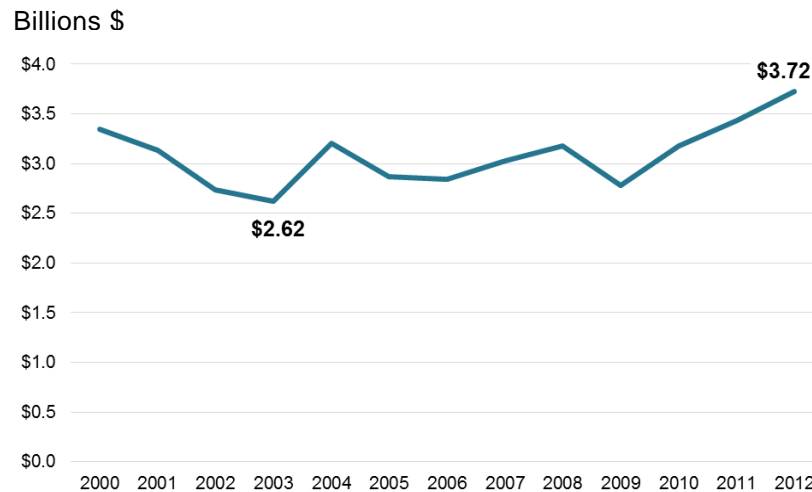
Source: Community Attributes, Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics (2013).

**Exhibit 23. Maritime Logistics and Shipping Jobs, Washington State,  
2007 – 2012**



Source: Community Attributes, Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics (2013).<sup>15</sup>

**Exhibit 24. Statewide Gross Business Income in Maritime Logistics and Shipping, Washington State, 2000 – 2012**



Sources: Community Attributes Inc.; Washington State Department of Revenue; U.S. Bureau of Economic Analysis.

<sup>15</sup> Notes: 483211 1990-2000 is imputed using method #3; 483111 2010-2012 is imputed using method #3. See **Appendix B** for more information on imputation.



## Maritime Subsectors: Maritime Logistics and Shipping

### History

From the beginning of its history, Washington's unique geographical location established it as a hub for the movement of people and goods. Washington's naturally deep harbors led to the creation of the two seaports of Seattle and Tacoma, which together represent the third largest shipping hub in North America (Center of Excellence for Global Trade & Supply Chain Management). Seattle was built on lumber, which was then transported to the booming city of San Francisco, as well as growing towns in Puget Sound (Seattle Municipal Archives).

In 1873, the Northern Pacific Railroad chose Tacoma as the western terminus of its transcontinental line, which established Tacoma as a center for trade (Port of Tacoma). The discovery of gold in Alaska and Canada in 1890 allowed the area to exploit its existing shipping lines to become an outfitting point for prospectors (Seattle Municipal Archives). Puget Sound's strong shipbuilding sector benefitted both the First and Second World War efforts.

Washington's ties to Asia were established even before statehood; in 1885 the first tea cargo from Asia docked in Tacoma (Ott, 2008). From the 1860s, Chinese pioneers comprised a large portion of the workforce in Washington's early history of logging, mining, and railroads, and Japanese pioneers arrived in the 1880s to work as farmers and merchants. These ties helped Seattle capitalize on its reputation as a trading hub, a reputation which would later help foster other sectors like Aerospace and technology.

Today, Puget Sound is the home of one of the leading international trade and logistics clusters in the world (Center of Excellence for Global Trade & Supply Chain Management, 2013), sectors which have been identified as strategic to the economic growth of Washington (Center of Excellence for Global Trade & Supply Chain Management, 2013).

### Port Operations

As real estate owners, The Ports of Seattle and Tacoma are considered 'landlord' ports, because they lease land to terminal operators. In Washington, the Pacific Maritime Association negotiates contracts between terminal operators and longshoremen. On the West Coast, longshoremen are entirely represented by the International Longshore and Warehouse Union (ILWU).

### Previous Studies

The Port of Seattle estimated that direct employment related to marine cargo at the Port of Seattle was responsible for 12,428 jobs directly, with a total impact of 33,291 jobs. They estimated a direct impact of nearly \$637 million in direct income, with a total income impact of nearly \$2.8 billion (Port of Seattle, 2009).

A City of Seattle Office of Economic Development study included King County port cargo operations and some railroad jobs in their category of 'water transportation', which was estimated at \$2 billion of direct output and a total output impact of nearly \$3.5 billion in 2007. They found that water transportation was directly responsible for 5,702 jobs,

## Maritime Subsectors: Maritime Logistics and Shipping

with a total employment impact of 15,969 jobs (City of Seattle Office of Economic Development, 2009).

### Trade Flows

In 2012, Washington State ports handled \$106 billion in vessel shipments. More than two thirds of vessel traffic by value were imports, with more than \$64 billion handled by the Ports of Tacoma and Seattle (**Exhibit 25**). The vast majority of these products are destined for markets outside Washington State, predominately in the Midwest. The ports also serve as major export gateways for U.S. products, in particular bulk commodities such as oil seeds and wheat, in many cases destined for markets in East Asia (**Exhibit 26**).

**Exhibit 25. Washington State Ports Total Vessel Trade, 2012 (millions \$)**

Rank	Port	Exports	Imports	Total
1	Tacoma, WA	10,056.2	35,958.4	46,014.6
2	Seattle, WA	10,094.3	28,324.5	38,418.7
3	Kalama, WA	3,570.8	279.6	3,850.4
4	Bellingham, WA	299.0	3,212.1	3,511.1
5	Anacortes, WA	2,171.3	1,143.9	3,315.2
6	Vancouver, WA	1,972.7	1,203.5	3,176.3
7	Longview, WA	2,742.0	259.5	3,001.5
8	Aberdeen-Hoquiam, WA	2,163.7	47.3	2,210.9
9	Everett, WA	404.3	1,143.7	1,548.0
10	Blaine, WA	501.5	10.4	511.9
11	Olympia, WA	75.6	22.3	98.0
12	Port Angeles, WA	70.2	15.0	85.1
13	Port Townsend, WA	0.3	24.7	25.0
14	Friday Harbor, WA	0.1	4.5	4.5
15	Point Roberts, WA	0.2	0.2	0.5
<b>Total</b>		<b>34,122.2</b>	<b>71,649.7</b>	<b>105,771.9</b>

Source: Washington State Department of Commerce.

**Exhibit 26. Top 10 Washington State Port Import and Export Vessel Commodities, 2012 (million \$)**

Exports			Imports		
Rank	Commodity	Value	Rank	Commodity	Value
1	Oil Seeds Etc.; Misc Grain, Seed, Fruit, Plant Etc	6,881.4	1	Industrial Machinery, Including Computers	11,944.8
2	Cereals	4,277.6	2	Electric Machinery Etc; Sound Equip; Tv Equip; Pts	9,676.9
3	Mineral Fuel, Oil Etc.; Bitumin Subst; Mineral Wax	3,538.1	3	Vehicles, Except Railway Or Tramway, And Parts Etc	8,681.8
4	Industrial Machinery, Including Computers	2,224.3	4	Mineral Fuel, Oil Etc.; Bitumin Subst; Mineral Wax	4,697.7
5	Vehicles, Except Railway Or Tramway, And Parts Etc	2,150.7	5	Toys, Games & Sport Equipment; Parts & Accessories	4,397.2
6	Wood And Articles Of Wood; Wood Charcoal	1,223.0	6	Furniture; Bedding Etc; Lamps Nesoi Etc; Prefab Bd	2,835.9
7	Inorg Chem; Prec & Rare-Earth Met & Radioact Compd	1,052.2	7	Apparel Articles And Accessories, Knit Or Crochet	2,607.3
8	Prep Vegetables, Fruit, Nuts Or Other Plant Parts	997.9	8	Aircraft, Spacecraft, And Parts Thereof	2,568.3
9	Fish, Crustaceans & Aquatic Invertebrates	997.0	9	Articles Of Iron Or Steel	2,377.9
10	Ores, Slag And Ash	925.5	10	Footwear, Gaiters Etc. And Parts Thereof	2,191.5

Source: Washington State Department of Commerce.

## Maritime Subsectors: Maritime Logistics and Shipping

### Alaska Transport

Ocean-towing tugs provide towing services for both short and long distances from Washington's coast. These tugs tow cargo such as oil rigs, retired military vessels, or mineral extracts from remote mines. Three firms - Crowley Maritime Corporation, Foss Marine Holdings, and Harley Marine Services - comprise roughly 85% of the tugboat business on the West Coast. Two local firms, Tote Maritime, and Horizon Lines, provide ocean cargo carrier service between Washington's coast and the domestic markets of Alaska and Hawaii. Some 70% of cargo from the lower 48 states to Alaska goes through the Port of Tacoma. While Horizon provides ocean shipping services for containerized cargo, Tote provides break bulk services as well.

### Maritime Logistics and Shipping by Commodity

#### Construction and Contracting Firms Supporting the Ports

Over the past three years, 126 Washington-based firms in construction, structural engineering, and geotechnical and environmental engineering did work with the ports. These projects entailed terminal construction, geotechnical environmental work, and support such as metal manufacturing. Such firms account for nearly 4,000 workers in Washington.

**General Construction Company** is based in Federal Way, and builds bridges, piers, marinas, breakwaters, jetties, dam upgrades, ferry terminals, and submarine cables. The company has worked for Port authorities, state departments of transportation, governmental agencies, the U.S. Department of Defense, the Army Corps of Engineers, the Coast Guard, and numerous private companies.

**Streich Brothers** is located in Tacoma, and has been in business since 1957 in fabrication, forming, machining, and welding. Streich Brothers is one of the largest industrial maintenance facilities in the Pacific Northwest. The company repairs construction equipment, makes new parts, and does industrial quality welding for Maritime and construction. Streich Brothers employs 50 people.

#### Examples of Maritime Logistics and Shipping in Washington

- **Northland Services** is an ocean freight company based in Seattle, providing freight transportation services between Seattle, Alaska and Hawaii. Annually they provide 125 sailings to Alaska and 17 sailings to Hawaii. Their 70-acre campus is the largest cargo barge facility on the West Coast. Northland Services employs 450 people and is captured under NAICS code 483113, coastal and great lakes freight transport.
- **Tidewater Holdings Inc.** is a multi-commodity transportation and terminal company headquartered in Vancouver, Washington. Founded in 1932, Tidewater operates four terminals along the Snake and Columbia Rivers and a barge line specializing in grain, petroleum products, wood products, liquid and dry fertilizers, and all types of containerized freight. The company also provides harbor services, owns a shipyard, and sells flat decks, covered hoppers and house barges; and tugboats-towboats, and line handling winches. Tidewater employs more than 230

## Maritime Subsectors: Maritime Logistics and Shipping

in Oregon and Washington, and is the largest inland marine transportation company in the Pacific Northwest. Tidewater Holdings, Inc. is captured under NAICS code 483211, Inland water freight transportation.

- The **Port of Tacoma** was created by Pierce County citizens in 1918, and has become one of the largest container ports in North America. While the Port handles container cargo similar to that of the Port of Seattle, it also handles automobile imports and break-bulk cargo (cargo which doesn't fit within a container) (Washington State Department of Commerce, 2011). In 2011, the Port of Tacoma handled 1.7 TEUs, and their facilities include marine terminals, on-dock rail yards, cargo handling equipment and warehouses and docks. The Port has 500 employees.
- The **Port of Grays Harbor** was created in 1911 as an original land grant of seventy acres between Hoquiam and Aberdeen. Historically a timber Port, the Port is now unique in that it is heavily and increasingly export-oriented, and that it specializes in break-bulk products. The Port handles one-third of Chrysler vehicles leaving the West Coast, and Port facilities include marine terminals, a marina, a business park, and Bowerman Field Airport (Washington State Department of Commerce, 2011). The Port has 140 employees.
- Created in 1920, the **Port of Bellingham** has focused on increasing shipping at the Bellingham waterfront. The Port has expanded into a multi-purpose port, with facilities including a passenger terminal which is the southern connection for the Alaska Marine Highway System, a shipping terminal, two marinas serving both commercial and pleasure boats, and Bellingham International Airport. The Port has 120 employees.
- In addition to operating the largest public port on the West Coast with 2,300 slips, The **Port of Everett** also plays a strategic role in serving Washington's Aerospace industry, importing Aerospace parts for assembly of aircraft by Boeing and others. The port employs 13,778 people, and because of its special relationship with the Aerospace industry, it ranks second statewide in terms of Port export value, and is the third largest container facility in Washington state. The port is home to six shipping lines, and also exports energy supplies and forest products (Port of Everett, 2013).
- The **Port of Seattle** is a port district which operates Seattle's seaport and airport. Created in 1911, the Port currently employs 1,650 individuals. In 2011, Sea-Tac Airport handled a record 32.8 million passengers and the seaport division handled just over two million containers (TEUs), making it the 7th largest port in North America and the 57th largest in the world. Among its facilities are the Seattle-Tacoma International Airport; the Shilshole Bay Marina; the Maritime Industrial Center and Fishermen's Terminal on Salmon Bay; cargo terminals and a grain elevator on Smith Cove; and numerous cargo terminals on Elliott Bay, Harbor Island, and the Duwamish Waterway. The Port of Seattle also controls recreational

## Maritime Subsectors: Maritime Logistics and Shipping

and commercial moorage facilities and two cruise ship terminals. The Port of Seattle falls under NAICS code 488310, Port and harbor operations.

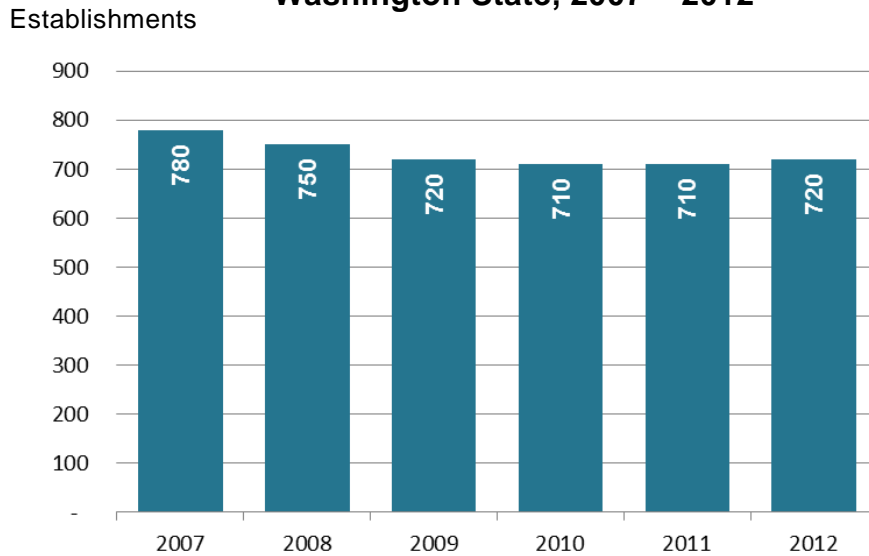
- **Foss Marine Holdings** has been operating for 124 years on the West Coast. Founded by Thea Foss in 1881, Foss began as a launch company, and has grown into Foss Marine Holdings. It is now a division of Saltchuck. The firm owns a coastal tug and barge fleet, including harbor services and ocean-towing tugs, as well as a ship repair and construction business. Foss employs approximately 800 employees in Washington.
- **CityIce Seattle** operates as a public port warehouse with deep water dock-side access for the simultaneous vessel offloads, specializing in seafood products and offers on-site processing of seafood products. Providing 375,850 square feet of temperature-controlled storage, CityIce is a wholly owned subsidiary of Lineage, a California based warehousing and Logistics Company. CityIce employs 40 people.
- **Crowley Marine Services** was founded in San Francisco in 1892, and expanded operations into Puget Sound in 1923. The company operates Ocean class tugs between Alaska and Tacoma and plays a key role in helping distribute Alaska fuel by barge. Crowley has 400 employees in Seattle.

## Fishing and Seafood Processing

The number of total establishments in this sector have demonstrated the cluster-wide trend of consolidation, as evidenced by **Exhibit 27**. Still, employment has remained steady and actually grown (**Exhibit 28**), demonstrating that consolidation exists only in establishment numbers of the sector as smaller businesses sell to larger corporations.

**Exhibit 29** shows a breakdown of employment in the sector for 2011 including self-employers, which comprise a large number of commercial fishing establishments. **Exhibit 30** evidences the growth in gross business income in the sector despite its consolidation, despite falling off slightly in 2012.

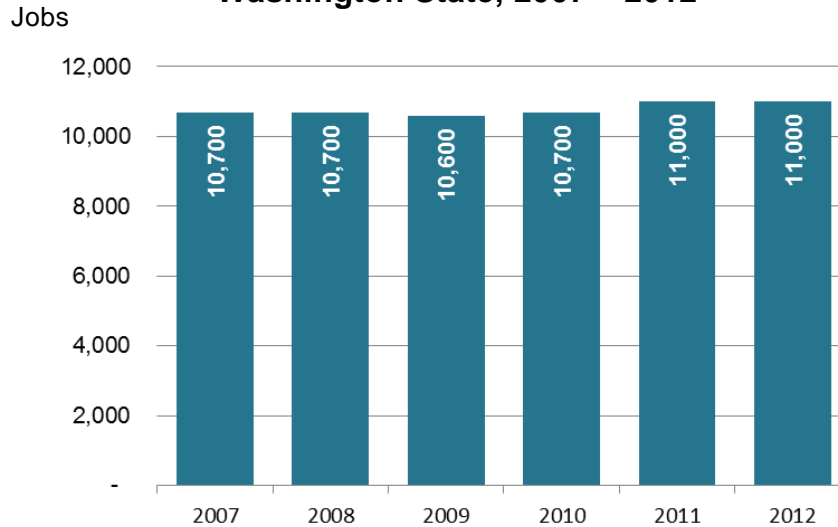
**Exhibit 27. Establishments in Fishing and Seafood Processing,  
Washington State, 2007 – 2012**



Source: Community Attributes Inc., Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics (2013).

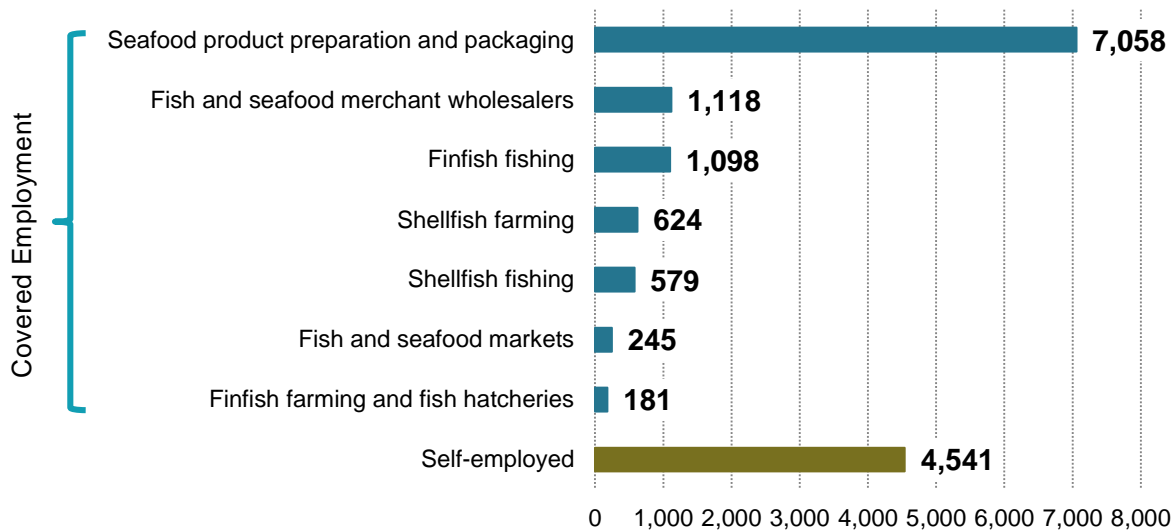
## Maritime Subsectors: Fishing and Seafood Processing

**Exhibit 28. Fishing and Seafood Processing Covered Jobs,  
Washington State, 2007 – 2012**



Source: Community Attributes, Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics (2013).<sup>16</sup>

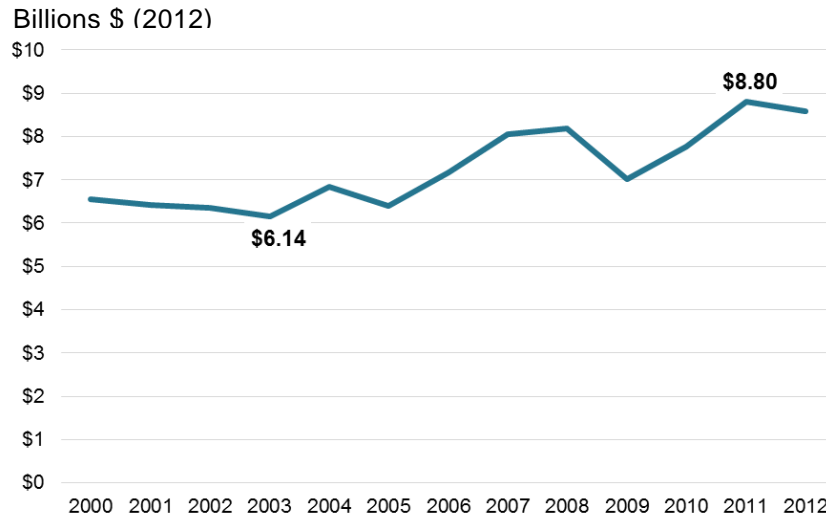
**Exhibit 29. Fishing and Seafood Processing Jobs in Sub segments, 2011**



Source: Community Attributes, Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics (2013).<sup>17</sup>

<sup>16</sup> Note: NAICS 112512: between 1990-2000 was imputed using method #1. See **Appendix B** for more information on imputation.

**Exhibit 30. Gross Business Income in Fishing and Seafood Processing,  
Washington State, 2000 – 2012**



Sources: Community Attributes Inc.; Washington State Department of Revenue; U.S. Bureau of Economic Analysis.

**History of Commercial Fishing and Seafood Processing in Washington**

Native American tribes in present-day Washington have fished for salmon, halibut, and shellfish for thousands of years. Commercial fishing by Euro-Americans in Washington along the Columbia River began in the 1880s, and shellfish production in coastal areas began in the 1860s (Pacific Shellfish Institute, 2013). Since their discovery by Washington's first settlers, fisheries in Washington State have experienced the boom and bust cycle typical of extraction industries, and regulation has played an integral role in ensuring the sustainability of the resource.

In Alaska, fishermen from Asia and Europe superseded American fishermen, beginning to fish there as early as the 1880s for crab and salmon. After cycles of overfishing in what American fishermen considered "their" waters, U.S. fishermen appealed to Congress for help. In 1976 the Magnuson Fishery Conservation and Management Act extended fishing jurisdiction to 200 miles off the coastline, and effectively established the dominance of the American domestic fishing fleet in Alaskan waters while addressing the issue of depleted fisheries. (Sabella & Associates, 2003).

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<sup>17</sup> Note: NAICS 112512: between 1990-2000 was imputed using method #1. See **Appendix B** for more information on imputation.



## Maritime Subsectors: Fishing and Seafood Processing

Though this legislation opened up a new resource to Americans, the fishing industry in Alaska did not have the processing infrastructure in place to take advantage of it (Sampson, 1990). The advent of joint venture trawling brokered a partnership between the newly-ousted foreign fishermen who did have processing capacity, and American fishing operations. This partnership allowed American trawlers to take advantage of the newly-opened fishery despite their lack of food processing capacity. The Magnuson Act contributed significantly to the strength of an American deep-water fishing fleet, and today Seattle is the point of entry for 50 percent of the seafood caught in the United States (Trade Development Alliance of Greater Seattle, 2013).

In the 1880s, Europeans, who believed cod to only be an Atlantic fish, discovered it in the Bering Sea. Within a generation of the discovery of the Pacific Cod, a new industry was born, with Seattle at its hub (Centuries of Fish: Seattle's Dynamic High Seas Fishing Fleet, 2003). Cod was harvested heavily by Japanese and Russian fisheries in the 1970s and 80s (NOAA Fish Watch Pacific Cod overview). Cod is the second highest commercial ground catch off Alaska, following pollock, and it is considered one of the best managed fisheries in the world (NOAA Fish Watch Pacific Cod overview).

The non-Indian Columbia River commercial salmon fishery began in the mid-19th century. After a salmon canning process was developed, the fishery began a boom and bust cycle. Immigrant fishermen from Scandinavia and Europe settled in the area and stabilized the industry. However, early canneries were inefficient, and as early as the 1890s the fishery began to decline. The combination of development along the Columbia River, damming efforts, and over-fishing, had a deleterious effect on the salmon population (University of Washington Libraries Special Collections, 2013). Washington and Oregon formed a bi-state Columbia River Compact in 1915, and since then the two states have co-managed all Columbia River fisheries (Columbia River Commercial Fishermen: Fishing for the General Public, 2013). Today, to protect Washington salmon, state fishing regulations are some of the most complex in the world (Washington Department of Fish & Wildlife, 2013).

In Alaska, Russian fisheries were the first to operate commercially in the late 1800s (John H. Clark, 2006). While the salmon catch was always biggest in Alaska, the salmon business in Seattle was far bigger, where all the companies were located (Centuries of Fish: Seattle's Dynamic High Seas Fishing Fleet, 2003). Food production during WWII led to liberalizing of regulations, and by the 1960s, the Alaska stocks were depleted. Through a long-term research and management program, Alaskan salmon fisheries have been rebuilt into one of the strongest and most sustainable fishery resources in the world (John H. Clark, 2006).

Native Americans have fished halibut off the West Coast for hundreds of years, but the American commercial fishery began in 1888, when halibut from the Strait of Juan de Fuca first landed in Tacoma (NOAA Fish Watch Pacific Halibut overview). Cycles of overfishing marked the halibut catch, and in the 1990s managers adopted a quota system to address the declining catch, and it is considered to be well-managed today (NOAA Fish Watch Pacific Halibut overview, 2013).

## Maritime Subsectors: Fishing and Seafood Processing

King crab was overfished largely by Japanese and Russian commercial fleets as early as the 1930s (Zimmermann, Dew, & Malley, 2009). In 1946, U.S. fishermen began to fish Alaskan waters for king crab, and by 1963 the U.S. dominated the fishery. In 1960, trawls and tangle nets were outlawed as fishing methods, and fishermen were only allowed to take male crabs. 1980s male-only king crab fishery was the most valuable single-species fishery in Alaska with a peak catch of 59 million kg of Bristol Bay crab, but in 1981 the fishery collapsed (Zimmermann, Dew, & Malley, 2009). **Exhibit 31** shows the Count and Type of Washington's top 20 commercial fishing licenses; Dungeness crab is one of the most popular fishing licenses in Washington.

As a result, bankrupt crabbing vessels lined the wharves of Ballard, and eventually many diversified by retrofitting boats for trawling as well as crab fishing (Sabella & Associates, 2003). In 2000, a vessel license system was implemented to address overfishing, and today the catch is carefully monitored and fished (Alaska Bering Sea Crabbers, 2013).

Food processing in Washington began with salmon canneries on the Columbia River. In the early 19<sup>th</sup> century, salmon harvesting had been at a subsistence level because of a lack of processing infrastructure. In 1866, the first cannery on the Columbia opened, and canned salmon became a popular and cheap food source for the working class. In less than 20 years, over 50 canneries had opened on the river (University of Washington Libraries Special Collections, 2013).

In 1903, the invention of the automatic salmon processing machine increased processing capacity from two fish a minute by an experienced worker, to 110 fish a minute (Wilma, 2000). The machine displaced workers, but greatly increased commercial yield, and eventually this increase in production led to a decline in salmon populations in the Columbia (University of Washington Libraries Special Collections, 2013).

On the Pacific Coast, seafood processing began with salmon salteries in the 1880s, with much of the labor being done by Native women. This salmon was destined for Japan and Washington State. As the salmon population on the Columbia and Sacramento Rivers began to decline, Alaska's salmon canning industry saw a boom in new entrants. After acquisitions by larger canneries, some of these operations continued until the 1930s. Commercial troll fishery began in 1905, with king salmon. The fish were packed in ice in wooden boxes and shipped to Puget Sound ports. Dungeness crab was first fished and processed in Glacier Bay in the 1930s, with fishermen holding their catch in floating live boxes (Mackovjak, 2010).

During WWII, seafood production in general was ramped up, and cold storage facilities became the norm for storage of both crab and fish. Bellingham Cold Storage, first a shipbuilder, built its first warehouses for cold storage in 1946. The 1950s saw a major expansion in cold storage, and in the 1970s, firms like Trident began to vertically integrate their operations to include processing on the same vessels they fished from (Trident Seafoods, 2013). Seafood processing continues to be a major contributor to Washington's economy; according to one study, shore-based seafood processing contributes \$1.87 billion into the state's economy annually (The Seattle Times, 1994).

### Alaska's Seafood Industry

Though much of Washington's fishing activity takes place in Alaska, most of the economic impact of the industry accrues in Washington through an extensive and broad network of supporting industries. Seafood generates enormous value for both Alaska and Washington, accounting for \$6.4 billion in combined exports and retail value in 2011, according to a recent study (Alaska Seafood Marketing Institute, 2013).

With just over seven thousand Washington residents participating in Alaska's commercial fisheries in 2011, Alaska's seafood industry also employs more Washington residents than Washington's own seafood industry. The same study estimated the total economic impact of Alaska's seafood industry in Washington including indirect and induced effects to be 34,490 jobs and \$1.9 billion in labor income.

A commercial fishing vessel is dependent not only on the shipbuilders, fueling operations, and legal and engineering services which supply them, but also on the processing, warehousing, refrigeration, and food distribution networks which they supply to.

Fishing and Seafood Processing operations have varying degrees of vertical integration; some fishing vessels operate completely independently and pay for the services of processing and warehousing facilities either in Alaska or Washington. Some vessels have integrated some portion of the process into their operation, either through on-board processing facilities or by delivering their harvest to a processing mother ship which they may or may not own. Other operations (such as Trident Seafoods) have completely integrated the process of harvesting, processing, packaging and warehousing, where all of these activities occur in-house.

Rough processing of the product may occur on the fishing boat or in an Alaska processor. Then, the product is delivered to Puget Sound or other Alaska processors for value-added processing such as curing, smoking, or fileting. The product is exported to Europe or Asia for final consumption. Alternatively, the product can be first sent to Puget Sound, exported to Asia for processing, and then re-exported from Washington for final consumption. From the fuel on the ships, to the employees, to the export value, Washington's economy benefits. **Exhibit 31** shows the growth of the total commercial catch value, which topped \$300 million in 2011.

Alaska and Washington's economies are interdependent regarding seafood; neither can function without the other. Historically, Alaska has been geographically isolated and has lacked the infrastructure needed to support a commercial fishing fleet and the activities associated with it. Washington has fulfilled that role, though Alaska's competitiveness is increasing as longtime industry players build up infrastructure in the state.

### **Aquaculture**

Clams, oysters, and mussels have been in production commercially along Washington estuarine areas since the 1860s, with Willapa Bay oysters in particular finding a strong market in San Francisco from 1851 to the 1880s (Story, 2006). Washington State is the largest producer of hatchery-reared and farmed shellfish in the U.S., with over 300 farms accounting for 25% of the total domestic production. In the 1970s, to increase the availability of shellfish and to develop aquaculture, methods were developed to produce shellfish seed in hatcheries. Today, commercially important species include mussels, clams, oysters, and geoduck (Pacific Shellfish Institute, 2013). Salmon is also incubated in Puget Sound waters. Atlantic salmon is raised for market while native salmon is cultivated for release into the wild.

### **Recreational Fishing**

In addition to Fishing and Seafood Processing, recreational anglers generate a significant economic impact in Washington. A 2008 study exploring the economic importance of non-treaty commercial and recreational fisheries in Washington found that combined, commercial and recreational anglers directly and indirectly supported an estimated 16,374 jobs and \$540 million in personal income in 2006. The study found that recreational fishing generated the larger share of economic impacts, with a total jobs impact of 12,850 (Washington Department of Fish and Wildlife, 2008).

### **Tribal Fishing**

In 1974, the State of Washington re-affirmed the rights of Washington's Indian tribes to fish in their native waters. The Boldt Decision allocated 50% of the annual salmon catch to treaty Tribes of Washington (Crowley & Wilma, 2003). Since that ruling, tribes have won similar allocations for other fisheries, including Pacific whiting, sablefish, rockfish, albacore, halibut, sea urchin and shellfish.

Washington Tribes are heavily involved in fisheries management, and are major players within commercial fishing; total commercial landings in 1997 were valued at \$139.6 million. Most of the fish harvested by Indians are marketed unprocessed to outside buyers, including a significant foreign market (Tiller & Chase, 1997, p. 13).

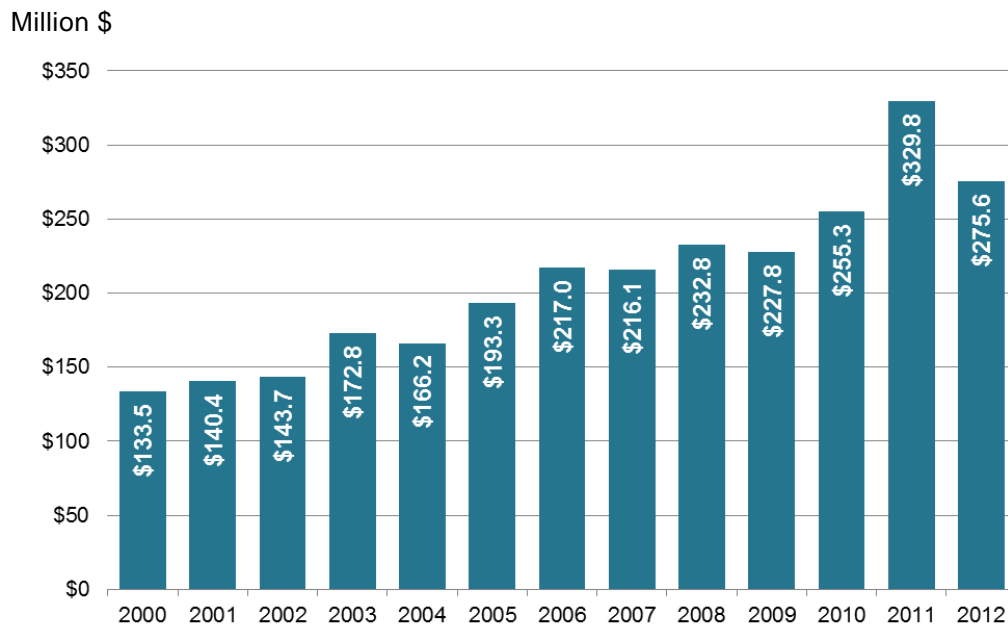
## Maritime Subsectors: Fishing and Seafood Processing

**Exhibit 31. Count and Type of Top 20 Washington Commercial Fishing Licenses, 2011**

License Type	License Count
Non-salmon Ocean Delivery	275
Dungeness Crab Pots Puget Sound	249
Dungeness Coastal Crab Pots (Perm)	223
Puget Sound Salmon Gill Net	195
Willapa Bay Salmon Gill Net	193
Salmon Troll	154
Ocean Delivery Pink Shrimp	83
Puget Sound Salmon Purse Seine	75
Grays Harbor Salmon Gill Net	63
Sea Cucumber Dive	27
Baitfish Lampara	26
Sea Urchin Dive	26
Non-Shrimp Shellfish Pots	19
Puget Sound Shrimp Pots	18
Herring Lampara	16
Sardine Purse Seine	16
Herring Purse Seine	15
Herring Dip Bag Net	14
Coastal Hagfish Pot	12
Puget Sound Salmon Reef Net	11
Other	80
<b>Total</b>	<b>1,790</b>

Source: Washington Department of Fish and Wildlife.

**Exhibit 32. Washington State Commercial Seafood Landing Catch Value, 2000 – 2012**



Source: National Marine Fisheries Service.

## Maritime Subsectors: Fishing and Seafood Processing

### Examples of Fishing and Seafood Production in Washington

- **Troutlodge Inc.** Founded in 1945, Troutlodge is a leading producer of eyed salmonid eggs, specializing in Rainbow trout eggs, Silver steelhead eggs, and Atlantic salmon eggs for aquaculture. They also serve as a wholesaler and retailer of live fish for stocking programs and bioassay testing. Headquartered in Sumner, Troutlodge has ten facilities in Washington, Idaho, and Oregon, as well as subsidiaries in Chile and the Isle of Man. Troutlodge employs 120 people globally.
- **Taylor Shellfish Farms.** Taylor Shellfish is a leading producer of farmed shellfish in the United States. Family owned and operated, Taylor Shellfish has been farming shellfish in Puget Sound since the 1890s. Headquartered in Shelton, they operate additional hatcheries and nursery facilities in Hawaii and California, as well as a shellfish distribution company in Hong Kong, and grow Fiji Pearls in partnership with J. Hunter Pearls Fiji, Ltd. Taylor Shellfish employees nearly 500 people.
- **American Seafoods Company.** Headquartered in Seattle, American Seafoods Company was established in 1987 and became a subsidiary of American Seafoods Group in 2000, to comply with the American Fisheries Act U.S. ownership requirements. American Seafoods Company manages a fleet of catcher-processor vessels that operate in the Alaskan Bering Sea, harvesting and at-sea processing Alaska pollock, yellowfin, sole, Pacific cod and Pacific hake. The company has 1,000 employees.
- **Trident Seafoods.** Trident Seafoods is the largest vertically integrated seafood company in the United States. Based in Seattle, Trident manages nearly 30 fishing and trawling vessels, and 20 onshore processing plants located in Alaska, Washington, and Oregon, and vertically integrated distributorship of its products. Processing facilities are located in Anacortes, Bellingham, Seattle, Everett, and Tacoma. Trident Seafoods sells frozen, canned, smoked and ready-to-eat seafood products for the wholesale, retail and food service markets under a variety of different brand names. Founded in 1973, Trident has over 6,500 employees (1,600 of those in Washington).
- **Pike Place Fish Market.** Pike Place Fish Market is an iconic fish market located in downtown Seattle's historic open-air Pike Place Market. Renowned for their salmon tossing fish-mongers, Pike Place Fish Market was founded in 1930. The Pike Place Fish Market has been featured in a variety of advertisements, television shows, movies, and was the subject of a 1998 documentary. They employ 18 people and are visited by as many as 10,000 people daily.
- **Ocean Beauty Seafoods.** Ocean Beauty Seafoods began in 1910 as a storefront on the Seattle waterfront. Today, Ocean Beauty is one of the largest seafood companies in the U.S., with nine domestic facilities, eight distribution facilities across the western U.S., and a global reach. In Washington the company operates two value-added seafood plants in Monroe and Seattle. Depending on the season, Ocean Beauty has anywhere from 1,000-2,000 employees worldwide.

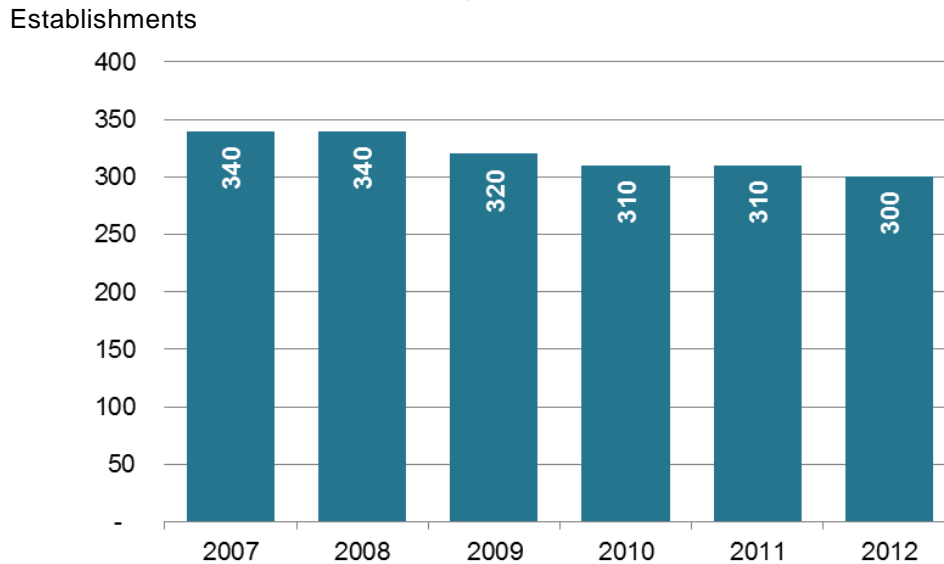
## **Maritime Support Services**

This study defines Maritime Support Services as the NAICS codes of Marinas (NAICS 713930) and Boat dealers (NAICS 441222), technical services such as fueling and petroleum services, Maritime electronics and parts suppliers, professional services such as accountants, attorneys, and naval architects, as well as federally funded support services which include NOAA and Army Corps of Engineers activities.

Establishments in this subsector have declined steadily in recent years (**Exhibit 33**). Jobs decreased in 2009 during the recession but held steady since then (**Exhibit 34**). Statewide gross business income has declined beginning in 2007, shown in **Exhibit 35**, probably due to the poor economic climate. Boat dealers comprise the great majority of the segment, but other activities include:

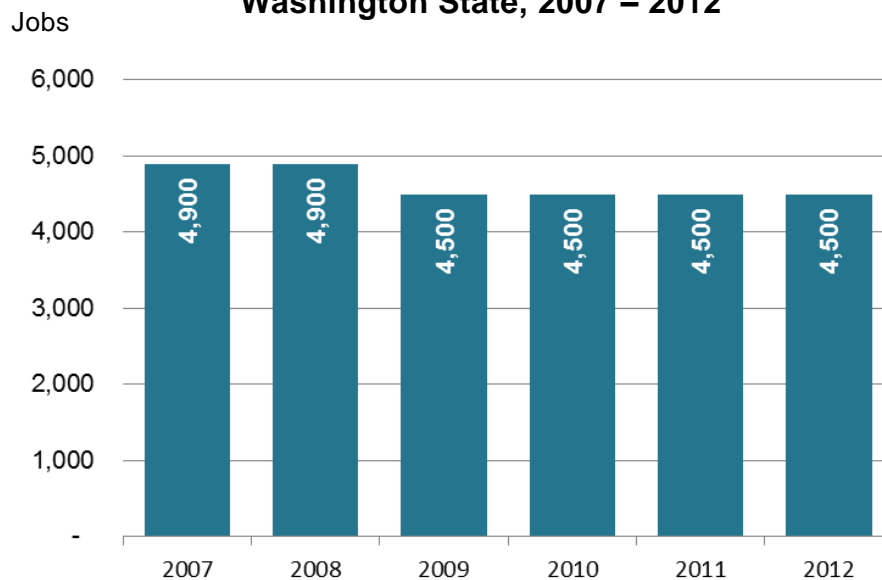
- **Gig Harbor Marina and Boatyard** was originally founded as a fishing boat repair shop in 1905. Originally Skansie's Ship Building Company, it built the original Washington State Ferries. Today, they are a full service boatyard and marina with capacity for haulouts, marine services, and both open and covered moorage.
- **Ballard Oil** was established in 1937, and operates in Lake Union providing fuel, lubricants, and other supplies to the Pacific Northwest and Alaska fishing fleets, as well as providing heating oil delivery to consumers in Seattle. Ballard Oil is one of two commercial marine fuel providers in Seattle.
- **West Sound Marina, Inc.** was established in 1950, and is the largest marina on Orcas Island. They offer mechanical services, haulouts, and wet and drydock facilities for boats up to 80 ft. plus.
- **Cap Sante Marine**, located in Anacortes, has served Northwest recreational boaters, professional skippers, and charter boat and commercial owners since 1979. They offer boat repair, boat launch and haulout up to 50 tons, and an indoor heated fiberglass, gelcoat, and paint shop.
- **Lunde Marine Electronics** is headquartered in Seattle and offers services and installation of auto pilots, radar, navigation, communications and fish finders. The company has three locations, in Seattle, Tacoma, and Dutch Harbor, Alaska, and has been in operation for 25 years.
- **LFS Commercial Gear** is a supplier to the Fishing and Seafood Processing industry with four locations in Alaska, and with retail locations in Bellingham and Seattle. The company stocks gear for all major commercial fisheries, as well as safety gear and supplies for processing.

**Exhibit 33. Maritime Support Services Establishments, Washington State, 2007 – 2012**



Source: Community Attributes, Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics (2013).

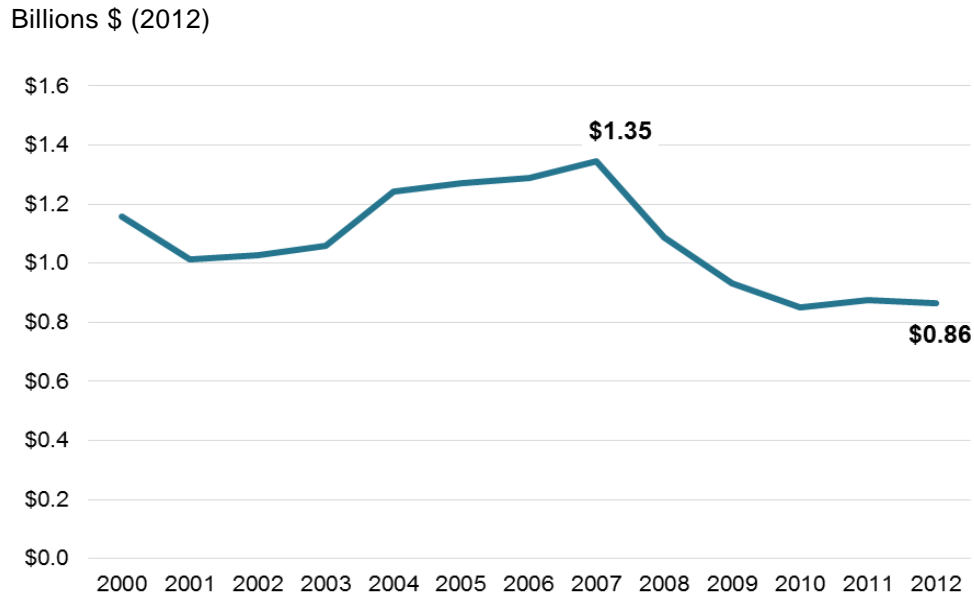
**Exhibit 34. Maritime Support Services Jobs, Washington State, 2007 – 2012**



Source: Community Attributes, Washington State Employment Security Department (2013), U.S. Department of Labor Bureau of Labor Statistics (2013).



**Exhibit 35. Statewide Gross Business Income in Maritime Support Services, 2000-2012 (Expressed in 2012 Dollars)**



Sources: Community Attributes Inc.; Washington State Department of Revenue (2013); U.S. Bureau of Economic Analysis.

**Maritime-Related Engineering**

Maritime engineering includes both naval architecture—the design of boats and other floating structures—and engineering related to on-shore facilities and structures. In 2012, there were approximately 630 naval architects in Washington State, representing a location quotient for Washington of 4.32; these positions paid an average annual salary of \$85,470 (U.S. Bureau of Labor Statistics, 2013). Naval architecture firms in Washington State include:

- **Art Anderson Associations Inc.** founded in 1955, Art Anderson Associates Inc. is an engineering services firm specializing in naval architecture and marine engineering. Clients include NOAA and Washington State Ferries. They provide shore-side facilities engineering services, as well as vessel design, transportation planning for ferries, and construction project management. Headquartered in Bremerton, Art Anderson Associates' clients include international agencies looking for efficiencies in their water transportation systems.
- **Elliot Bay Design Group**, headquartered in Seattle and with operations in New Orleans, provides naval architecture, marine engineering and production support services to owners, operators and shipyards across the globe. An employee-owned company, they specialize in ferry boat design. Clients include Alaska Marine Highways, Washington State Ferries, and the India's Oil and Natural Gas Company.

## Maritime Subsectors: Maritime Support Services

- **Glosten Solutions, Inc.** is a full service consulting firm of naval architects, marine engineers and ocean engineers located in Seattle. Design experience includes tugs, barges, research vessels, cruise vessels, passenger/car ferries, and special-purpose platforms. The firm offers specialized expertise in hydrodynamic analysis, climatology, risk analysis, and consulting to civil engineers and marine construction contractors for floating and coastal structures.
- **Guido Perla & Associates Inc.** Headquartered in Seattle, GPA is a naval architecture and marine engineering firm with operations in China, Germany, Chile, and Brazil. They specialize in large-scale factory trawlers, next generation offshore vessels, and diesel-electric passenger vessels, as well as tug boats, fire boats, research vessels and navy vessels.
- **Hockema & Whalen Associates.** Based in Seattle, Hockema & Whalen Associates is a full service naval architectural firm primarily involved in commercial and government projects. They provide naval architecture and marine engineering services for tugs, commercial fishing vessels, dredgers, cargo barges, derrick barges, small cargo vessels, workboats and passenger vessels.
- **Jensen Maritime Consultants, Inc.** A full-service naval architecture and marine engineering firm based in Seattle, Jensen Maritime Consultants is a subsidiary of Crowley Maritime. They design tug and other workboats as well as fishing vessels, including the first modern Bering Sea crabbing vessel in 1966. Passenger vessels, shipyards, and cargo transport represent additional firm expertise.

On-shore engineering and construction firms deal with a wide range of waterfront-related projects, including terminal and waterfront facility design, seawalls, and underwater structures.

### Other Professional Maritime Support Services

This study defines professional Maritime Support Services as firms engaged in finance, law, and accounting services, as well as Maritime-related engineering services. Such businesses provide crucial services to the Maritime industry by providing the same types of support services needed by any business as well as specialized services addressing the complexities of the Maritime industry.

Professional services to Maritime are specialized because the industry frequently involves multiple and overlapping jurisdictions in international waters. Law firms provide a variety of services to Maritime, including ensuring environmental compliance, representing personal injury cases, and negotiating cargo disputes. Accountants provide bookkeeping and tax services for firms who work in international waters, and who employ seasonal and sometimes non-resident workers. Finance also plays a critical role in securing funds for new boats, whether pleasure or work craft.

- **Garvey Schubert Barer** has a comprehensive, full-service Maritime practice in the Northwest. Their clients include vessel owners and operators, a ferry line, shipyards and trade associations, fishing companies, and luxury yacht owners. The

## Maritime Subsectors: Maritime Support Services

firm assists in labor disputes, fisheries regulations, as well as vessel financings and other commercial transactions.

- **Philip D. Hingston, Inc. P.C.** is located in Seattle and offers services including payroll and bookkeeping, business consulting, tax preparation, and financial planning.
- **Keesal, Young & Logan** opened their Seattle office in 1994 and has a significant Maritime practice located in the state. Their clients include Crowley Maritime Corporation, Foss Maritime, Hanjin Shipping, Trident Seafoods, and Holland America Line. Their areas of practice include environmental incidents, Jones Act and longshore litigation, and Maritime lien disputes.
- **Greenwood, Ohlund & Co, LLP** is located in Seattle and was founded in 1978. Their staff includes industry specialists in commercial and crab fishing as well as manufacturing. The firm provides services in auditing, accounting, and tax and business consulting.
- **Nicoll Black & Feig** has a full service Maritime and transportation practice located in Seattle. Their attorneys include graduates of the U.S. Merchant Marine Academy, the U.S. Coast Guard Academy, former Navy JAG lawyers, and marine engineers. The firm has extensive experience in Maritime litigation including cargo claims, personal injury, environmental litigation, and salvage and cargo claims.

### Federal Maritime Support Services

**National Oceanic and Atmospheric Administration.** NOAA operates numerous offices aimed at research and conservation in Washington State, including:

- The National Weather Service staffs weather forecast offices in Spokane and Seattle, provides aviation forecasts for Washington, most of Oregon, and parts of California and Idaho, and maintains a network of data buoys to aid in early detection of tsunamis.
- National Marine Fisheries Service manages fisheries, conducts research on fish migration for endangered and non-endangered species, conducts aquaculture research, and inspects seafood.
- National Ocean Service provides technical assistance for spills, collects data on sea trends, protects coastline, and conducts navigational surveys.

NOAA employs over 1,000 people in the state and had a payroll of \$129 million in 2012.

**The Army Corps of Engineers.** Army Corps of Engineers maintains and operates important navigation projects, performs flood risk management, and ecosystem restoration. The Corps operates the Lake Washington Ship Canal and Hiram M. Chittenden Locks as well as Grays Harbor navigation channel and jetties, which have significant benefit to the Maritime industry. Corps civil works projects include the

## **Maritime Subsectors: Maritime Support Services**

Howard A. Hanson Dam in the Green River Valley, as well as a number of other flood risk management and, ecosystem restoration, and fish passage projects. The Army Corps of Engineers employs 859 people in the state and had a payroll of \$64 million.

## **Military Operations**

The Coast Guard and U.S. Navy contribute significantly to Maritime in Washington State through contract spending, operations, and research functions. The Puget Sound Naval Shipyard (PSNS), located in Bremerton has nearly 11,300 civilian Department of Defense employees and is Washington's second largest industrial employer, behind only Boeing.

### **The Navy**

The Navy operates many installations in Washington State, the largest being Naval Base Kitsap, which was created in 2004 by merging the former Naval Station Bremerton with Naval Submarine Base Bangor. Naval Base Kitsap is the third largest naval base in the U.S., and the Pacific Northwest's largest Naval shore facility. Naval Station Everett is Washington's second-largest installation, and the Navy's most modern facility. Naval Station Everett is home to two destroyers, three frigates, one nuclear-powered aircraft carrier and a Coast Guard buoy tender. The Navy accounts for the majority of Military and Federal Operations in the state, in terms of both contract spending (**Exhibit 36**), as well as payroll and total employees (**Exhibit 37**).

As of September 2013, Puget Sound Naval Shipyard reported 11,228 civil service and Department of Defense civilian employees (PSNS, 2013). Historically, the shipyard built many ships for the Allied war effort. During the Great Depression, Puget Sound Naval Shipyard (PSNS) went through a period of expansion as the nation built up its fleet, and during WWII, the yard repaired warships damaged in battle (Mc Clary, 2003). DOD employees in the shipyard do not work on conventionally powered ships, only on nuclear-powered ships, and private sector employers in the yards such as Vigor Industrials service non-nuclear ships.

In federal fiscal year 2012, nearly half a billion dollars in federal contracts were awarded for procurement and services rendered for Congressional District 6, home PSNS, Bangor Submarine Base, and Naval Undersea Warfare Center in Keyport. While PSNS handles nuclear-powered ship maintenance and repair, non-nuclear-powered surface ships are exclusively handled via private sector contracts, and even among nuclear-powered ships, many non-nuclear maintenance and repair activities are contracted to private sector third parties. For instance, in fiscal year 2012 Vigor Industrial received more than 261 federal contracts for work performed in Washington worth in aggregate \$91.8 million; almost all of this work (\$91.4 million) was for non-nuclear ship repair (U.S. Federal Government, 2013).

PSNS contracts out \$200 million in work each year in services, but also contracts for additional workers for Navy-led projects in need of additional workforce. PSNS provides maintenance and repair work for five major Navy bases across the Pacific Rim—one each in Japan, San Diego, Everett, Bangor, and Guam. In 2012, payroll at PSNS was approximately \$900 million, and is expected to grow significantly over next two years.

### **The Coast Guard**

The Coast Guard operates six programs in Washington, including Maritime response, security and law enforcement, as well as defense operations and marine transportation system management. The organization owns and maintains 17 cutters, 95 boats, and three

## Maritime Subsectors: Military Operations

aircraft statewide. In 2012, the Coast Guard performed 1,165 search and rescue operations. The Coast Guard also oversees safety inspections for all commercial fishing vessels as well as enforcing recreational boating laws. In 2012, the Coast Guard had nearly 6,500 active duty, reserve, and civilian employees, and had a payroll of \$163 million in Washington.

### Maritime Government Contractors

Examples of Washington-based Maritime government contractors include:

- **Safe Boats International**, a leading manufacturer of aluminum hull high performance patrol boats with locations in Bremerton and Tacoma, successfully bid on contracts with the U.S. Navy and Defense Logistics worth more than \$35 million in 2012. The firm directly employs 350 shop floor workers engaged in welding, system integration, finishing, and other support activities, with another roughly 30 workers in engineering.
- **AMSEC** is a wholly owned subsidiary of Huntington Ingalls Industries and is the largest builder for Puget Sound Naval Shipyard's amphibious vehicles, destroyers, and submarines. The company has 300 employees in Bremerton.
- **QED Systems** is a nationwide government contractor engaged in engineering and technical services. The company also has a logistics and planning arm which supports specialized development for navy contractors. QED is headquartered in Virginia, but operates a location in Port Orchard.

**Exhibit 36. Table of DOD Contract Spending by Agency, 2012**

	Navy	Coast Guard	NOAA
King	\$3,107,563,000	\$49,695,000	\$30,997,000
Pierce	\$31,939,000	\$3,085,000	\$18,000
Kitsap	\$768,454,000	\$11,196,000	\$1,313,000
Whatcom	\$7,423,000	\$5,914,000	\$267,000
Snohomish	\$41,256,000	\$1,235,000	\$2,770,000
Island	\$93,189,000	N/A	\$9,000
Yakima	\$440,000	N/A	N/A
Spokane	\$4,318,000	\$726,000	\$51,000
<b>Total</b>	<b>\$4,054,584,000</b>	<b>\$71,853,000</b>	<b>\$35,429,000</b>

Source: Federal Procurement Data System- Next Generation (2013).

**Exhibit 37. Statewide Personnel and Payroll by Agency**

Corps	Year	Total Personnel	Total Payroll
Navy	2009	53,000	\$2,936,277,766
Coast Guard	2012	6,500	\$163,000,000

Sources: Coast Guard; Navy Region Northwest 2009 Economic Impact Assessment. Navy payroll Includes retirees. Coast Guard includes active duty, reserve, and civilian employees.

## WORKFORCE ASSESSMENT

Washington’s Maritime Cluster encompasses a broad swath of activities, both land- and sea-based. Accordingly, the Maritime workforce, as defined for this study, comprises a wide diversity of occupations necessary to water-based transportation, ports and logistics, and Maritime-related manufacturing (seafood processing and boat building). **Exhibit 38** maps some of the occupations in this study to the Maritime segments defined. Sea-faring positions contribute to the workforces of several Maritime segments. Boat building includes a variety of general manufacturing positions, such as Welders, Metal Fabricators, Electronics Installers, and Upholsterers. Military and Federal Operations employ a cross-section of Maritime occupations—both sea-based and industrial land-based. **Exhibit 39** displays the typical educational requirements, on-the-job-training needed to be competent, and work experience needed for each occupation.

**Exhibit 38. Occupations by Maritime Segment**

<b>Passenger Water Transportation</b>	<b>Fishing and Seafood Processing</b>	<b>Maritime Logistics and Shipping</b>	<b>Military and Federal Operations</b>
Captains, Mates, and Pilots	Captains, Mates, and Pilots	Captains, Mates, and Pilots	Captains, Mates, and Pilots
Sailors and Marine Oilers	Sailors and Marine Oilers	Sailors and Marine Oilers	Sailors and Marine Oilers
Ship Engineers	Ship Engineers	Ship Engineers	Ship Engineers
Electricians	Electricians	Electricians	Electricians
Transportation Workers, All Other	First-Line Supervisors	Crane and Tower Operators	Fish and Game Wardens
	Fishers	Longshoremen (Material Moving Workers)	Materials Engineers
	Fish Cutters		Ship Fitters (Layout Workers)
	Machine Setters (Cutting)		Riggers
			Metal Fabricators
			Diesel Engine Specialists
			Electronics Installers
			Motorboat Mechanics
<b>Ship and Boat Building, Repair, and Maintenance</b>	<b>Maritime Support Services -- Engineering</b>	<b>Maritime Support Services -- Professional</b>	<b>Maritime Support Services -- Other</b>
Materials Engineers	Marine Engineers and Naval Architects	Surveyors Drafters Logisticians	Commercial Divers Dredge Operators
Ship Fitters (Layout Workers)			Civil Engineering Technicians Civil Engineers
Riggers			
Metal Fabricators			
Diesel Engine Specialists			
Electronics Installers			
Motorboat Mechanics			
Welders			
Upholsterers			
Boilermakers			
Plumbers, Pipefitters, and Steamfitters			

Source: Community Attributes, 2013.



**Exhibit 39. Maritime Occupations and Education, Work and Training Experience Required**

<b>Occupation</b>	<b>Typical education needed for entry</b>	<b>Work experience in a related occupation</b>	<b>Typical on-the-job training needed to attain competency in the occupation</b>
Fishers and Related Fishing Workers	Less than high school	None	Moderate-term on-the-job training
Meat, Poultry, and Fish Cutters and Trimmers	Less than high school	None	Short-term on-the-job training
Sailors and Marine Oilers	Less than high school	None	Short-term on-the-job training
Crane and Tower Operators	Less than high school	1 to 5 years	Long-term on-the-job training
Material Moving Workers, All Other	Less than high school	None	Short-term on-the-job training
Hoist and Winch Operators	Less than high school	None	Moderate-term on-the-job training
Laborers and Freight, Stock, and Material Movers, Hand	Less than high school	None	Short-term on-the-job training
Electrical and Electronics Installers and Repairers, Transportation Equipment	Postsecondary non-degree award	None	Long-term on-the-job training
Surveying and Mapping Technicians	High school diploma or equivalent	None	Moderate-term on-the-job training
Fish and Game Wardens	High school diploma or equivalent	None	Short-term on-the-job training
First-Line Supervisors of Farming, Fishing, and Forestry Workers	High school diploma or equivalent	1 to 5 years	None
Boilermakers	High school diploma or equivalent	None	Apprenticeship
Electricians	High school diploma or equivalent	None	Apprenticeship
Plumbers, Pipefitters, and Steamfitters	High school diploma or equivalent	None	Apprenticeship
Bus and Truck Mechanics and Diesel Engine Specialists	High school diploma or equivalent	None	Long-term on-the-job training
Motorboat Mechanics and Service Technicians	High school diploma or equivalent	None	Long-term on-the-job training
Riggers	High school diploma or equivalent	None	Short-term on-the-job training
Structural Metal Fabricators and Fitters	High school diploma or equivalent	None	Moderate-term on-the-job training
Welders, Cutters, Solderers, and Brazers	High school diploma or equivalent	Less than 1 year	Moderate-term on-the-job training
Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	High school diploma or equivalent	None	Moderate-term on-the-job training
Layout Workers, Metal and Plastic	High school diploma or equivalent	None	Moderate-term on-the-job training
Upholsterers	High school diploma or equivalent	None	Moderate-term on-the-job training
Cutting and Slicing Machine Setters, Operators, and Tenders	High school diploma or equivalent	None	Short-term on-the-job training
Painters, Transportation Equipment	High school diploma or equivalent	None	Moderate-term on-the-job training
Transportation Workers, All Other	High school diploma or equivalent	None	Short-term on-the-job training
Drafters, All Other	Associate's degree	None	None
Civil Engineering Technicians	Associate's degree	None	None
Logisticians	Bachelor's degree	1 to 5 years	None
Surveyors	Bachelor's degree	None	None
Civil Engineers	Bachelor's degree	None	None
Marine Engineers and Naval Architects	Bachelor's degree	None	None
Materials Engineers	Bachelor's degree	None	None
Engineers, All Other	Bachelor's degree	None	None
Captains, Mates, and Pilots of Water Vessels	Bachelor's degree	None	None
Ship Engineers	Bachelor's degree	None	None

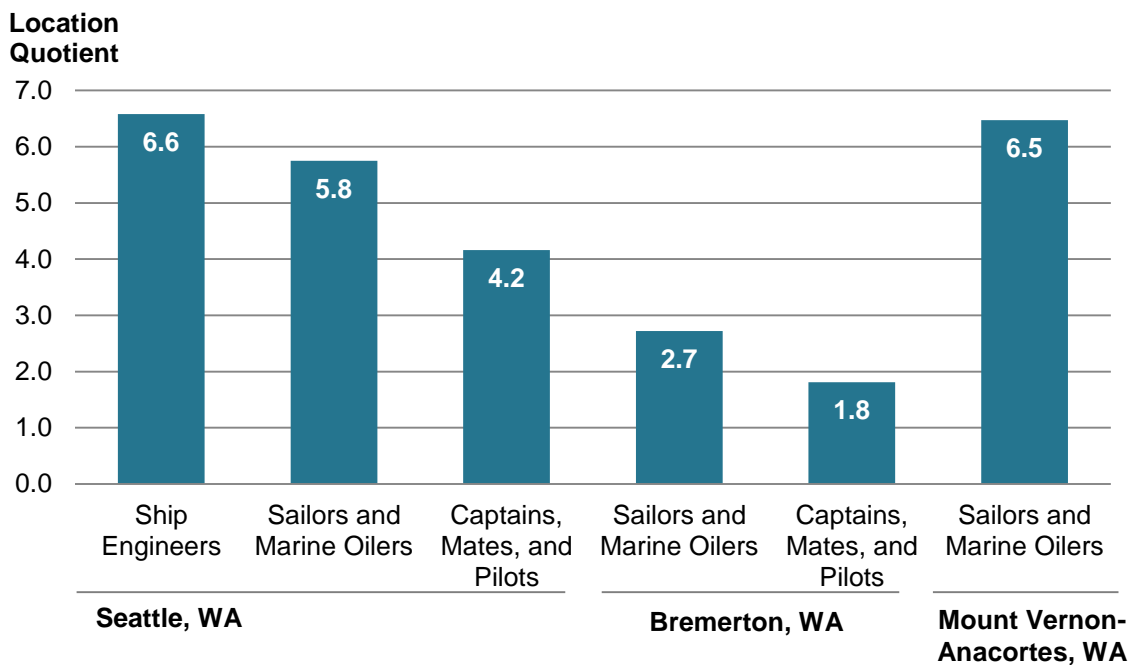
Source: Bureau of Labor Statistics (2010).

## Competitive Occupations

High concentrations of key Maritime occupations are indicative of Washington's prominence as a center of Maritime activities (**Exhibit 40**). Coastal metro areas (Seattle, Bremerton, and Mount-Vernon-Anacortes) in the state have relatively high concentrations of employment in three key Maritime occupations: Ship Engineers, Sailors and Marine Oilers, and Captains, Mates and Pilots. Relative concentration is measured by location quotient which is based on a calculated ratio between the local economy and the economy of other MSAs. The U.S. concentration equals 1.0. Any figure above 1.0 demonstrates a specialization of the Industry in the local economy. Thus, Ship Engineers are nearly seven times more concentrated in the Seattle metro area than the U.S. average, ranking Seattle second among major coastal metro areas (behind Miami, FL). Seattle ranks highest for concentration in Captains, Mates and Pilots.

**Exhibit 41** displays concentration of Captains, Mates, and Pilots in absolute terms (by number of workers engaged in that occupation) and by location quotient. Seattle has the second highest concentration of Captains, Mates, and Pilots in terms of volume, and the highest concentration in terms of location quotient.

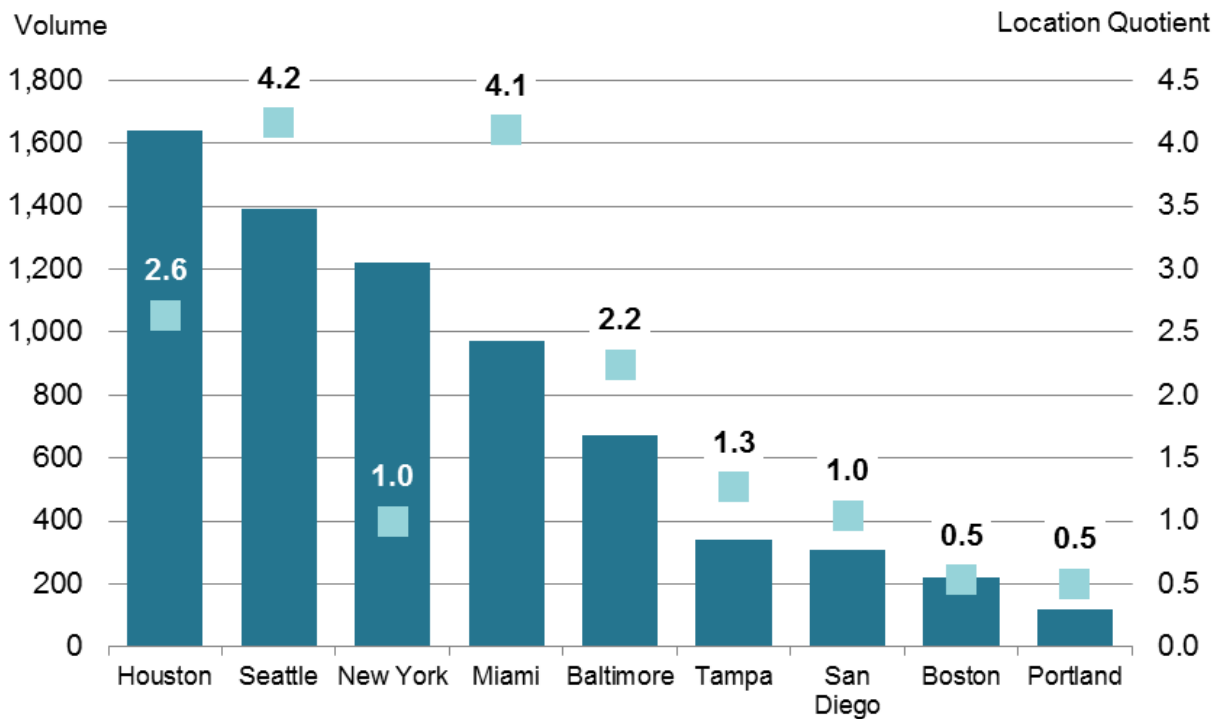
**Exhibit 40. Concentration of Selected Maritime Occupations (Location Quotient), Coastal Washington MSAs, 2012**



Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics (2012).

Note: A metropolitan statistical area is defined by OMB as a geographical region with a relatively high population density at its core and close economic ties throughout the area. Snohomish and Pierce counties are included in the Seattle MSA, Bremerton includes Kitsap County, and Mt. Vernon-Anacortes includes Skagit County.

**Exhibit 41. Volume and Relative Concentration of Captains, Mates, and Pilots (Location Quotient), Select MSAs, 2012**

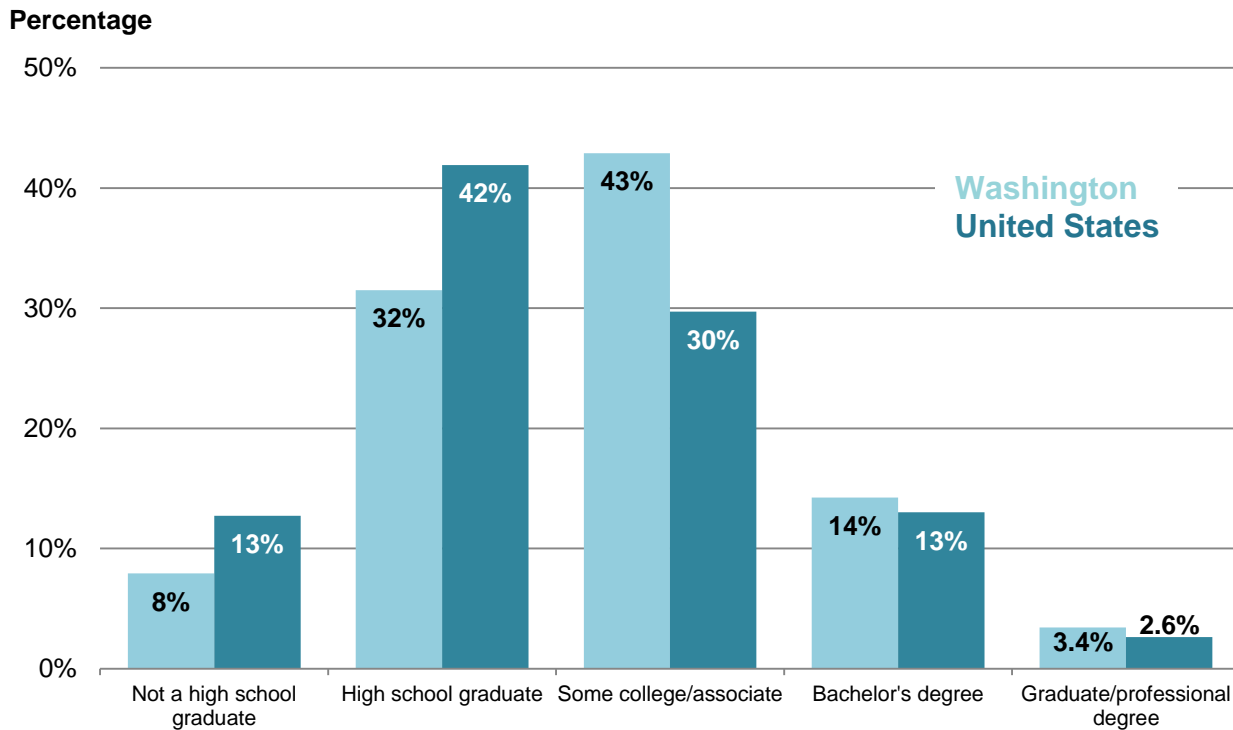


Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics (2012).

## Worker Profile

Overall, Maritime workers in Washington are more educated than their counterparts nation-wide. **Exhibit 42** summarizes the distribution of educational attainment for select Maritime industries in both Washington and the nation. The comparison indicates that the proportion of Maritime Industry employees in Washington State with Some College/Associates Degree is approximately 13 percentage points higher than the national average (43% in Washington versus 30% nationally). Conversely, the proportion of employees with a high school degree or less is lower than the national average.

**Exhibit 42. Educational Attainment of Select Maritime Occupations, Washington and U.S., 2010**

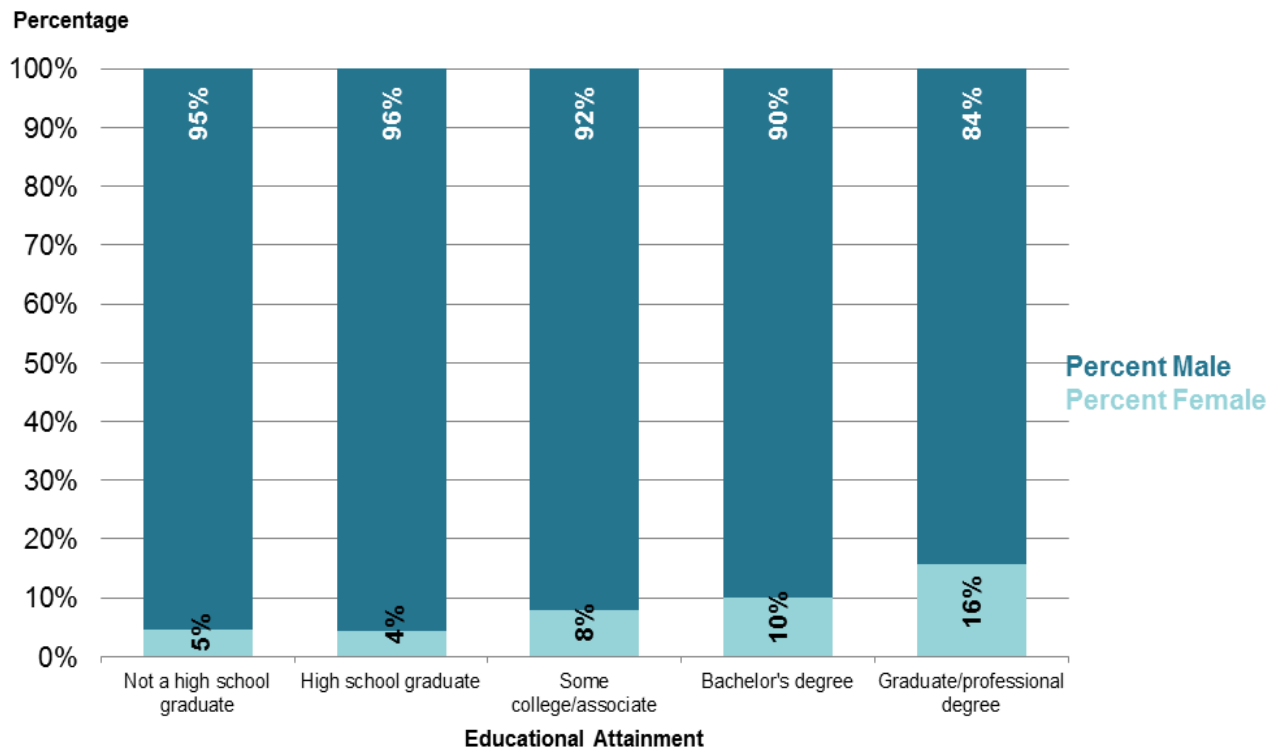


Source: American Community Survey (2010).

Note: Includes sailors, marine oilers, ship engineers, ship and boat captains and operators.

The Maritime workforce is predominately male (90% in Washington). **Exhibit 43** summarizes the distribution of educational attainment by gender in Washington for Maritime-related occupations. Female Maritime employees in Washington make up a relatively small percentage of all Maritime employees, but they are represented in increasingly higher proportions at higher levels of educational attainment, especially when compared to the U.S. (**Exhibit 44**). For example, 16% of Maritime Industry employees with a Graduate/Professional Degree are female compared with just 4% of workers that are high school graduates.

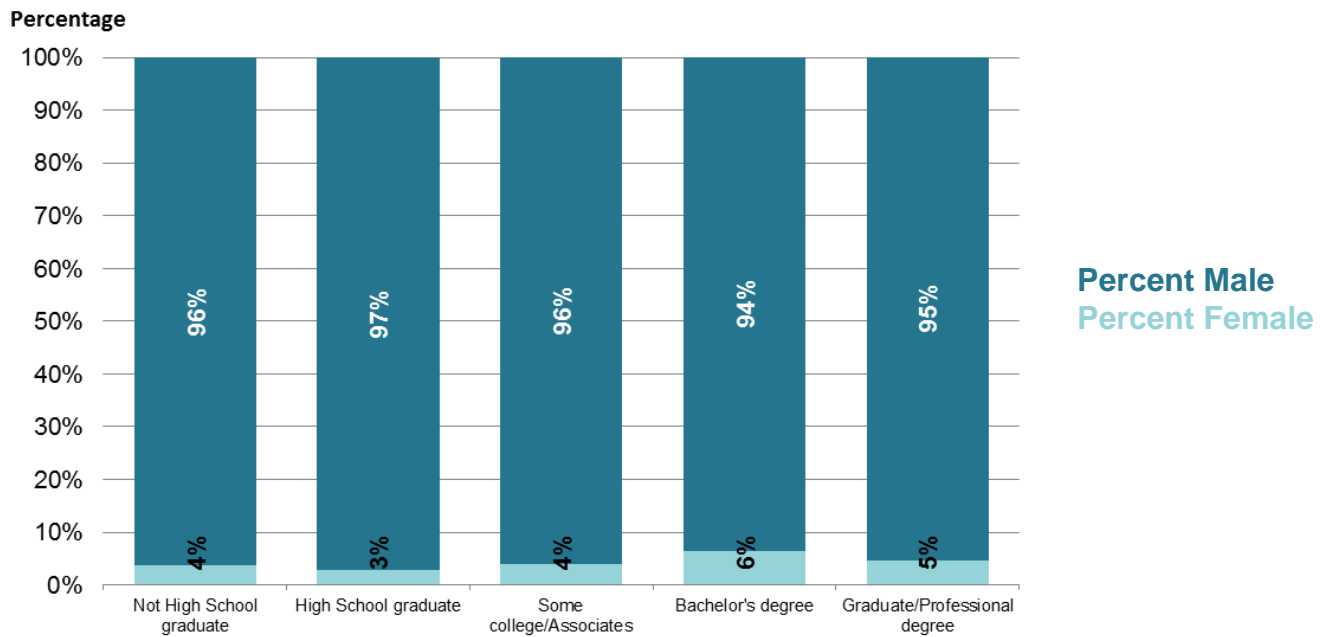
**Exhibit 43. Educational Attainment of Select Maritime Occupations by Gender, Washington State, 2010**



Source: American Community Survey (2010).

Note: Includes sailors, marine oilers, ship engineers, ship and boat captains and operators.

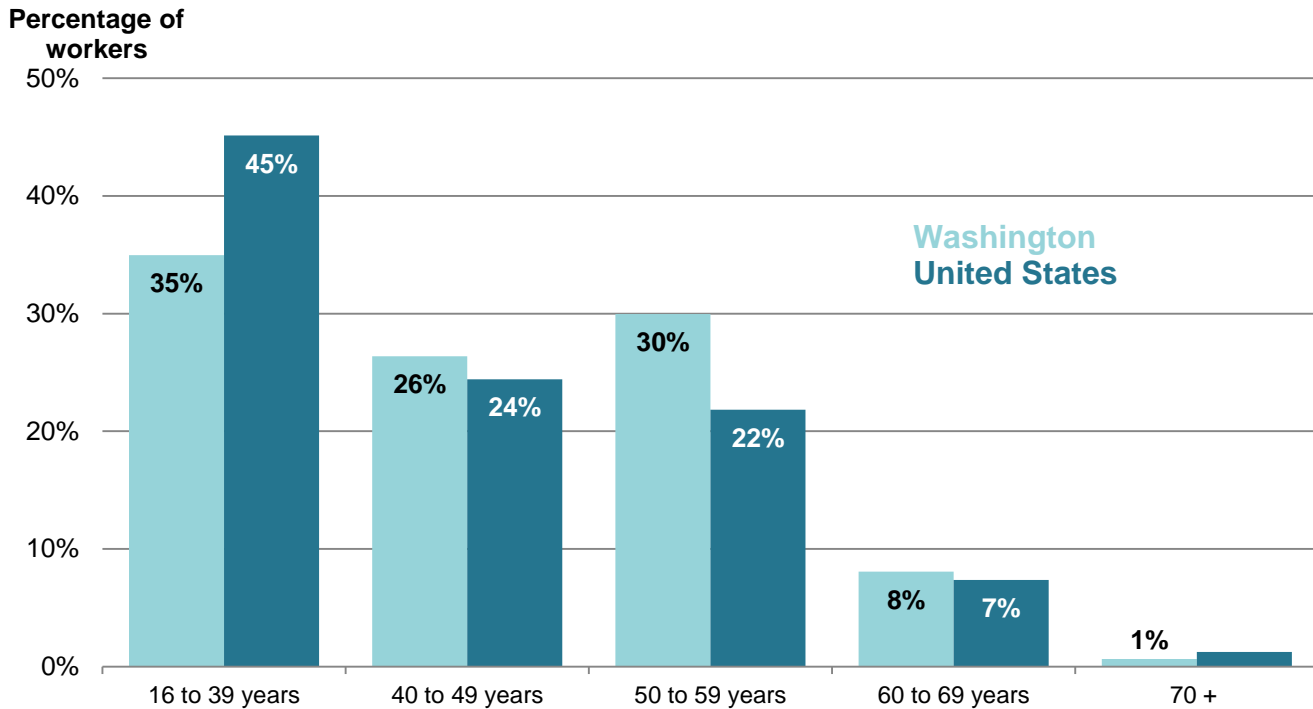
**Exhibit 44. Educational Attainment of Select Maritime Occupations by Gender, U.S., 2010**



Source: American Community Survey (2010). Note: Includes sailors, marine oilers, ship engineers, ship and boat captains and operators.

The data suggest that an aging workforce is apparent in the cluster. More than a third of workers in the cluster are over 50 years of age. Additionally, Washington's Maritime workforce is generally older relative to the U.S. average (**Exhibit 45**). For example, 45% of Maritime workers nationally are between 16 and 39 years old, while in Washington the same age group represents 35% of Maritime workers. Washington has a higher percentage of Maritime workers between the ages of 40 to 69 than does the U.S. as a whole.

**Exhibit 45. Age of Select Maritime Workers, Washington State and US, 2010**



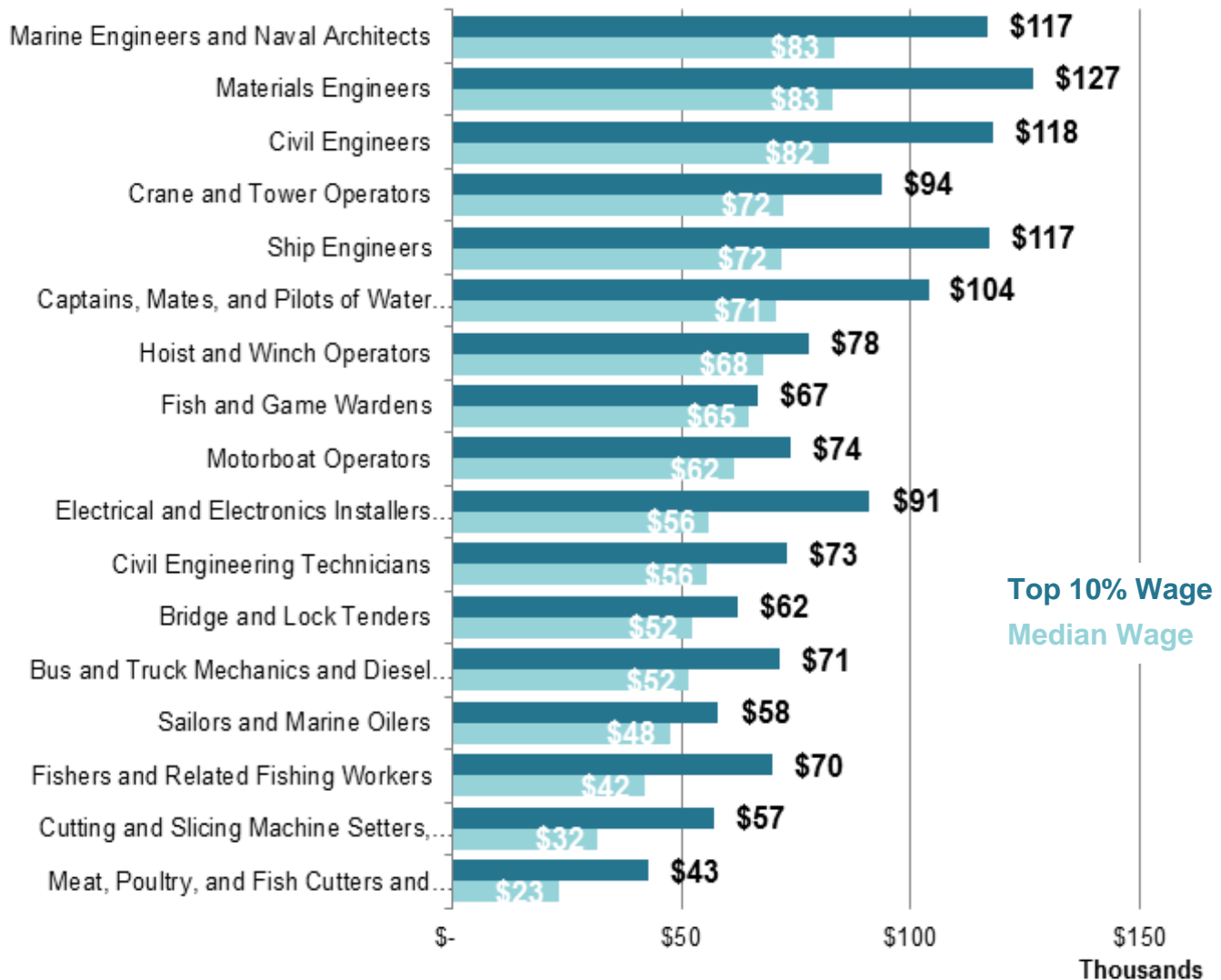
Source: American Community Survey (2010).

Note: Includes sailors, marine oilers, ship engineers, ship and boat captains and operators.

## Wages by Occupation

Many of the Maritime occupations in Washington offer salaries close to or greater than the state median wage (\$51,000 in 2012). The highest paid Maritime occupations included in this study are Marine Engineers and Materials Engineers. Lower wage jobs include Fish Cutters, Upholsterers and Machine Setters (Cutting and Slicing) (Exhibit 46).

**Exhibit 46. Median and top 10% Annual Wage for Select Maritime Occupations, Washington State, 2012**



Source: Bureau of Labor Statistics, 2012.



### Occupation Spotlight: Longshoremen

Represented by the International Longshore and Warehouse Union, approximately 42,000 members in 60 unions are employed across the states of Oregon, California, Hawaii, Alaska, and Washington. Begun in 1934 by Harry Bridges in San Francisco, the union employs longshoremen who are responsible for loading and unloading international cargo that comes to the West Coast of the U.S. via shipping container. Longshoremen are employed by the Pacific Maritime Association, who negotiates the labor contract between the workers and the terminal operators.

Longshoremen illustrate the difficulty in accounting for impacts within the Maritime sector based on industry and occupational codes. For example, according to the Pacific Maritime Association, the average full-time wage for a fully registered worker can reach \$132,946 a year for a longshore worker, and \$206,675 for a foreman. These wages are higher than the wage reported for even the top 10% of workers according to the Bureau of Labor Statistics in Washington State. BLS reports that, not including benefits, the top 10% of Hoist and Winch Operators make \$78,000 annually (**Exhibit 46**), while the top 10% of Laborers and Freight, Stock, and Material Movers, Hand make \$47,000 (**Appendix J**). Pacific Maritime Association delineates skill rates based on experience, and by type of worker (longshore, clerk, and foreman), none of which are reported directly by BLS.

In this study, longshoremen are included in the NAICS code 488320 Marine Cargo Handling, reflected in the subsector of Maritime Logistics and Shipping. In 2012, Washington Employment Security Department reported 4,314 workers in Washington. According to the Bureau of Labor Statistics, the occupation of longshoremen is reflected in two occupational codes, Hoist and Winch Operators, and Laborers and Freight, Stock, and Material Movers, Hand.

## Educational and Training

The Maritime occupations included in this study reflect a wide range of jobs, but are predominantly low- or semi-skilled jobs that require on-job-training and/or certification and endorsements rather than traditional higher education. The Maritime industry is highly regulated, and career pathways for seamen are largely determined by the Coast Guard. **Exhibit 47** shows a list of educational programs available at colleges and universities. Most of these are available in Washington State, and students may leverage many other degrees to transfer skills into a Maritime career.

### Exhibit 47. Accredited Educational Programs Associated with Maritime Occupations

Major
Agricultural and Food Products Processing
Aquaculture
Autobody/Collision and Repair Technology/Technician
Automobile/Automotive Mechanics Technology/Technician
Commercial Fishing
Construction/Heavy Equipment/Earthmoving Equipment Operation
Diesel Mechanics Technology/Technician
Diver, Professional and Instructor
Electrician
Fishing and Fisheries Sciences and Management
Forest Resources Production and Management
Machine Tool Technology/Machinist
Marine Maintenance/Fitter and Ship Repair Technology
Marine Science/Merchant Marine Officer
Materials Engineering
Medium/Heavy Vehicle and Truck Technology/Technician
Metal Fabricator
Metallurgical Engineering
Mobil Crane Operation/Operator
Natural Resource Economics
Natural Resources Law Enforcement and Protective Services
Naval Architecture and Marine Engineering
Polymer/Plastics Engineering
Small Engine Mechanics and Repair Technology/Technician
Surveying Technology/Surveying
Upholstery/Upholsterer
Welding Engineering Technology/Technician
Welding Technology/Welder
Wildlife, Fish and Wildlands Science and Management

Source: Integrated Postsecondary Education Data System (IPEDS) from the National Center for Education Statistics (2012); Community Attributes.

Other specialized Maritime training programs exist in Washington. Several private training institutions in the state offer certification and licensing programs for sailors and deckhands that are accredited by the Coast Guard instead of the Council of Higher Education, as shown in **Exhibit 48**. These include the Maritime Institute of Technology and Graduate Studies, Crawford Nautical School and Compass Courses. There are also

programs for career changers and K-12 students that contribute to the pipeline of available workers in Washington's Maritime sector.

## Exhibit 48. Maritime Workforce Training Programs, Washington State

<i>Institution</i>	<i>Program</i>
<i>Ballard Maritime Academy</i>	Maritime training programs
<i>Bates Technical College</i>	Boat Building
<i>Clatsop Community College</i>	Maritime training, certification and licensing programs
<i>Compass Courses Maritime Training</i>	Maritime training, certification and licensing programs
<i>Crawford Nautical School</i>	Maritime training, certification and licensing programs
<i>Flagship Maritime Training Center</i>	Maritime training, certification and licensing programs
<i>Fremont Maritime Services</i>	Maritime safety training programs
<i>Fryar's Maritime Service</i>	Maritime training, certification and licensing programs
<i>Lake Washington Institute of Technology</i>	Motorcycle, Marine and Power Service Technology
<i>Maritime Training Services</i>	General
<i>Northwest School of Wooden Boat Building</i>	Boat Building
<i>NPFVOA</i>	Vessel Safety Program
<i>Olympic College</i>	Manufacturing, Welding
<i>Pacific Maritime Institute</i>	Maritime training, certification and licensing programs
<i>Renton Technical College</i>	Welding
<i>Seattle Central Community College</i>	Maritime training, certification and licensing programs
<i>Seattle Maritime Academy</i>	Maritime training, certification and licensing programs
<i>Skagit Valley College</i>	The Northwest Center of Excellence for Marine Manufacturing and Technology
<i>Sno-Isle Tech Skills Center</i>	Diesel Power Tech, Welding
<i>South Seattle Community College</i>	Welding
<i>The Anchor Program</i>	Maritime training, certification and licensing programs
<i>University of Washington</i>	School of Aquatic and Fishery Sciences
<i>University of Washington</i>	School of Marine Affairs
<i>U.S. Maritime Academy</i>	Maritime training, certification and licensing programs
<i>Washington State Patrol Fire Training Academy</i>	Marine Firefighter Training
<i>Youth Maritime Training Associations</i>	K-12 programs to promote Maritime careers
<i>Zenith Maritime</i>	Maritime training, certification and licensing programs

Source: Workforce Development Council of Seattle-King County, Community Attributes (2013).

### Occupational Demand Outlook

The overall employment outlook for Maritime occupations is strong with most of the fields included in this study expected to expand between 2016 and 2021, as illustrated in **Appendix F**. The Washington State Employment Security Department (ESD) predicts the highest number of predicted openings from 2016-2021 for Meat and Fish Cutters, Sailors and Marine Oilers, and Fishers. Even in occupations where growth is expected to be flat or declining, job openings are predicted due to the aging workforce and the need to replace retiring workers.

### Talent Pipeline

The Talent Pipeline model, as conceptualized by the Workforce Development Council of Seattle-King County, compares the supply of workers available with the demand for workers predicted for each occupation. The model defines supply as unemployment claimants for the occupation plus annual completions from accredited higher education programs associated with the occupation. It captures demand as average annual openings (as reported in the ESD occupation forecast for Washington State). It then allocates a certain percentage of both supply and demand to the pre-defined cluster (**Appendix G**; **Appendix L** displays the percentage of employment of all suitable Maritime occupations by industry NAICS). For this study, the model includes occupations in the Maritime Cluster throughout Washington State, a summary of which is shown in **Exhibit 49**<sup>18</sup>.

The results of the model indicate that potential supply is generally sufficient to meet demand for low- and semi- skilled entry level workers in the Maritime industry, with three exceptions:

- Laborers and Freight, Stock, and Material Movers, Hand<sup>19</sup>
- Meat, Poultry, and Fish Cutters and Trimmers
- Sailors and Marine Oilers

College-educated Maritime workers are in short supply, however, and will not meet the demand for Captains, Mates and Pilots, Ship Engineers, and Marine Engineers and Naval Architects unless local institutions of higher education expand their Maritime programs and offerings.

Supply exceeds demand for many occupations for low- and semi- skilled entry level workers, largely driven by high numbers of graduates and not by unemployment claims. For example, in 2012 3,099 graduates were reported for programs which are related to the occupation of Electrical and Electronics Installers and Repairers, Transportation Equipment. The model allocates 34% of these workers to our designated Maritime

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<sup>18</sup> Other occupations considered but not included in **Exhibit 49** are included in **Appendix J**.

<sup>19</sup> According to BLS, longshoremen are reflected in this occupation and Hoist and Winch operators.

Cluster (see **Appendix G** for definition), but even then, supply is 1,042 graduates (there were no unemployment claims for this occupation).

In order to understand which components of the model are driving the final supply and demand for these occupations, **Appendix H** and **Appendix I** contain the data for both supply and demand, respectively. **Appendix J** also contains talent pipeline results for all occupations suitable for Maritime, while **Exhibit 49** contains selected results. **Appendix K** breaks out employment by percentage for each occupation by two-digit industry code.

## Exhibit 49. Annual Maritime Workforce Supply and Demand by Educational Attainment, Select Occupations, Washington 2016-2021

Education	Occupation	Demand	Supply	Gap
Less than high school	Meat, Poultry, and Fish Cutters and Trimmers	173	119	(54)
	Sailors and Marine Oilers	140	100	(40)
	Fishers and Related Fishing Workers	123	396	273
	Laborers and Freight, Stock, and Material Movers, Hand	117	43	(74)
	Crane and Tower Operators	24	319	295
	Material Moving Workers, All Other	12	25	13
	Hoist and Winch Operators	5	55	50
Postsecondary non-degree award	Electrical and Electronics Installers and Repairers, Transportation Equipment	4	1,042	1,038
High school diploma or equivalent	Welders, Cutters, Solderers, and Brazers	35	269	234
	Electricians	15	36	21
	Plumbers, Pipefitters, and Steamfitters	14	27	13
	Bus and Truck Mechanics and Diesel Engine Specialists	14	27	13
	Transportation Workers, All Other	13	9	(4)
	Riggers	13	21	8
	Layout Workers, Metal and Plastic	9	1,184	1,175
	Cutting and Slicing Machine Setters, Operators, and Tenders	7	4	(3)
	Structural Metal Fabricators and Fitters	7	17	10
	First-Line Supervisors of Farming, Fishing, and Forestry Workers	5	65	60
	Upholsterers	4	17	13
	Painters, Transportation Equipment	3	95	92
	Motorboat Operators	3	-	(3)
	Fish and Game Wardens	3	307	304
	Motorboat Mechanics and Service Technicians	2	6	4
	Boilermakers	1	9	8
	Surveying and Mapping Technicians	1	2	1
	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	1	5	4
Associate's degree	Civil Engineering Technicians	7	12	5
	Construction Managers	2	174	172
	Drafters, All Other	2	143	141
Bachelor's degree	Captains, Mates, and Pilots of Water Vessels	108	59	(49)
	Ship Engineers	57	39	(18)
	Civil Engineers	39	113	74
	Marine Engineers and Naval Architects	9	7	(2)
	Engineers, All Other	5	9	4
	Logisticians	4	19	15
	Materials Engineers	1	6	5
	Surveyors	1	2	1

Source: Washington State ESD, 10 year Occupational Employment Projections (2012); ESD Unemployment Claims (2013); IPEDS (2012); Community Attributes (2013).

## SUMMARY

The Maritime industry is an engine of economic prosperity and growth in Washington State. In 2012, the cluster directly employed 57,700 workers across five major subsectors and paid out wages of \$4.1 billion. Maritime firms directly generated more than \$15.2 billion in business revenues and remitted \$79.5 million state tax revenues. Indirect and induced Maritime jobs account for another 90,000 jobs, for a total impact of 148,000 Washington jobs. Additionally, the direct contribution of Maritime's \$15.2 billion in gross business income generates another \$14.8 billion in induced and indirect output, for a total contribution effect of nearly \$30 billion to Washington's economy.

Maritime firms innovate, export their goods and services to other parts of the U.S. and globally, and drive economic growth. The cluster represents a deep network of activities that extend across manufacturing, services, and the federal and state governments. Activities in the cluster include:

- Passenger Water Transportation, which includes state ferry operations, recreational tours, private ferries, and the private cruise industry;
- Ship and Boat Building, Maintenance, and Repair, which includes construction of commercial and recreational vessels, repair and overhaul, and maintenance;
- Maritime Logistics and Shipping, which includes Port and Harbor operations, their subcontractors, cold storage, and freight logistics firms;
- Fishing and Seafood Products, which includes commercial and recreational fishing, aquaculture, and processing and distribution of seafood;
- Maritime Support Services, which includes technical services like construction and environmental, parts and electronics suppliers, boat dealers, marinas, and professional services such as attorneys and accountants as well as NOAA and the Army Corps of Engineers; and
- Military and Federal Operations, which includes research, defense, and environmental mitigation activities of the Navy, the U.S. Coast Guard.

Statewide, for every direct job in Maritime an additional 1.6 jobs were supported elsewhere in the state economy. Likewise, every million dollars of sales by Maritime firms supported almost 10 jobs throughout the state economy. Fishing and seafood processing alone supports—via direct, indirect, and induced impacts—44,353 jobs across the state paying \$2.9 billion in wages and benefits and business revenues of \$13.3 billion. Maritime Logistics and Shipping supported \$7.2 billion in sales across the state, while Ship and Boat Building, Maintenance, and Repair supported over \$4.0 billion in sales. The federal government is also a major player in the economic vitality of the Maritime Cluster in Washington. Puget Sound Naval Shipyard alone generates \$150 million in technical services work, while the Navy and Coast Guard both procure Maritime hardware, such as patrol boats, from Washington State businesses.

The Maritime Cluster reaches all of Washington State. While there are large concentrations of firms and activities in King, Snohomish, Kitsap, Pierce, Skagit, Grays Harbor, and Whatcom counties, the Maritime Cluster reaches as far east as Spokane and south to Vancouver, Washington. While Eastern Washington does not have direct access to the ocean and/or Puget Sound, there are a variety of activities along the Snake and

Columbia Rivers and inland either directly engaged in or in support of Maritime Logistics and Shipping and boat manufacturing. In 2012, an estimated 139 such Maritime establishments employing more than 2,200 workers were located across eighteen of the twenty counties that constitute Eastern Washington.

Unlike many other sectors, workers in Maritime can work their way up from an entry-level position to management in the same company in many cases. Because some workers have traditionally stayed with a single company or job function for generations, retention and maintenance of existing workforce is crucial. Recruiting and maintaining talent is difficult for many sectors in the Maritime Cluster. Maritime leaders perceive a need to improve knowledge of the industry among the general public and the economic opportunities which exist in Maritime.



## APPENDIX A. MARITIME CLUSTER ECONOMIC IMPACT STUDY PARTICIPANTS

The following individuals provided valuable feedback towards gaining a robust understanding of Maritime Cluster dynamics, opportunities and challenges.

Affiliation	Contact	Title
All Ocean Services	Jim R. Geissinger	Technical Services Manager
AMSEC	Mark Kipps	Regional Manager
Andrew Furuseth School of Seamanship	Berit Eriksson	Workforce Development Director
Art Anderson Associates	Ben Anderson	Naval Architect and Project Manager
Ballard Oil	Warren Aakervik	Owner
Bering Sea Crabbers	Mark Gleason	Executive Director
City Ice Cold Storage Inc.	Kim Suelzle	President
Foss Maritime Company	Scott Merritt	Senior Vice President of Operations
Go2Marine	Hal Cook	President
ILWU Local 21	Jake Whiteside	President
Kvichak Marine Industries	Brian Thomas	Owner
National Marine Trade Association	Peter Schrappen	Director of Government Relations
Navy Region Northwest	Joe Overton	Internal Relations Manager
NOAA	Carl Lian & Erin Steiner	Economist, Economist
Ocean Beauty Seafoods	Tom Sunderland	Vice President of Marketing and Communications
Pacific Merchant Shipping Association	Captain Mike Moore	Vice President
Philips Publishing Group	Peter Philips	President
Port of Seattle	Linda Styrk	Managing Director, Seaport Division
Port of Tacoma	Larry Kvidera	
Puget Sound Naval Shipyard	Richard Tift	Executive Director
QED Systems	David Jack	Northwest Area Manager
Recreational Boating Association of Washington	Doug Levy & Robert Razenbach	Lobbyist, 1st Vice President
SAFE Boats International	John McConnell	Engineering Manager
Seattle CC Maritime Academy	Malcolm Groethe	Associate Vice Chancellor
Tidewater	Bruce Reed	Vice President & COO
Transportation Institute	Richard Berkowitz	Director
Trident Seafoods	John Van Amerongen & Brant Rigby	Director of Communications, Vice President Human Resources
U.S. Army Corps of Engineers	Patricia Graesser	Public Affairs Supervisor
U.S. Coast Guard	Timi Vann	Western Regional Collaboration Coordinator
Vigor Industrial	Fred Kiga & Grant Fosheim	Senior VP of Government Affairs, Sales & Marketing Associate
Washington Department of Fish and Wildlife	Carol Turcotte, Peter Vernie	Public Affairs

### **APPENDIX B. IMPUTATION & COMMERCIAL FISHING METHODOLOGY**

Method #1: Estimates were derived by subtracting the sum of all the six-digit NAICS from the total reported for a five digit NAICS.

Method #2: Where a single year's value was suppressed or missing, averages of the previous and subsequent years were used as an estimate.

Method #3: Where more than two values from consecutive years were suppressed or missing, the proportion of the contribution of the missing six digit NAICS to the five digit NAICS total reported was determined. The average of the previous and subsequent reported years were then averaged and multiplied to the missing year's five digit NAICS total to arrive at an estimate. If two values for the previous and subsequent years did not exist (for example the missing data began with the first year of reported data), the subsequent reported year's proportional contribution was multiplied to the missing year's five digit NAICS total to arrive at an estimate.

Method #4: Missing values are imputed by calculating slope between two existing values.

#### **Fishing and Seafood Processing Methodology**

Obtaining statewide Fishing and Seafood Processing counts is a complex endeavor. First, traditional employment counts from the Bureau of Labor Statistics include only that employment which is covered by unemployment insurance. While some commercial fishing operations are large enough to be included in this category, many boats are small and rely on seasonal and temporary workers who are paid in a share of the final catch rather than a salary. Second, these data also exclude sole-proprietorships, which comprise a significant proportion of Fishing and Seafood Processing businesses.

This report sums Fishing and Seafood Processing firm employment numbers two ways. First, the study reports number of firms which are eligible for unemployment insurance as reported to the Bureau of Labor Statistics. Then, the report supplements this estimate with the number of non-employer firms engaged in Fishing and Seafood Processing activities, from the U.S. Census Bureau.

## APPENDIX C. LIST OF NAICS CODES AND SUBSECTOR ASSIGNED

Core Private Sector	NAICS	Description	Category
	336611	Ship building and repairing	Boat Building, Repair, and Maintenance
	336612	Boat building	Boat Building, Repair, and Maintenance
	112511	Finfish farming and fish hatcheries	Fishing and Seafood Processing
	112512	Shellfish farming	Fishing and Seafood Processing
	114111	Finfish fishing	Fishing and Seafood Processing
	114112	Shellfish fishing	Fishing and Seafood Processing
	311710	Seafood product preparation and packaging	Fishing and Seafood Processing
	311711	Older: seafood canning	Fishing and Seafood Processing
	311712	Older: Fresh and frozen seafood processing	Fishing and Seafood Processing
	424460	Fish and seafood merchant wholesalers	Fishing and Seafood Processing
	445220	Fish and seafood markets	Fishing and Seafood Processing
	483111	Deep sea freight transportation	Maritime Logistics and Shipping
	483113	Coastal and great lakes freight transport.	Maritime Logistics and Shipping
	483211	Inland water freight transportation	Maritime Logistics and Shipping
	488210	Support activities for rail transportation	Maritime Logistics and Shipping
	488310	Port and harbor operations	Maritime Logistics and Shipping
	488320	Marine cargo handling	Maritime Logistics and Shipping
	488330	Navigational services to shipping	Maritime Logistics and Shipping
	488510	Freight transportation arrangement	Maritime Logistics and Shipping
	493120	Refrigerated warehousing and storage	Maritime Logistics and Shipping
	483114	Coastal and great lakes passenger transport.	Passenger Water Transportation
	483212	Inland water passenger transportation	Passenger Water Transportation
	483112	Deep sea passenger transportation	Passenger Water Transportation
	487210	Scenic and sightseeing transportation, water	Passenger Water Transportation
	488390	Other support activities for water transport.	Passenger Water Transportation
	441222	Boat dealers	Maritime Support Services
	713930	Marinas	Maritime Support Services

## APPENDIX D. ECONOMIC AND FISCAL IMPACT ANALYSIS

The primary tool for estimating the broader impacts of Maritime industries in Washington State was the Washington State Input-Output (I-O) Model for year 2007, published in 2012. The model provides a data-rich rendering of the state economy across 52 sectors. The transactions table, which underpins the I-O model, provides estimates of intermediate purchases, sales, and final demand across all modeled sectors. The complex analysis of the model, published online by the Washington State Office of Financial Management, allows analysts to model the impacts of economic activities when output, labor, wages, and first round direct purchases/requirements are known.

In order to best utilize the I-O for Maritime impact analysis, Community Attributes Inc. reconstructed the I-O model from the transactions table, with separate models for total impacts and for only direct and indirect effects to account for the extent to which impacts are linked with these effects versus those of household labor income expenditures (induced effects).

Because the Washington State I-O Model does not include government activities other than Puget Sound Naval Shipyard, NOAA and Army Corps of Engineers activities were excluded from Washington State I-O estimates. Instead, for these activities an IMPLAN model was used to arrive at multiplier effects and integrated into overall indirect and induced effects.

A fuller discussion of the calculations underpinning the construction of an input-output model can be found on pages 13-14 of Beyers and Lin (2012).

To arrive at state fiscal impacts, the direct and effective rates for business & occupation taxes (B&O), use and utility fees and other taxes, and sales tax were first calculated. Tax rates are characterized as “effective” because they represent the ratio of state fiscal revenues per category of taxation as a share of gross business income (GBI), since modeled impacts are for gross sales and cannot be further segmented by B&O and other activities. For example, in 2012 primary metal manufacturers (NAICS 331) generated \$2.8 billion in gross business income in Washington State and paid \$8.2 million in B&O tax and \$20.3 million in other state taxes, resulting in effective B&O and use and related rates of 0.29% and 0.71% (as a percentage of GBI).

For each sector in which the 2012 Washington State Input-Output Model generated output estimates, effective rates were calculated and then applied to net Maritime-supported output by sector. Estimated effective rates for the sectors included in the 2007 Washington State Input-Output Model are presented below in **Appendix E**.

## APPENDIX E. EFFECTIVE TAX RATES BY SECTOR, 2012

Industry Sector	B&O	Sales Tax	Other Taxes
Crop Production	0.0023	0.0047	0.0012
Animal Production	0.0025	0.0009	0.0013
Forestry and Logging	0.0029	0.0017	0.0008
Fishing, Hunting, and Trapping	0.0010	0.0003	0.0015
Mining	0.0035	0.0059	0.0027
Electric Utilities	0.0006	0.0002	0.0328
Gas Utilities	0.0008	0.0006	0.0266
Other Utilities	0.0065	0.0010	0.0210
Highway, Street, and Bridge Construction	0.0029	0.0117	0.0017
Other Construction	0.0027	0.0188	0.0005
Food, Beverage and Tobacco Manufacturing	0.0018	0.0024	0.0009
Textiles and Apparel Mills	0.0023	0.0033	0.0001
Wood Product Manufacturing	0.0024	0.0013	0.0007
Paper Manufacturing	0.0019	0.0003	0.0006
Printing and Related Activities	0.0029	0.0142	0.0002
Petroleum and Coal Products Manufacturing	0.0023	0.0001	0.0031
Chemical Manufacturing	0.0025	0.0011	0.0007
Nonmetallic Mineral Products Manufacturing	0.0030	0.0047	0.0005
Primary Metal Manufacturing	0.0029	0.0002	0.0005
Fabricated Metals Manufacturing	0.0028	0.0018	0.0003
Machinery Manufacturing	0.0023	0.0012	0.0003
Computer and Electronic Product Manufacturing	0.0022	0.0015	0.0005
Electrical Equipment Manufacturing	0.0018	0.0006	0.0003
Aircraft and Parts Manufacturing	0.0027	0.0000	0.0005
Ship and Boat Building	0.0026	0.0023	0.0003
Other Transportation Equipment Manufacturing	0.0023	0.0019	0.0001
Furniture Product Manufacturing	0.0028	0.0075	0.0001
Other Manufacturing	0.0025	0.0017	0.0003
Wholesale	0.0030	0.0057	0.0002
Non-Store Retail	0.0021	0.0134	0.0008
Other Retail	0.0020	0.0129	0.0010
Air Transportation	0.0010	0.0012	0.0261
Water Transportation	0.0006	0.0013	0.0035
Truck Transportation	0.0011	0.0006	0.0042
Other Transportation/Postal Offices	0.0023	0.0023	0.0140
Support Activities for Storage, Transportation and Warehousing	0.0037	0.0039	0.0018
Software Publishers & Data Processing & related services	0.0052	0.0062	0.0005
Telecommunications	0.0054	0.0189	0.0009
Other Information	0.0070	0.0050	0.0022
52-53	0.0089	0.0056	0.0003
Legal /Accounting and Bookkeeping /Management Services	0.0119	0.0023	0.0003
Architectural, Engineering, and Computing Services	0.0068	0.0033	0.0006
Educational Services	0.0057	0.0057	0.0050
Ambulatory Health Care Services	0.0137	0.0003	0.0003
Hospitals	0.0106	0.0005	0.0016
Nursing and Residential Care Facilities, Social Assistance	0.0093	0.0025	0.0024
Arts, Recreation, and Accommodation	0.0040	0.0246	0.0004
Food Services and Drinking Places	0.0020	0.0220	0.0002
Administrative/Employment Support Services	0.0076	0.0080	0.0004
Waste Management/Other, and Agriculture Services	0.0055	0.0136	0.0021

Sources: Community Attributes Inc.; Washington State Department of Revenue

## APPENDIX F: WA STATE OCCUPATIONAL GROWTH PROJECTIONS, SELECTED OCCUPATIONS SUITABLE FOR MARITIME, 2011 – 2021

Education	Occupation	2011	2016	2021	Average annual growth rate 2011-2016	Average annual growth rate 2016-2021	Openings, 2016-2021
Less than high school	Laborers and Freight, Stock, and Material Movers, Hand	38,263	38,794	40,280	2.28%	1.23%	1,486
	Meat, Poultry, and Fish Cutters and Trimmers	5,750	5,628	5,836	2.05%	1.60%	208
	Sailors and Marine Oilers	2,282	2,371	2,446	1.68%	0.81%	75
	Crane and Tower Operators	1,479	1,499	1,555	2.19%	0.78%	56
	Material Moving Workers, All Other	903	886	920	1.92%	0.89%	34
	Hoist and Winch Operators	146	144	150	1.72%	0.74%	6
Postsecondary non-degree award	Fishers and Related Fishing Workers	5,399	5,621	5,590	-0.20%	-0.25%	(31)
	Electrical and Electronics Installers and Repairers, Transportation Equipment	459	471	472	0.69%	-0.08%	1
High school diploma or equivalent	Electricians	14,185	14,070	14,919	3.49%	1.55%	849
	Plumbers, Pipefitters, and Steamfitters	8,547	8,495	8,963	3.23%	1.37%	468
	Welders, Cutters, Solderers, and Brazers	6,116	6,387	6,805	3.80%	1.77%	418
	Bus and Truck Mechanics and Diesel Engine Specialists	6,519	6,606	6,713	0.91%	0.42%	107
	Structural Metal Fabricators and Fitters	1,207	1,259	1,363	4.27%	1.86%	104
	Surveying and Mapping Technicians	1,180	1,169	1,230	1.77%	0.87%	61
	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	556	588	631	3.92%	1.64%	43
	Transportation Workers, All Other	894	912	953	2.43%	1.16%	41
	Boilermakers	367	374	408	4.94%	1.90%	34
	First-Line Supervisors of Farming, Fishing, and Forestry Workers	3,896	4,021	4,044	0.37%	0.42%	23
	Riggers	803	799	815	1.40%	0.78%	16
	Motorboat Mechanics and Service Technicians	547	557	571	1.21%	0.58%	14
	Cutting and Slicing Machine Setters, Operators, and Tenders	1,393	1,278	1,292	-0.25%	0.30%	14
	Layout Workers, Metal and Plastic	695	730	742	1.37%	0.19%	12
	Painters, Transportation Equipment	1,728	1,804	1,813	0.50%	-0.54%	9
	Fish and Game Wardens	118	117	118	0.00%	0.17%	1
	Upholsterers	802	810	810	0.22%	-0.30%	-
	Civil Engineering Technicians	2,344	2,324	2,374	0.62%	0.25%	50
	Drafters, All Other	751	760	804	3.06%	1.47%	44
	Civil Engineers	13,555	13,391	14,052	1.92%	1.13%	661
Bachelor's	Engineers, All Other	3,912	4,001	4,147	2.15%	1.07%	146
	Logisticians	6,534	6,839	6,974	1.17%	-0.12%	135
	Captains, Mates, and Pilots of Water Vessels	1,828	1,939	2,030	2.68%	1.37%	91
	Materials Engineers	1,118	1,188	1,268	3.74%	1.92%	80
	Surveyors	1,050	1,030	1,087	1.84%	0.82%	57
	Ship Engineers	824	865	901	2.27%	1.23%	36
	Marine Engineers and Naval Architects	669	668	696	1.62%	0.68%	28

Source: Washington State ESD, 10 year Occupational Employment Projections (2012); ESD Unemployment Claims (2013); IPEDS (2012); Community Attributes (2013).

## APPENDIX G: TALENT PIPELINE MARITIME NAICS DEFINITION

NAICS Code	NAICS Definition
1140	Fishing & Hunting
3117	Seafood product preparation and packaging
3366	Ship and boat building
4831	Sea, coastal, and Great Lakes transportation
4872	Scenic and sightseeing transportation, water
4883	Support activities for water transportation
4832	Inland water transportation
9991	Federal Govt*
9992	State government other*
9993	Local government other*

\*To more accurately assess how many workers to include in government employment, Community Attributes estimated how much a particular occupation was employed by government by occupation title, and then used that percentage to determine the percent of occupation in Maritime.

## APPENDIX H: TALENT PIPELINE SUPPLY

Occupation	% of Occupation in Maritime	Allocated, Adjusted Completions	Allocated, Adjusted UI Claims	Total Supply
Construction Managers	1%	171	3	174
Managers, All Other	2%	1,764	19	1,783
Logisticians	3%	17	2	19
Surveyors	2%	1	1	2
Civil Engineers	8%	107	6	113
Marine Engineers and Naval Architects	39%	-	7	7
Materials Engineers	2%	6	-	6
Engineers, All Other	3%	7	2	9
Drafters, All Other	7%	141	2	143
Civil Engineering Technicians	12%	11	1	12
Surveying and Mapping Technicians	2%	1	1	2
Fish and Game Wardens	100%	307	-	307
First-Line Supervisors of Farming, Fishing, and Forestry Workers	4%	64	1	65
Fishers and Related Fishing Workers	91%	110	286	396
Boilermakers	5%	-	9	9
Electricians	2%	14	22	36
Plumbers, Pipefitters, and Steamfitters	3%	-	27	27
Electrical and Electronics Installers and Repairers, Transportation Equipment	34%	1,042	-	1,042
Bus and Truck Mechanics and Diesel Engine Specialists	7%	19	8	27
Motorboat Mechanics and Service Technicians	13%	4	2	6
Commercial Divers	1%	1	-	1
Riggers	54%	-	21	21
Structural Metal Fabricators and Fitters	12%	9	8	17
Meat, Poultry, and Fish Cutters and Trimmers	58%	-	119	119
Welders, Cutters, Solderers, and Brazers	10%	205	64	269
Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	2%	4	1	5
Layout Workers, Metal and Plastic	58%	1,177	7	1,184
Upholsterers	21%	15	2	17
Cutters and Trimmers, Hand	0%	-	-	-
Cutting and Slicing Machine Setters, Operators, and Tenders	21%	-	4	4
Painters, Transportation Equipment	11%	86	9	95
Sailors and Marine Oilers	96%	-	100	100
Captains, Mates, and Pilots of Water Vessels	91%	22	37	59
Motorboat Operators	100%	-	-	-
Ship Engineers	97%	12	27	39
Bridge and Lock Tenders	94%	-	-	-
Transportation Workers, All Other	31%	-	9	9
Crane and Tower Operators	40%	283	36	319
Dredge Operators	6%	1	-	1
Material Moving Workers, All Other	72%	-	25	25
Hoist and Winch Operators	79%	55	-	55
Laborers and Freight, Stock, and Material Movers, Hand	6%	-	43	43

Source: Washington State ESD, 10 year Occupational Employment Projections (2012); ESD Unemployment Claims (2013); IPEDS (2012); Community Attributes (2013). Note: Allocation refers to multiplying raw data by the “percent in cluster” (the first column). Adjustment refers to adjusting raw data for unemployment forecasts, for unemployment claims, and to distribution of completions by demand of occupation, for completions.



## APPENDIX I: TALENT PIPELINE DEMAND

Occupation Title	% in Maritime Cluster	Average annual total openings 2016-2021	Allocated Openings (Demand)
Construction Managers	1%	213	2
Managers, All Other	2%	718	15
Logisticians	3%	138	4
Surveyors	2%	37	1
Civil Engineers	8%	512	39
Marine Engineers and Naval Architects	39%	23	9
Materials Engineers	2%	67	1
Engineers, All Other	3%	155	5
Drafters, All Other	7%	31	2
Civil Engineering Technicians	12%	54	7
Surveying and Mapping Technicians	2%	38	1
Fish and Game Wardens	100%	3	3
First-Line Supervisors of Farming, Fishing, and Forestry Workers	4%	128	5
Fishers and Related Fishing Workers	91%	135	123
Boilermakers	5%	26	1
Electricians	2%	757	15
Plumbers, Pipefitters, and Steamfitters	3%	446	14
Electrical and Electronics Installers and Repairers, Transportation Equipment	34%	12	4
Bus and Truck Mechanics and Diesel Engine Specialists	7%	196	14
Motorboat Mechanics and Service Technicians	13%	19	2
Commercial Divers	1%	10	0
Riggers	54%	24	13
Structural Metal Fabricators and Fitters	12%	59	7
Meat, Poultry, and Fish Cutters and Trimmers	58%	301	173
Welders, Cutters, Solderers, and Brazers	10%	342	35
Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	2%	30	1
Layout Workers, Metal and Plastic	58%	16	9
Upholsterers	21%	17	4
Cutters and Trimmers, Hand	0%	10	0
Cutting and Slicing Machine Setters, Operators, and Tenders	21%	34	7
Painters, Transportation Equipment	11%	31	3
Sailors and Marine Oilers	96%	146	140
Captains, Mates, and Pilots of Water Vessels	91%	119	108
Motorboat Operators	100%	3	3
Ship Engineers	97%	59	57
Bridge and Lock Tenders	94%	2	2
Transportation Workers, All Other	31%	42	13
Crane and Tower Operators	40%	61	24
Dredge Operators	6%	2	0
Hoist and Winch Operators	79%	6	5
Laborers and Freight, Stock, and Material Movers, Hand	6%	1919	117
Material Moving Workers, All Other	72%	17	12

Source: Washington State Employment Security Department, 10 year Occupational Employment Projections (2012).

## APPENDIX J: TALENT PIPELINE RESULTS, ALL OCCUPATIONS SUITABLE FOR MARITIME, 2016-2021

Education	Occupation	Demand	Supply	Gap
Less than high school	Meat, Poultry, and Fish Cutters and Trimmers	173	119	(54)
Less than high school	Sailors and Marine Oilers	140	100	(40)
Less than high school	Fishers and Related Fishing Workers	123	396	273
Less than high school	Laborers and Freight, Stock, and Material Movers, Hand	117	43	(74)
Less than high school	Crane and Tower Operators	24	319	295
Less than high school	Material Moving Workers, All Other	12	25	13
Less than high school	Hoist and Winch Operators	5	55	50
Less than high school	Bridge and Lock Tenders	2	-	(2)
Less than high school	Dredge Operators	0	1	1
Less than high school	Cutters and Trimmers, Hand	0	-	(0)
Postsecondary non-degree award	Electrical and Electronics Installers and Repairers, Transportation Equipment	4	1,042	1,038
Postsecondary non-degree award	Commercial Divers	0	1	1
High school diploma or equivalent	Welders, Cutters, Solderers, and Brazers	35	269	234
High school diploma or equivalent	Electricians	15	36	21
High school diploma or equivalent	Managers, All Other	15	1,783	1,768
High school diploma or equivalent	Plumbers, Pipefitters, and Steamfitters	14	27	13
High school diploma or equivalent	Bus and Truck Mechanics and Diesel Engine Specialists	14	27	13
High school diploma or equivalent	Transportation Workers, All Other	13	9	(4)
High school diploma or equivalent	Riggers	13	21	8
High school diploma or equivalent	Layout Workers, Metal and Plastic	9	1,184	1,175
High school diploma or equivalent	Cutting and Slicing Machine Setters, Operators, and Tenders	7	4	(3)
High school diploma or equivalent	Structural Metal Fabricators and Fitters	7	17	10
High school diploma or equivalent	First-Line Supervisors of Farming, Fishing, and Forestry Workers	5	65	60
High school diploma or equivalent	Upholsterers	4	17	13
High school diploma or equivalent	Painters, Transportation Equipment	3	95	92
High school diploma or equivalent	Motorboat Operators	3	-	(3)
High school diploma or equivalent	Fish and Game Wardens	3	307	304
High school diploma or equivalent	Motorboat Mechanics and Service Technicians	2	6	4
High school diploma or equivalent	Boilermakers	1	9	8
High school diploma or equivalent	Surveying and Mapping Technicians	1	2	1
High school diploma or equivalent	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	1	5	4
Associate's degree	Civil Engineering Technicians	7	12	5
Associate's degree	Construction Managers	2	174	172
Associate's degree	Drafters, All Other	2	143	141
Bachelor's degree	Captains, Mates, and Pilots of Water Vessels	108	59	(49)
Bachelor's degree	Ship Engineers	57	39	(18)
Bachelor's degree	Civil Engineers	39	113	74
Bachelor's degree	Marine Engineers and Naval Architects	9	7	(2)
Bachelor's degree	Engineers, All Other	5	9	4
Bachelor's degree	Logisticians	4	19	15
Bachelor's degree	Materials Engineers	1	6	5
Bachelor's degree	Surveyors	1	2	1

Source: Washington State ESD, 10 year Occupational Employment Projections (2012); ESD Unemployment Claims (2013); IPEDS (2012); Community Attributes (2013).

## APPENDIX K: PERCENT OF SUITABLE MARITIME OCCUPATIONS IN INDUSTRY

	Agriculture, Forestry, Fishing and Hunting	Mining, Quarrying, and Oil and Gas Extraction	Utilities	Construction	Manufacturing	Wholesale Trade	Retail Trade	Transportation and Warehousing	Information	Finance and Insurance	Real Estate and Rental and Leasing	Professional, Scientific, and Technical Services	Management of Companies and Enterprises	Administrative and Support and Waste Management and Remediation Services	Educational Services	Health Care and Social Assistance	Arts, Entertainment, and Recreation	Accommodation and Food Services	Other Services (Except Public Administration)	Government
Construction Managers	0%	0%	0%	67%	0%	0%	0%	0%	0%	7%	9%	2%	1%	1%	0%	0%	0%	0%	12%	
Managers, All Other	0%	0%	1%	4%	8%	1%	1%	4%	9%	2%	1%	17%	11%	4%	5%	3%	1%	0%	7%	22%
Logisticians	0%	0%	0%	0%	53%	2%	0%	2%	31%	0%	0%	1%	7%	0%	0%	0%	0%	0%	3%	
Surveyors	0%	0%	0%	2%	0%	0%	0%	0%	0%	0%	80%	5%	0%	0%	0%	0%	0%	0%	13%	
Civil Engineers	0%	0%	0%	11%	0%	0%	0%	0%	0%	0%	47%	4%	0%	2%	0%	0%	0%	0%	35%	
Marine Engineers and Naval Architects	0%	0%	0%	0%	7%	0%	0%	14%	0%	0%	69%	0%	0%	0%	0%	0%	0%	0%	10%	
Materials Engineers	0%	0%	0%	0%	90%	4%	0%	2%	0%	0%	4%	0%	0%	0%	0%	0%	0%	0%	0%	
Engineers, All Other	0%	0%	0%	3%	24%	5%	0%	9%	0%	0%	29%	1%	20%	1%	0%	0%	0%	0%	8%	
Drafters, All Other	0%	0%	0%	47%	18%	3%	0%	0%	0%	0%	14%	8%	10%	0%	0%	0%	0%	0%	0%	
Civil Engineering Technicians	0%	0%	0%	6%	1%	0%	0%	0%	0%	0%	37%	1%	0%	2%	0%	0%	0%	0%	53%	
Surveying and Mapping Technicians	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	78%	10%	0%	0%	0%	0%	0%	0%	9%	
Fish and Game Wardens	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	
First-Line Supervisors of Farming, Fishing, and Forestry Workers	56%	0%	0%	0%	3%	22%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	14%	
Fishers and Related Fishing Workers	96%	0%	0%	0%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Boilermakers	0%	0%	0%	70%	27%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%	
Electricians	0%	0%	0%	80%	7%	1%	0%	0%	0%	0%	0%	0%	3%	1%	0%	1%	0%	0%	6%	
Plumbers, Pipefitters, and Steamfitters	0%	0%	1%	73%	6%	0%	0%	0%	0%	0%	3%	0%	4%	2%	0%	0%	0%	0%	9%	
Electrical and Electronics Installers and Repairers, Transportation Equipment	0%	0%	0%	0%	48%	32%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	8%	2%	
Bus and Truck Mechanics and Diesel Engine Specialists	0%	0%	0%	4%	9%	9%	1%	20%	0%	0%	1%	0%	0%	2%	3%	8%	1%	0%	12%	30%
Motorboat Mechanics and Service Technicians	0%	0%	0%	0%	8%	0%	41%	7%	0%	0%	0%	0%	0%	0%	0%	16%	0%	27%	1%	
Commercial Divers	0%	0%	0%	6%	0%	0%	0%	0%	0%	0%	0%	0%	94%	0%	0%	0%	0%	0%	0%	
Riggers	0%	0%	0%	63%	3%	0%	0%	0%	0%	7%	0%	0%	12%	0%	0%	5%	0%	9%	1%	
Structural Metal Fabricators and Fitters	0%	0%	0%	10%	88%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%	
Meat, Poultry, and Fish Cutters and Trimmers	0%	0%	0%	71%	3%	14%	0%	0%	0%	0%	0%	0%	12%	0%	0%	0%	0%	0%	0%	
Welders, Cutters, Solderers, and Brazers	0%	0%	0%	14%	64%	1%	0%	2%	0%	0%	0%	0%	11%	0%	0%	2%	0%	5%	0%	
Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	0%	0%	0%	0%	82%	18%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	
Layout Workers, Metal and Plastic	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Upholsterers	0%	0%	0%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	86%	6%	
Cutters and Trimmers, Hand	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Cutting and Slicing Machine Setters, Operators, and Tenders	0%	0%	0%	0%	99%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	
Painters, Transportation Equipment	0%	0%	0%	0%	45%	4%	2%	2%	0%	0%	0%	0%	1%	0%	0%	4%	0%	38%	4%	
Sailors and Marine Oilers	0%	0%	0%	0%	2%	0%	0%	55%	0%	0%	0%	0%	3%	0%	0%	0%	0%	0%	39%	
Captains, Mates, and Pilots of Water Vessels	0%	0%	0%	0%	1%	0%	0%	75%	0%	0%	0%	1%	7%	1%	0%	0%	0%	0%	14%	
Motorboat Operators	0%	0%	0%	0%	0%	0%	0%	75%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	25%	
Ship Engineers	0%	0%	0%	0%	3%	0%	0%	67%	0%	0%	0%	1%	1%	1%	0%	0%	0%	0%	27%	
Bridge and Lock Tenders	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	98%	
Transportation Workers, All Other	0%	0%	0%	0%	2%	0%	0%	95%	0%	0%	0%	0%	0%	3%	0%	0%	0%	0%	0%	
Crane and Tower Operators	0%	0%	0%	15%	16%	0%	0%	52%	0%	0%	6%	0%	7%	0%	0%	0%	0%	3%	1%	
Dredge Operators	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Material Moving Workers, All Other	0%	0%	0%	0%	0%	5%	82%	0%	0%	0%	0%	0%	12%	0%	0%	1%	0%	0%	0%	
Hoist and Winch Operators	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Laborers and Freight, Stock, and Material Movers, Hand	0%	0%	0%	2%	12%	16%	16%	26%	0%	0%	1%	1%	0%	20%	0%	2%	0%	0%	2%	1%

Source: Washington State ESD 2010 NAICS by SOC Matrix.