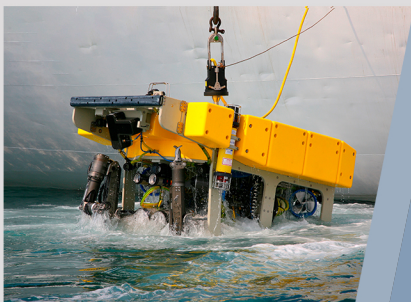
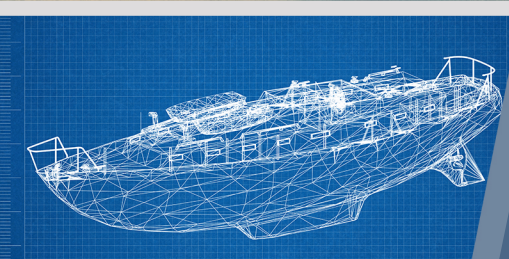


April 2021



The Maritime Industry in Virginia



Report prepared for
Office of Career, Technical, and Adult Education
Virginia Department of Education

April 2021



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Introduction

The Commonwealth of Virginia, home to the one of the largest and busiest port complexes in the nation, is a leader in the maritime industry. Virginia's strategic geographic location and robust surface transportation networks enable service to 75 percent of the U.S. population within 24 hours, making the commonwealth a natural gateway to global markets.¹ The Port of Virginia, a group of facilities on the harbor of Hampton Roads, and the deepest harbor on the East Coast, serves 30 international shipping lines with connections to 200+ countries around the world.²

The Port of Virginia is an expanding and significant force in the commonwealth's economy, providing more than 397,000 jobs and \$92 billion in total annual revenue.³

Virginia is the nation's third largest seafood producer, and the largest on America's East Coast,⁴ thanks to the Chesapeake Bay and its tributary rivers—one of the largest and most biodiverse estuaries in the U.S.

The commonwealth also proudly serves as home of the world's largest naval base at Norfolk and is a strategic port for the U.S. military. The naval base and naval shipyards are important assets to Virginia's maritime industry; they drive the shipbuilding industry, defense contractor employment, and employment in indirect jobs associated with supporting the military population.

Over decades, the commonwealth has invested strategically to further maritime industry capacity.

- The Port of Virginia is investing in expansions that will make its facilities the most modern on the East Coast, including dredging the channel to a depth of 55 feet by 2025.¹
- Virginia's ports move nearly 80 million tons of cargo annually, having established one of the nation's most efficient inland transportation networks. Cargo is transported by 30 miles of on-dock rail, then distributed nationwide by numerous national and regional trucking companies operating on the third largest state-maintained transportation network and by two of the nation's largest railroads, CSX and Norfolk Southern.⁵

The maritime industry workforce is advanced in Virginia through numerous high-quality educational institutions and programs that cross multiple Career and Technical Education (CTE) Career Clusters. In addition, Virginia has the second highest concentration of professional services jobs in the U.S.—1.3 times the national average.⁶ These architects, engineers, lawyers, advocates, and managers contribute to the success of the maritime industry by providing essential support services.

¹ <https://www.portofvirginia.com/capabilities/>

² <https://www.virginia.gov/agencies/virginia-port-authority/>

³ <https://www.portofvirginia.com/who-we-are/newsroom/port-of-virginia-sets-new-annual-volume-record-in-2019-having-handled-2-9-million-teus/>

⁴ <http://www.virginiaseafood.org/about-virginia-seafood/>

⁵ [https://cdn1.shipserv.com/ShipServ/pages/profiles/215254/documents/PA2019 Introduction.pdf](https://cdn1.shipserv.com/ShipServ/pages/profiles/215254/documents/PA2019%20Introduction.pdf)

⁶ <https://beta.bls.gov/maps/cew/us>

Structure of the Maritime Industry

The maritime industry is complex, ranging from skilled trades to professional services, from shipbuilders and dock workers to commercial fisheries and oceanographers. The following analysis of the industry by sectors and subsectors will help to illuminate this important part of the Virginia economy.



Source: Maritime industry sectors adapted from the Washington Maritime Federation for Virginia.

This report does not break out military as a separate sector because 1) military employment spans all aspects of the maritime industry, and 2) the focus of this analysis is to review the occupations and workforce skills needed to succeed in the maritime industry. Individuals who develop these workforce skills will enjoy success in either military- or civilian-sector careers.

Sectors and Subsectors – The Current State of the Maritime Industry

SHIP & BOAT BUILDING, REPAIR, & MAINTENANCE SECTOR

The Ship & Boat Building, Repair, & Maintenance sector includes two subsectors: Ship Building & Repair and Recreational Boat Building & Repair.

Ship Building & Repair Subsector

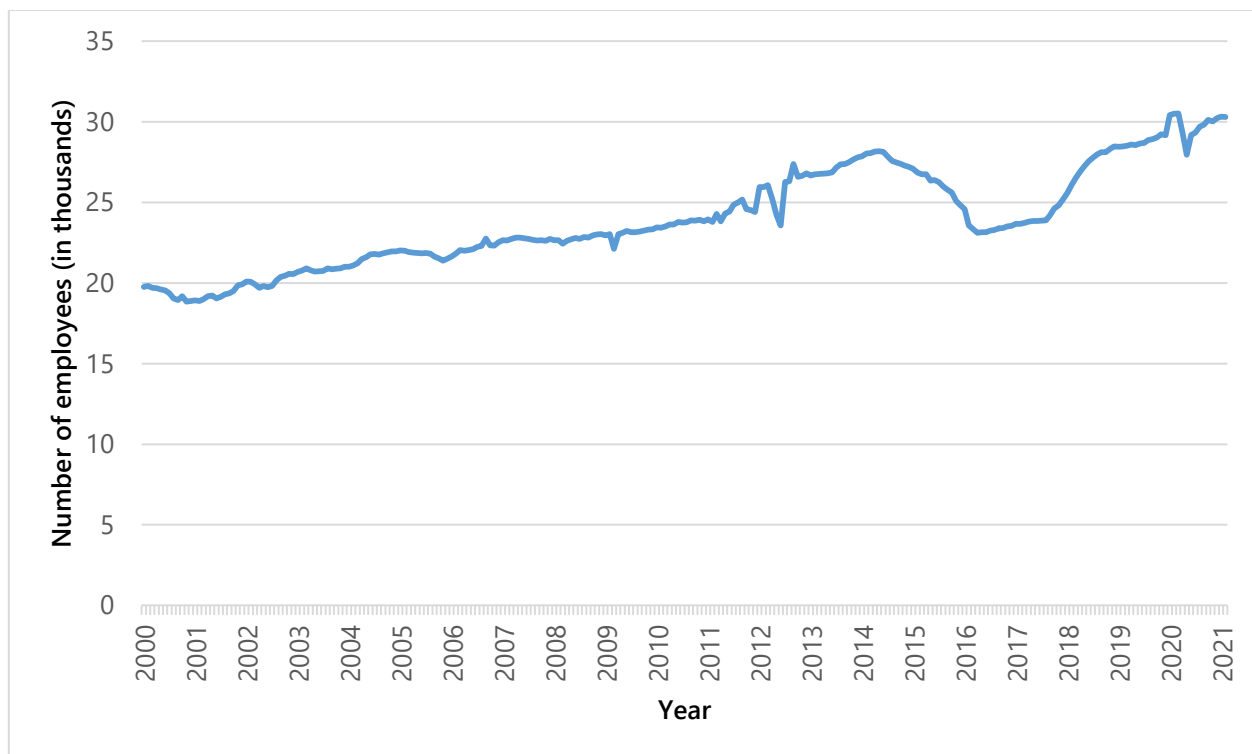
Ship Building & Repair is limited to vessels designed for deep-water use that are able to operate independently for long periods of time. There are currently 124 shipyards classified as active shipbuilders across 26 states in the U.S. According to the U.S. Maritime Administration, the U.S. shipbuilding and repair industry supports more than 400,000 jobs.⁷

⁷ <https://www.maritime.dot.gov/sites/marad.dot.gov/files/docs/resources/3641/maradeconstudyfinalreport2015.pdf>

Over the last several decades, the number of large U.S. shipyards and associated skilled labor force has declined due to subsidized international shipbuilding competition (among other factors), resulting in shipyard closures and reductions. Consequently, shipbuilding in the United States today is focused on building warships for the U.S. Navy or ships that confine their operations to routes within the United States. The five largest U.S. commercial shipyards build relatively small numbers of large cargo vessels for domestic use, averaging five such vessels per year over the last five years compared to the worldwide production of 1,408 such ships in 2016.⁸

Despite declines in commercial shipyards and their skilled labor force, the Virginia shipbuilding industry is stable as evidenced by job growth at Newport News Shipbuilding, the Norfolk Naval Shipyard, the Virginia Ship Repair Association, and a statewide network of Virginia-based industrial suppliers (*Figure 7*). Virginia is home to the largest number of shipbuilding and repair jobs (in private industry)—29,172, in 2019—which is 25.6% of the U.S. total and more than double the second highest state, Mississippi. Virginia was also the highest in total labor income and state GDP generated by the shipbuilding industry.⁹

Figure 1: Shipbuilding Employees in the Virginia Beach-Norfolk-Newport News MSA



Source: U.S. Bureau of Labor Statistics and Federal Reserve Bank of St. Louis

Most shipbuilding is tied to the defense sector, with revenue tied to defense spending, which helps explain why this is a predominant industry in Virginia. Newport News Shipbuilding is the sole designer, builder, and refueler of U.S. Navy aircraft carriers; is one of two providers to service U.S. Navy

⁸ <https://www.transportation.gov/testimony/us-maritime-and-shipbuilding-industries-strategies-improve-regulation-economic>

⁹ https://cdn.ymaws.com/vamaritime.site-ym.com/resource/resmgr/ASHLEY/VA_Maritime_Economic_Impact_.pdf

submarines; is the largest industrial employer in Virginia; and is the largest shipbuilding company in the United States. Newport News Shipbuilding anticipates hiring almost 7,000 people, which includes the creation of 2,000 new jobs over the next five years.¹⁰

Recreational Boat Building & Repair Subsector

The second component of the Ship and Boat Building, Repair, & Maintenance sector is Recreational Boat Building & Repair. This subsector focuses on the construction and maintenance of vessels for leisure activity in inland and coastal water bodies, such as recreational fishing, cruising, and watersports.

Virginia is well-positioned for manufacturing recreational vessels as it is a prime spot for boating activities, with just under 3,300 square miles of inland and coastal water bodies or about 8 percent of its total area.¹¹ According to the National Marine Manufacturers Association, 225,732 recreational boats were registered in Virginia in 2018, which accounts for 1.9 percent of all recreational boats in the United States. Recreational boating supports over 17,000 jobs and 790 businesses in the commonwealth.¹²

MARITIME LOGISTICS, SHIPPING, & TRANSPORTATION SECTOR

The Maritime Logistics, Shipping, & Transportation sector includes establishments that provide water transportation for cargo, warehouse facilities, and specialized logistics and shipping services, such as port operation and marine cargo handling. The sector is split into two subsectors: Port & Harbor Operations and Deep Sea & Coastal Freight.

Port & Harbor Operations Subsector

The Port & Harbor Operations subsector includes marine cargo handling, warehousing and storage, and navigational services to shippers. The Virginia Port Authority (VPA) is the government agency responsible for overseeing marine shipping activity in the commonwealth and partners with the private Virginia International Terminals (VIT) to operate the Port of Virginia. The principal facilities of the Port of Virginia are four marine terminals, all on the harbor of Hampton Roads, and one intermodal container transfer facility (dry port):

- Norfolk International Terminals (NIT) at Norfolk, Virginia
- Portsmouth Marine Terminal (PMT) at Portsmouth, Virginia
- Newport News Marine Terminal (NNMT) at Newport News, Virginia
- Virginia International Gateway (VIG) at Portsmouth, Virginia
- Virginia Inland Port (VIP) at Front Royal, Virginia

In addition to the four general cargo marine facilities, there are more than 20 privately-owned bulk-handling facilities in the Hampton Roads harbor.

The Port of Virginia is the sixth largest containerized cargo complex in the United States and continues to grow in size and sophistication. Virginia International Gateway was expanded in 2019 through the largest private investment in the history of the Commonwealth of Virginia. The Virginia Port Authority is

¹⁰ https://www.pilotonline.com/inside-business/article_dd1640c2-9737-11e8-af54-3b85007add2c.html

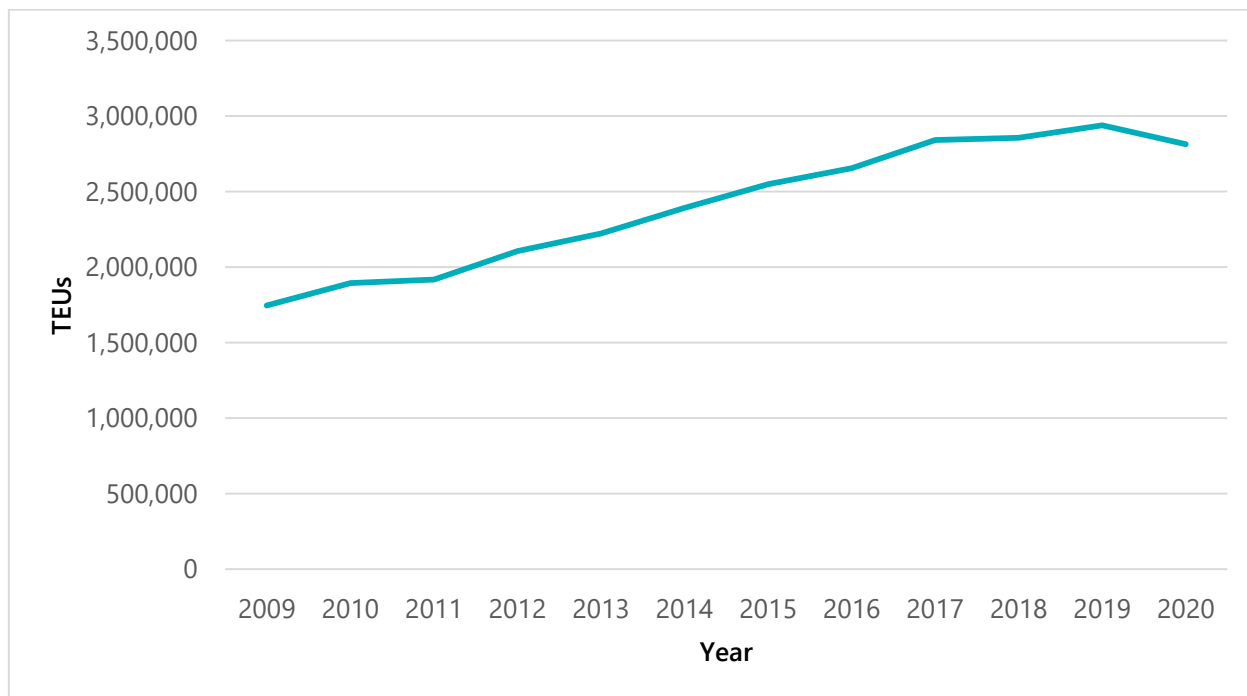
¹¹ <http://www.virginiaplaces.org/watersheds/howmuchwater.html>

¹² <https://www.nmma.org/statistics/publications/economic-impact-infographics>

also renovating the Norfolk International Terminals to improve throughput capacity. The Port has container cranes among the largest in the world. With an outreach of 26 containers, these giant “Suez-Class” cranes are capable of loading and unloading containers from modern ultra-large container vessels. Virginia is continuing to invest in the port to increase efficiency and capacity. (See pages 16-17 for detailed future investments.)

The tonnage and cargo values of Virginia’s ports are growing because these ports are skilled at handling high volumes of any type of cargo. The volume of port container traffic is measured by the flow of containers from land to sea transport modes (and vice versa) in standard twenty-foot equivalent units (TEUs), which is a standard-size container. A twenty-foot equivalent unit (TEU) is a shipping container with internal dimensions that measure about 20 feet long, 8 feet wide, and 8 feet tall. In 2019, the Port of Virginia set a new annual record for container cargo volume, having handled more than 2.93 million TEUs, a 3 percent increase over the previous year’s total.¹³

Figure 2: Port of Virginia Annual Container Traffic Volume in Twenty-Foot Equivalent Units (TEUs)



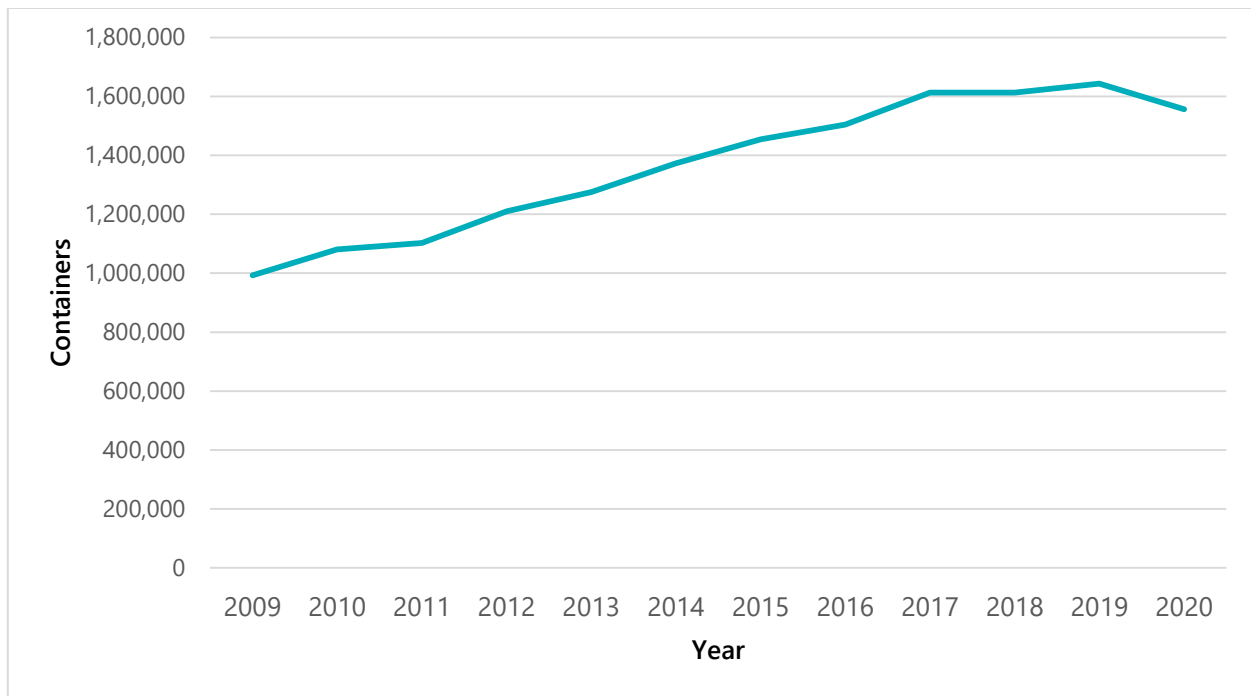
Source: Virginia Port Authority

To gain a better picture of actual amount of goods transported through Virginia’s ports, it is informative to look at a few other metrics, including container unit volume (Figure 3) and cargo weight in short tons (Figure 4). Figures 3 and 4 indicate an upward trend in volume for both container units and cargo weight, a trend that mimics TEU flows (Figure 2). As a result, Virginia is ranked 6th among U.S. ports in container volume and 9th in tonnage of cargo.¹⁴

¹³ <https://www.virginiabusiness.com/article/inland-empire/#:~:text=The%20Port%20of%20Virginia,a%203%25%20increase%20over%202018.>

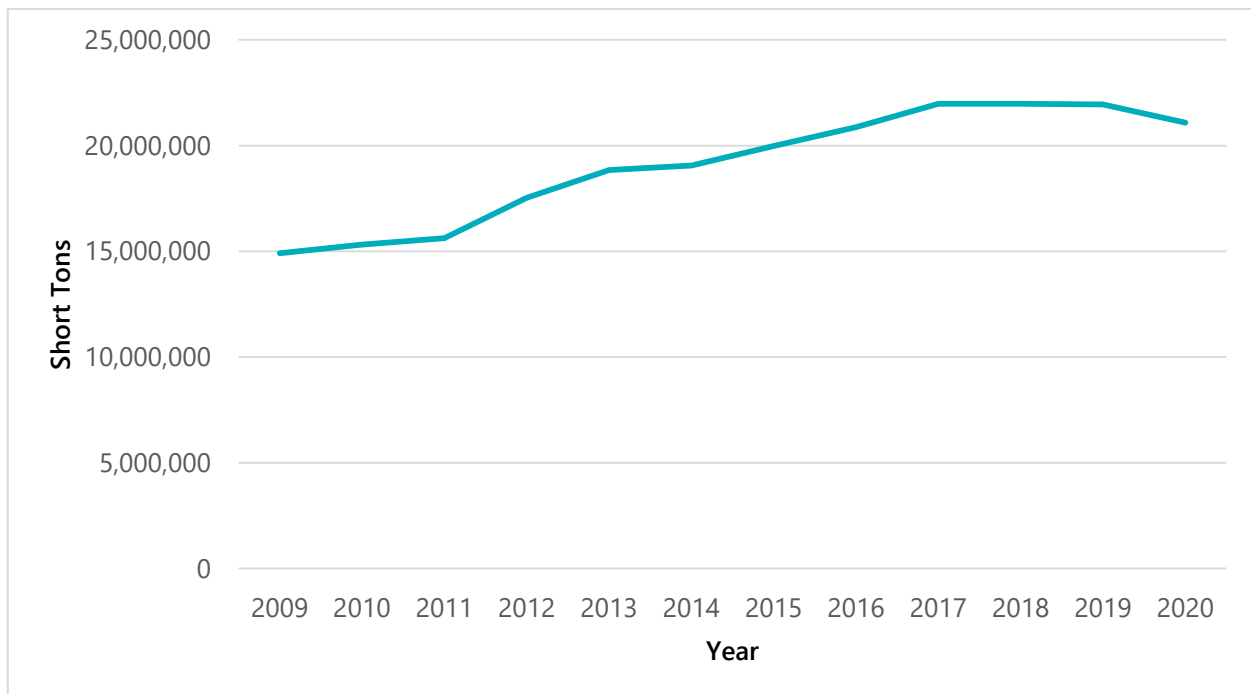
¹⁴ <https://explore.dot.gov/views/PortPerformance-temp-view2/ProfileDashboard?Port%20ID=5700&:isGuestRedirectFromVizportal=y&:embed=y>

Figure 3: Port of Virginia Annual Container Traffic Volume in Container Units



Source: Virginia Port Authority

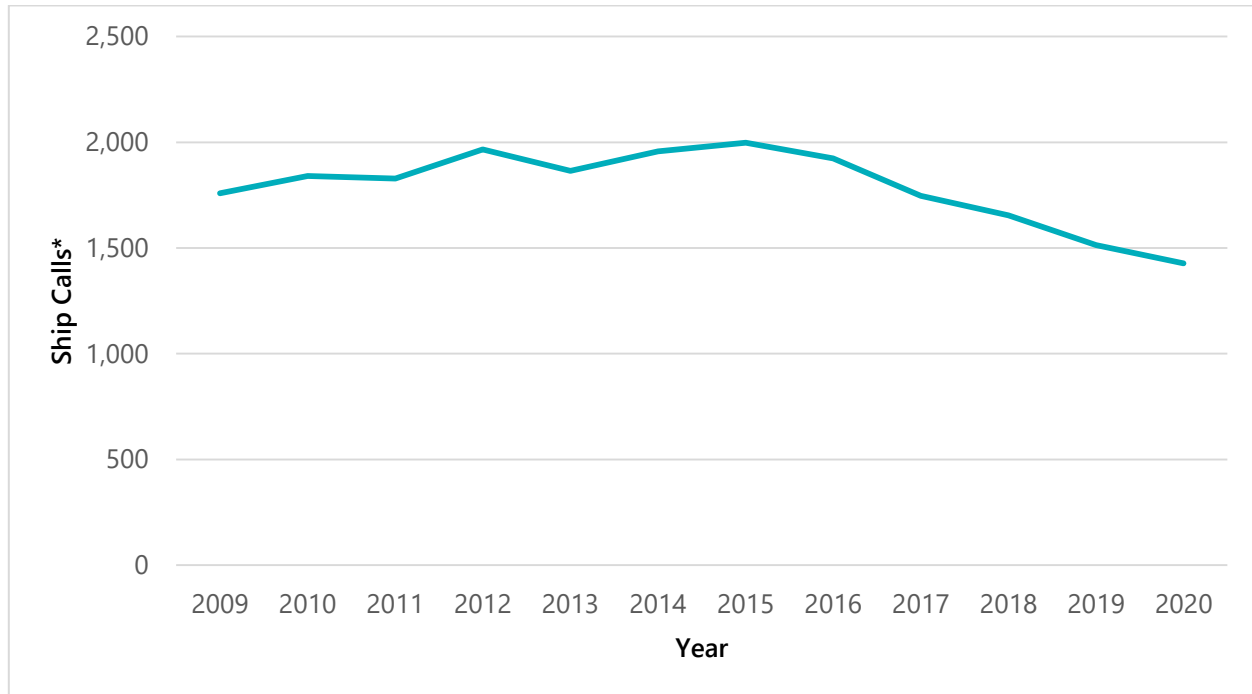
Figure 4: Port of Virginia Annual General Cargo Weight in Short Tons



Source: Virginia Port Authority

The number of vessels arriving at the Port of Virginia has decreased in recent years (*Figure 5*), but the volume of cargo is still increasing. This is because ships are now larger and can deliver more cargo per ship, which means they stop less frequently at ports, reducing the number of ship calls.

Figure 5: Port of Virginia Annual Ship Calls



*Does not include Layberth

Source: Virginia Port Authority

Deep Sea & Coastal Freight Subsector

Deep Sea & Coastal Freight is the second subsector of the Maritime Logistics, Shipping, & Transportation sector. This sector includes all shipping and logistics activities not occurring at the port: freight transportation arrangement; drayage and trucking; and maritime navigation and logistics.

Freight transportation services are a strength of Virginia's maritime industry. These drayage services (transport of goods over a short distance, which is often part of a longer overall move) include trucking, rail, and barge transport. In 2019, 63 percent of port cargo was moved via truck; 34 percent was moved via rail; and 3 percent was moved via barge. Two Class I railroads, CSX and Norfolk Southern, serve the port via on-dock intermodal container transfer facilities at Virginia International Gateway and Norfolk International Terminals. The third largest state-maintained transportation network enables efficient trucking.¹⁵

A wide variety of goods are transported through Virginia's ports as shown in Table 1 below.

¹⁵ https://aapa.files.cms-plus.com/AwardsCompetitionMaterials/2019CommunicationsAward/DirectoriesHandbooks/Virginia_Directories_Virginia-Advantages.pdf

Table 1: Top 10 Commodities by Volume at the Port of Virginia (thousands of short tons), 2019

Exports			Imports		
1	Mineral Fuels, Mineral Oils	33,752.92	1	Nuclear Reactors, Boilers, Machinery	1,093.34
2	Wood	2,610.79	2	Salt; Sulfur; Earths and Stone	1,066.95
3	Oil Seeds	2,397.14	3	Furniture and Bedding	836.01
4	Residues	1,811.29	4	Plastics	780.51
5	Wood Pulp, Etc.	1,433.89	5	Beverages, Spirits and Vinegar	565.33
6	Plastics	576.00	6	Electrical Machinery	488.49
7	Iron and Steel	421.44	7	Inorganic Chemicals	468.64
8	Animal or Vegetable Fats and Oils	358.65	8	Rubber	466.01
9	Paper and Paperboard	351.45	9	Vehicles, Other than Railway	463.17
10	Organic Chemicals	326.74	10	Iron or Steel	460.02

Source: Virginia Port Authority

When goods leave the port, deep-sea freight capacity and navigation become paramount. Virginia's ports offer direct service to more than 45 countries worldwide (*Table 2*), and that service is offered by every major shipping line.

Table 2: Top 10 Trading Partners by Volume at the Port of Virginia (thousands of short tons), 2019

Exports			Imports		
1	India	5,348.71	1	China	2,379.00
2	Brazil	4,560.46	2	Germany	1,018.42
3	Ukraine	3,549.30	3	India	948.13
4	Morocco	3,034.20	4	Brazil	681.67
5	Italy	2,965.17	5	Italy	636.99
6	Netherlands	2,586.96	6	Turkey	506.62
7	China	2,416.36	7	Vietnam	499.94
8	United Kingdom	2,261.34	8	Spain	481.23
9	Japan	2,087.27	9	France	425.40
10	Turkey	1,650.28	10	Greece	345.09

Source: Virginia Port Authority

Table 3: Trade Lanes by Volume at The Port of Virginia (thousands of short tons), 2019

Trade Lane	Exports	Imports
Africa	4,793.52	190.94
Asia, Northeast	6,192.47	2,941.03
Asia, Southeast	2,801.69	1,233.09
Caribbean	808.43	46.64
Central America	168.63	42.83
Europe, North	13,072.30	3,344.32
India & Others	5,743.76	1,092.61
Mediterranean	7,610.05	2,048.06
Middle East	534.69	141.74
North America	409.40	104.09
Oceania	42.58	18.74
South America	5,394.30	1,238.16

Source: Virginia Port Authority

Deep sea navigation is a portion of the Deep Sea & Coastal Freight subsector that requires uniquely skilled workers to ensure cargo reaches its destinations. A key part of this navigation relies on the U.S. Merchant Marine, which consists of privately-owned, U.S.-registered merchant ships and a variety of towing, offshore supply, and passenger vessels that provide waterborne transportation for passengers and cargo. Merchant Marine Officers, with their unique skills and training to operate and maintain deep-sea merchant ships, help to support international trade. The U.S. Merchant Marine Academy (USMMA) and six State Maritime Academies together graduate more than 1,000 entry-level officers each year.¹⁶ It is difficult to determine how many Merchant Marines call Virginia home, but as of 2020, Virginia had nearly 2,000 Captains, Mates, and Pilots of Water Vessels¹⁷—the fourth highest number among all states in the U.S.

Passenger Water Transportation Subsector

Passenger Water Transportation is the final subsector of the Maritime Logistics, Shipping, & Transportation sector of the maritime industry. Large-scale passenger water transportation is a small industry in Virginia with three VDOT-sponsored ferries:¹⁸ the Merry Point and Sunnybank Ferries crossing in the coastal rivers near Fredericksburg, and the Jamestown-Scotland Ferry crossing on the James River near the Jamestown settlement. Various tourist cruises operate along the Chesapeake Bay,

¹⁶ <https://www.congress.gov/116/chrg/CHRG-116hhrg35382/CHRG-116hhrg35382.pdf>

¹⁷ U.S. Bureau of Labor Statistics, Occupational Employment and Wage Statistics

¹⁸ <https://www.virginiadot.org/travel/ferry.asp>

such as cruises to Tangier Island. In addition, passenger water taxis operate in the National Harbor between Virginia and Washington D.C. No known deep sea passenger ships, such as cruise lines,¹⁹ dock or interact with Virginia's ports and harbors.

COMMERCIAL FISHING & SEAFOOD PRODUCTS SECTOR

Among the sectors within the maritime industry, the seafood sector is one of the largest in Virginia.²⁰ The Atlantic Ocean and the Chesapeake Bay and its many tributaries are some of the most productive seafood harvesting grounds in the United States, and the economic well-being of forty-five counties and cities in Virginia depend on the seafood industry.²¹ The Commercial Fishing & Seafood Products sector of the maritime industry includes three subsectors: Wild Capture Fishing, Aquaculture/Fish Farming, and Seafood Processing.

Wild Capture Fishing Subsector

Traditional wild capture fishing is the largest of the three Commercial Fishing & Seafood Products subsectors in Virginia. From some 620,000 acres of water, Virginia's watermen harvest 50 commercially valuable species, including (and in order of economic value): oysters, clams, blue crab, sea scallops, menhaden, conch, striped bass, summer flounder, spot and Atlantic croaker. Approximately 6,000 Virginians work on the water, which includes 2,866 licensed watermen and their mates and helpers.²²

Virginia is the nation's third largest seafood producer in terms of landings (fish and shellfish that are landed and sold in the U.S. by U.S. fishermen) and the largest on the East Coast, with total landings of over 390 million pounds in 2019.²³ As of 2018 and based on total landings, Reedville, VA is the fifth largest U.S. fishing port, and Hampton Roads is the nineteenth wealthiest seafood port in the nation.¹⁸ The Reedville, VA commercial fishery for menhaden is one of the largest on the Atlantic Coast.

¹⁹ <https://www.bts.gov/content/top-15-cruise-ship-ports-port-departure>

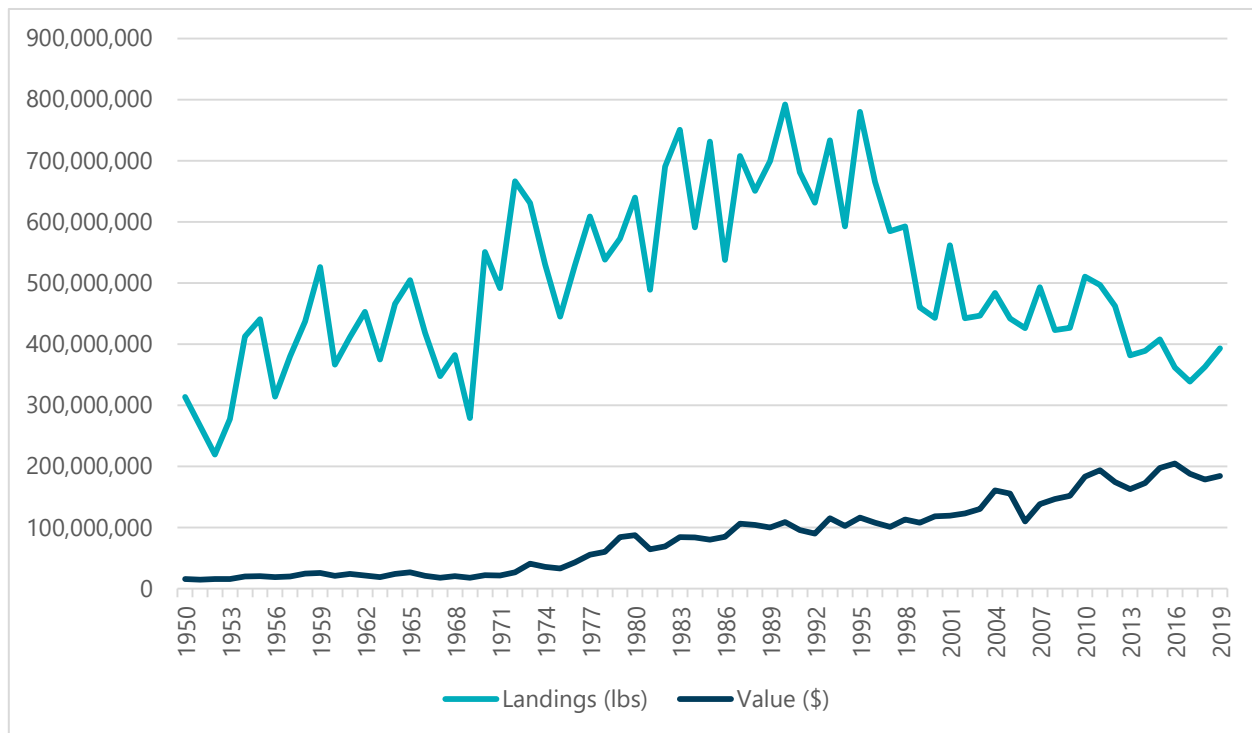
²⁰ <http://vmp.stratum.net/about-virginia-seafood/>

²¹ Based on College of William and Mary, Virginia Institute of Marine Science research

²² <http://www.virginiaseafood.org/2018/03/12/facts-about-the-virginia-seafood-industry-2017/>

²³ <https://www.fisheries.noaa.gov/foss/f?p=215:200:::>

Figure 6: Virginia Commercial Fisheries Landings and Value, 1950-2019



Source: U.S. National Oceanic and Atmospheric Administration, Division of Fisheries Statistics

Table 4: Top 10 US Commercial Fishing States by Landings and Value, 2019

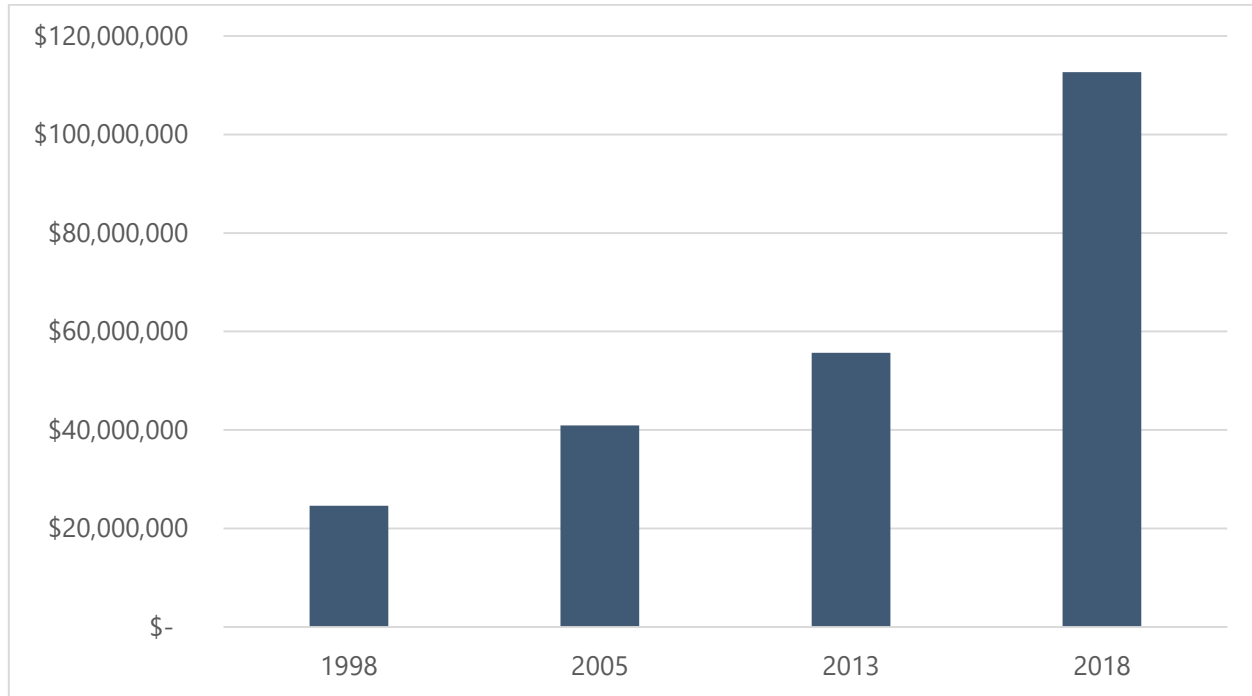
State	Landings (lbs)	Value (\$)
Alaska	5,631,389,035	\$ 1,754,110,799
Louisiana	892,366,466	\$ 303,614,266
Virginia	393,065,090	\$ 184,270,303
Mississippi	319,862,624	\$ 58,661,303
Oregon	313,148,193	\$ 160,277,976
Massachusetts	252,393,114	\$ 680,031,656
Maine	241,785,479	\$ 671,726,881
Washington	197,400,797	\$ 197,753,564
New Jersey	189,564,713	\$ 181,511,342
California	179,290,056	\$ 148,670,088

Source: U.S. National Oceanic and Atmospheric Administration, Division of Fisheries Statistics

Aquaculture Subsector

While commercial wild capture fishing is regulated by the National Oceanic and Atmospheric Administration, aquaculture is considered farming and regulated by the U.S. Department of Agriculture. Aquaculture is the propagation and rearing of aquatic species in controlled or selected environments and is the fastest growing seafood subsector of the marine industry. In terms of sales, Virginia ranks fourth nationally with total aquaculture sales of just over \$112 million in 2018.²⁴

Figure 7: Virginia Aquaculture Sales



Source: U.S. Department of Agriculture, Census of Agriculture

Table 5: Top U.S. Aquaculture States by Sales, 2018

Rank	State	Sales
1	Mississippi	\$ 215,709,000
2	Washington	\$ 207,685,000
3	Louisiana	\$ 135,712,000
4	Virginia	\$ 112,640,000
5	California	\$ 106,021,000

Source: U.S. Department of Agriculture, Census of Agriculture

²⁴ United States Census of Agriculture

Table 6: Mollusk and Food Fish Farms and Sales by Type, Virginia, 2018 and 2013

	2018		2013	
	Farms	Sales	Farms	Sales
Total Mollusk	152	\$94,308,000	80	\$41,522,000
Oysters	134	\$62,380,000	60	\$20,763,000
Clams	43	\$31,928,000	33	\$20,759,000
Total Food Fish	25	\$15,441,000	26	\$11,418,000
Trout	24	*	20	*
Bass, hybrid striped	4	\$17,000	4	\$25,000
Catfish	4	\$14,000	5	\$4,000
Tilapia	1	*	2	*
Other food fish	0	\$0	1	*

*Data suppressed

Source: U.S. Department of Agriculture, Census of Agriculture

According to the Virginia Institute of Marine Science, Virginia continues to lead the nation in hard clam aquaculture production, having planted 307 million clams in 2017 at a value of \$37.5 million. Virginia is known for its oyster industry, which includes both wild and farmed products. Virginia is first on the East Coast for Eastern Oyster production as well.²⁵

Seafood Processing Subsector

The Seafood Processing subsector is responsible for converting whole fish or shellfish, harvested by fishermen or produced by aquaculture operations, into products that are sold at retail stores or restaurants. Omega Protein Corporation in Reedville is one of the largest U.S. suppliers of fish oil and protein products made from menhaden. Suffolk-based Cooke Seafood is another large seafood processing company with over 1,000 employees. Numerous other fish and shellfish processors are present throughout the state.

The Virginia Seafood Agricultural Research and Extension Center in Hampton, VA is a valuable asset to the Seafood Processing sector. The center has provided educational, scientific, and technical guidance and support and leadership to the commercial seafood and aquaculture industries throughout Virginia for over four decades. The facility received a federal grant in late 2019 and has begun construction on an \$8.4 million renovation to upgrade its capabilities.²⁶

²⁵ https://www.vims.edu/research/units/centerspartners/map/aquaculture/docs_aqua/vims_mrr_2018-9.pdf

²⁶ <https://www.dailypress.com/government/local/dp-nw-hampton-virginia-tech-seafood-center-20191002-ypgv2w7a75ehrng47wlihwlr3a-story.html>

MARITIME SUPPORT SERVICES SECTOR

Maritime Support Services is a broad sector that covers service jobs in the maritime industry. These professionals and researchers may be from many fields (scientists, surveyors, engineers, environmentalists, lobbyists, mariners, and lawyers) but have expertise in the maritime realm. Maritime Support Services professionals ensure that the three other sectors of the maritime industry are operating successfully and sustainably. The Maritime Support Services subsector is divided into three subsectors: Naval Architecture & Marine Engineering; Geotechnical, Environmental & Ocean Science; and Other Professional Services.

The Naval Architecture & Marine Engineering Subsector

The Naval Architecture & Marine Engineering subsector supports the innovation and development of maritime vessels. Naval Architects and Marine Engineers work together as a team of designers and system integrators to design, develop, and evaluate the operation of marine vessels, ship machinery, and related equipment.

Maritime academies usually offer programs in Naval Architecture and Marine Engineering in the United States. In Virginia, the Department of Mechanical and Aerospace Engineering at Old Dominion University offers a non-degree, graduate-level certificate in Naval Architecture and Marine Engineering. Old Dominion University also hosts the Naval Engineering and Marine Systems Institute, which focuses on “multidisciplinary research, development, experimentation, and transition of technologies in marine vessels.” Virginia Tech offers an undergraduate major in Ocean Engineering and an undergraduate minor and graduate certificate in Naval Engineering.

The Coastal Virginia Offshore Wind project,²⁷ located 27 miles off the coast of Virginia Beach, will be able to power up to 660,000 Virginia homes per year when completed in 2025-26. This three-phase project will require expertise in geophysical, geotechnical, and ocean science to assess the seabed mobility of the project site as well as the potential impact of hurricanes and breaking waves. Besides the sector’s emphasis on sea-going vessels, Naval Architects and Marine Engineers also work on power generation projects, such as offshore wind turbines. In addition to those in the Naval Architecture & Marine Engineering subsector, professionals in the Geotechnical, Environmental, & Ocean Science subsector will play a significant role as a result of Virginia’s growing offshore wind energy production.

The Geotechnical, Environmental, & Ocean Sciences Subsector

Population growth, an increase in energy demand, and the rise in sea levels put stress on Virginia’s coastal communities, livelihood, and environment. The Geotechnical, Environmental, & Ocean Sciences subsector supports the sustainability of maritime communities by monitoring and assessing coastal resources and ensuring energy security in the commonwealth. Research professionals²⁸ in this subsector keep track of ocean and coastal areas by assessing environmental change; monitoring sea-level rise; and studying physical, chemical, and biological components of the maritime environment.

The Virginia Institute of Marine Science (VIMS), located at William & Mary’s Gloucester Point campus, is one of the largest marine science centers in the United States. VIMS conducts interdisciplinary research and provides advisory services to policymakers, industries, and the public regarding the conservation of

²⁷ <https://www.dominionenergy.com/company/making-energy/renewable-generation/wind/coastal-virginia-offshore-wind>

²⁸ <https://oceanservice.noaa.gov/observations/monitoring/>

coastal marine resources. William & Mary's School of Marine Science is located within VIMS, and its faculty represent multiple marine science sub-disciplines. Research centers and laboratory groups²⁹ established at VIMS include the Center for Coastal Resources Management, Eastern Shore Laboratory, and Seawater Research Laboratory. These labs and research centers deliver research capabilities in marine and coastal science and prepare students for a research career in the maritime industry. There were over 500 employees³⁰ (including 350 scientists, technicians, and students) working in VIMS facilities in 2010.

Other Professional Services Subsector

Other professional services associated with the maritime industry include facilitation of associated businesses, ensuring safety at sea, administration of enforceable law, and advocacy for protection of maritime habitats. Admiralty or maritime law officials specialize in legal cases that deal with personal injury or wrongful death related to accidents in cruise ships, cargo ships, fishing boats, and recreational boating. Maritime law also covers seaman, sailors, merchant marines, dock workers, crane operators, and other port workers. In Virginia, there are 87 Admiralty and Maritime Law specialty lawyers³¹ and 21 are members of the Maritime Law Association of the United States.

The range of professions focused on the conservation of resources and coastal protection has grown. To administer federal and state conservation laws and regulations within the Virginia coastal zone, the Virginia Coastal Zone Management Program (CZM)³² brings together state agencies and local governments. The coastal zone, as defined by the CZM, covers 29 percent of Virginia's land area, yet nearly 5.5 million live in the coastal zone, which is 63 percent of the state's population (Figure 8). State agencies involved in coastal regulation include the Virginia Department of Environmental Quality, Virginia Marine Resources Commission, Virginia Department of Game and Inland Fisheries, and Virginia Department of Health. The Virginia Coastal Policy Team consists of representatives from these agencies and works to identify and develop coastal policy recommendations. As Virginia's lead agency in environmental advocacy and management, The Department of Environmental Quality helps agencies and localities develop and implement coordinated marine policies and solve management problems.

Outreach and advocacy groups provide support for the maritime industry as well, such as the Chesapeake Bay Foundation (CBF). The CBF is a non-profit organization working on pollution reduction in the Chesapeake Bay watershed through advocacy and education programs. This organization employs about 170 staff members,³³ including scientists, policy experts, attorneys, educators, and grassroots organizers.

²⁹ <https://www.vims.edu/research/units/index.php>

³⁰ https://www.vims.edu/docs/programs_services_brochure.pdf

³¹ <https://lawyers.lawyerlegion.com/virginia/admiralty-maritime-law?page=2>

³² <https://www.deq.virginia.gov/Programs/CoastalZoneManagement/DescriptionBoundary.aspx>

³³ <https://www.cbf.org/about-cbf/jobs-internships/why-work-for-cbf.html>

Figure 8: Virginia's Coastal Zone



Source: Virginia Department of Environmental Quality

The Future of the Maritime Industry in Virginia

The Virginia maritime industry is well-positioned for the future. Worldwide population growth and continued globalization will increase cargo shipments through marine terminals. In the next five years, the Port of Virginia has plans to keep pace with anticipated cargo growth by expanding its capacity through expansion of the waterway and investment in multiple capital improvement projects.

The Port of Virginia is currently served by channels that are 50 feet deep but has congressional approval³⁴ to dredge to a depth of 55 feet, which is set to be completed by 2025. This "Wider, Deeper,

³⁴ The American's Water Infrastructure Act of 2018 authorized the deepening of the Thimble Shoals Channel to 56 feet and the Atlantic Ocean Channel to a depth of 59 feet. The Act also authorized the widening of the Thimble Shoals Channel to 1,400 feet, allowing for two-way traffic and accommodating ultra-large container vessels.

Safer” project, which is currently underway, will ensure the Port of Virginia remains competitive as the deepest water port on the East Coast, and will also restore 24/7 two-way navigation. Additional planned capital improvement projects in the near future include “utilizing advanced equipment at NIT, expanding VIG, constructing the Craney Island Marine Terminal, investing in the Richmond Marine Terminal to upgrade the equipment and facilities, and reinvesting in PMT and NNMT for non-containerized cargo services.”³⁵

As a result of the growing economic value of the Virginia’s coastal ports and trade infrastructure, multiple organizations have located in the commonwealth or have announced plans to do so. For example, Amazon announced in March 2020 its plans to establish a robotics fulfillment center in the City of Suffolk and a processing center in the City of Chesapeake, creating 1,500 new jobs altogether.³⁶ To incentivize companies to locate new maritime-related employment centers or expand existing centers, Virginia awards funds through its Port of Virginia Economic and Infrastructure Development Grant.

With sustained military operations and dedicated workforce programs, the Ship Building & Repair sector in Virginia shows promising growth. The Navy has a stated goal of growing its fleet by nearly 70, to reach a total of 355 ships, and the Hampton Roads region is home to one of the Navy’s four public shipyards. Newport News Shipbuilding is the only shipyard capable of making nuclear-powered aircraft carriers for the Navy, and one of its two shipyards makes nuclear-powered, Virginia-class submarines. The shipyard has a signed contract from the Navy for two aircraft carriers, is assisting in building a new fleet of ballistic missile submarines, and was awarded a 22.2 billion contract “for the next block purchase of Virginia-class submarines—the Navy’s largest single shipbuilding contract ever.”³⁷

Virginia is at the forefront of aquaculture research and production. A team led by the Aquaculture Genetics and Breeding Technology Center at the Virginia Institute of Marine Science (VIMS) was awarded a grant of more than \$4 million to work on breeding oysters that will be better equipped to weather disease and other threats.³⁸ Blue Ridge Aquaculture, located in Martinsville, is the world’s largest producer of tilapia using indoor recirculating aquaculture systems.³⁹

Climate change will play a significant role in shaping the future of commercial fishing. As water in the Chesapeake Bay warms, the once plentiful stocks of sea bass and flounder will move northward, while warmer-water species, like shrimp, will move into Virginia’s warming waters. Already, the Virginia commercial fishing industry is seeing an increase in their shrimp harvest, and in the spring of 2019, nineteen fishers had applied to participate in an experimental shrimp fishery run by the Virginia Marine Resources Commission.⁴⁰

³⁵ <https://www.portofvirginia.com/wp-content/uploads/2016/02/TPOV-master-plan-2065-final-020316.pdf>

³⁶ <https://www.vedp.org/press-release/2020-03/amazon-hampton-roads>

³⁷ <https://www.dailypress.com/business/shipyards/dp-nw-christening-kennedy-whats-next-20191205-stznw3jvcvcejpv7y2msc5juby-story.html>

³⁸ <https://chesapeakebaymagazine.com/vims-to-breed-oysters-of-the-future/>

³⁹ <http://www.blueridgeaquaculture.com/aboutus.cfm>

⁴⁰ <https://www.virginiamercury.com/2019/06/24/a-long-creeping-change-as-climate-warms-virginia-fisheries-struggle-to-adapt/>

Relevant Occupations in the Maritime Industry

The tables below group maritime-related occupations by their maritime industry sector. Within each table, each occupation is matched to the appropriate industry subsector and to the corresponding CTE Career Cluster and Pathway. Estimated 2018 employment, projected 2028 employment, and the percent change in employment from 2018-2028 are also included for each occupation.

SHIP & BOAT BUILDING, REPAIR, & MAINTENANCE SECTOR

Occupations in the Ship & Boat Building, Repair, & Maintenance sector are typically manufacturing- and construction-oriented jobs. There is no specific designation in the Standard Occupation Code for a shipbuilder since shipbuilding includes multiple trades. The occupations shown in Table 7 below have significant numbers of workers in the maritime industry, but are not exclusive to the maritime industry alone and include counts of jobs in other industries as well. Welders, Cutters, Solderers, and Brazers comprise nearly 10 percent of all workers in the ship and boat building industry, and over 10 percent of all Riggers work in the ship and boat building industry as well.

Table 7: Ship & Boat Building, Repair, & Maintenance Occupations in Virginia

SOC Code	Occupation	Industry Subsector	Career Cluster	Career Pathway	2018 Employment	2028 Employment	Percent Change
514121	Welders, Cutters, Solderers, and Brazers	Ship Building & Repair	Manufacturing	Production	9,255	9,688	5%
499096	Riggers	Ship Building & Repair	Architecture & Construction	Construction	1,429	1,479	3%
492093	Electrical and electronics installers and repairers, transportation equipment	Ship Building & Repair	Transportation, Distribution, & Logistics	Facility and Mobile Equipment Maintenance	805	829	3%
493051	Motorboat Mechanics and Service Technicians	Recreational Boat Building, Repair & Maintenance	Transportation, Distribution, & Logistics	Facility and Mobile Equipment Maintenance	603	627	4%

Sources: University of Virginia Weldon Cooper Center for Public Service; Virginia Employment Commission

THE LOGISTICS, SHIPPING, & TRANSPORTATION SECTOR

The Logistics, Shipping, & Transportation sector has many occupations that fit well within the maritime industry. Logisticians analyze and coordinate the acquisition, distribution, internal allocation, delivery and final disposal of resources—an occupation that is utilized in port and harbor operations and is expected to grow 8 percent through 2028. Laborers and Freight, Stock, and Material Movers, also identified as cargo handlers or wharf laborers, have a large employment presence in Virginia with over 55,000 jobs in 2018. Captains, Mates, and Pilots of Water Vessels command or supervise operations of ships and are required to hold a license issued by the U.S. Coast Guard. Sailors and Marine Oilers are considered general crew of a ship, performing a wide variety of tasks to assist the captain.

Table 8: Logistics, Shipping, & Transportation Occupations in Virginia

SOC Code	Occupation	Industry Subsector	Career Cluster	Career Pathway	2018 Employment	2028 Employment	Percent Change
131081	Logisticians	Port and Harbor Operations	Transportation, Distribution, & Logistics	Logistics Planning and Management Services	8,156	8,791	8%
113071	Transportation, Storage, and Distribution Managers	Port and Harbor Operations	Transportation, Distribution, & Logistics	Logistics Planning and Management Services	2,167	2,249	4%
537062	Laborers and Freight, Stock, and Material Movers, Hand	Deep Sea and Coastal Freight	Transportation, Distribution, & Logistics	Warehousing and Distribution Center Operations	56,886	58,653	3%
535011	Sailors and Marine Oilers	Deep Sea and Coastal Freight	Transportation, Distribution, & Logistics	Transportation Operations	2,414	2,569	6%
535021	Captains, Mates, and Pilots of Water Vessels	Deep Sea and Coastal Freight	Transportation, Distribution, & Logistics	Transportation Operations	2,202	2,428	10%
536061	Transportation Attendants, Except Flight Attendants	Passenger Water Transportation	Transportation, Distribution, & Logistics	Transportation Operations	244	250	2%

Sources: University of Virginia Weldon Cooper Center for Public Service; Virginia Employment Commission

COMMERCIAL FISHING & SEAFOOD PRODUCTS SECTOR

Occupations in the Commercial Fishing & Seafood Products sector are typically agricultural and natural resource-oriented jobs. Fishers and Related Fishing workers fall exclusively within the Wild Capture Fishing subsector of the maritime industry; however, employment data for this occupation is not available for Virginia. The Meat, Poultry, and Fish Cutters and Trimmers occupation, which focuses on seafood processing, is expected to contract in size by about 2 percent by 2028, as will the occupation that includes Farmers, Ranchers, and Other Agricultural Managers. Both of these occupations include jobs outside of the maritime industry.

Table 9: Commercial Fishing & Seafood Products Occupations in Virginia

SOC Code	Occupation	Industry Subsector	Career Cluster	Career Pathway	2018 Employment	2028 Employment	Percent Change
453011	Fishers and Related Fishing Workers	Wild Capture Fishing	Agriculture, Food, & Natural Resources	Natural Resources Systems	No data	No data	No data
119013	Farmers, Ranchers, and Other Agricultural Managers	Aquaculture / Fish Farming	Agriculture, Food, & Natural Resources	Agribusiness Systems	33,663	32,830	-2%
513022	Meat, Poultry, and Fish Cutters and Trimmers	Seafood Processing	Agriculture, Food, & Natural Resources	Food Products & Processing Systems	4,081	4,012	-2%

Source: University of Virginia Weldon Cooper Center for Public Service; Virginia Employment Commission

MARITIME SUPPORT SERVICES SECTOR

Maritime Support Services Occupations encompass work that includes various disciplines with specific skills and expertise in the maritime industry. Marine Engineers and Naval Architects design, develop, and evaluate the operation of marine vessels, ship machinery, and related equipment. This occupation provided over 2,600 jobs in Virginia in 2018 and is expected to grow by 16 percent through 2028.

Numerous occupations that are not entirely related to the maritime industry also support and contribute to the industry. Natural Sciences Managers coordinate marine research and advocacy groups and are part of an occupation that is projected to expand by about 4 percent through 2028. Other examples include Geoscientists, Surveying and Mapping Technicians, and Public Relations Specialists, who may help promote marine conservation.

Table 10: Maritime Support Services Occupations in Virginia

SOC Code	Occupation	Industry Subsector	Career Cluster	Career Pathway	2018 Employment	2028 Employment	Percent Change
172121	Marine Engineers and Naval Architects	Naval Architecture and Marine Engineering	Science, Technology, Engineering, & Mathematics	Engineering and Technology	2,648	3,083	16%
173031	Surveying and Mapping Technicians	Geotechnical, Environmental, and Ocean Science	Architecture & Construction	Design/Pre-Construction	2,132	2,260	6%
119121	Natural Sciences Managers	Geotechnical, Environmental, and Ocean Science	Agriculture, Food, & Natural Resources	Natural Resources Systems	1,348	1,404	4%
192021	Atmospheric and Space Scientists	Geotechnical, Environmental, and Ocean Science	Science, Technology, Engineering, & Mathematics	Science and Mathematics	345	388	12%
192042	Geoscientists, Except Hydrologists and Geographers	Geotechnical, Environmental, and Ocean Science	Science, Technology, Engineering, & Mathematics	Science and Mathematics	344	360	5%
231011	Lawyers	Other Professional Services	Law, Public Safety, Corrections, & Security	Legal Services	20,407	20,723	2%
131041	Compliance Officers	Other Professional Services	Government & Public Administration	Regulation	8,960	9,532	6%
273031	Public Relations Specialists	Other Professional Services	Marketing	Marketing Communications	7,212	7,776	8%

Source: University of Virginia Weldon Cooper Center for Public Service; Virginia Employment Commission

Preparing the Maritime Workforce

Virginia has multiple educational opportunities to prepare our maritime workforce for the occupations mentioned above.

HIGH SCHOOL

At the high school level, Virginia offers courses through its CTE programs across all Career Clusters that develop skills necessary for occupations in the maritime industry (as shown in the previous occupation tables). For example, the following Virginia CTE courses and course sequences are applicable to the maritime industry:

- Fisheries and Wildlife Management
- Ecology and Environmental Management
- Sustainability and Renewable Technologies
- Geospatial Technology
- Architectural Drawing and Design
- Power and Transportation
- Building Trades
- Building Management
- Welding
- Small Engine Technology
- Marine Service Technology

The Northern Neck Technical Center offers a STEM Academy for Agriculture and Maritime Studies.⁴¹ This program is offered in conjunction with regular high school studies and prepares students for college and careers in high-paying technical positions in agricultural and maritime engineering and technology. Courses in the Northern Neck Technical Center Maritime Service Technology Program include: ship and boat safety, navigation, engine mechanics, hull repair, chart reading, and instrumentation. Hampton High School offers its students a unique experience through its Maritime Academy. Hampton's academies enable students to learn through a hands-on learning environment with real-world application and experiences. The Maritime Academy provides the academic and technical courses needed for successful transition to postsecondary education, careers, and registered apprenticeship opportunities in shipbuilding and repair, as well as ship design.

In addition, the Virginia Department of Education in cooperation with the Virginia Institute of Marine Science (VIMS) offers a Marine Science Governors School for High School students.⁴² This 4-week summer residential school has been open since 1993, providing participants with authentic experiences in marine research.

⁴¹ http://www.doe.virginia.gov/instruction/career_technical/gov_academies/academies/northern_neck.shtml

⁴² https://www.vims.edu/education/high_school/governorsschool/index.php

CAREER AND TECHNICAL PROGRAMS

Beyond high school, Virginia offers career and technical opportunities that provide training and education to further support maritime occupations.

Career and technical programs in shipbuilding and the marine trades are offered at the following institutions:

- The Digital Shipbuilding Workforce Program at Old Dominion University is in development and will provide courses and a laboratory to train workers for the new digital manufacturing environment in the shipbuilding industry. This GO-Virginia-funded workforce program hopes to train approximately 8,500 workers for careers in the industry.⁴³
- The Apprentice School of Newport News Shipbuilding⁴⁴ provides 4- and 5-year apprenticeship programs for students interested in shipbuilding careers. The programs have produced over 9,000 graduates who are trained to provide operational support to Newport News Shipbuilding.
- Tidewater Community College (TCC) in Norfolk, Virginia⁴⁵ offers maritime logistics education and technical training. They offer associate degrees in Maritime Logistics and Maritime Technologies and career studies certificates in Marine Diesel, Electrical, Mechanical, Gasoline Engine, Pipefitter, and Machinist.
- Advanced Technology Institute (ATI) in Virginia Beach⁴⁶ offers an associate degree, diploma program, and certification program in maritime welding.

Beyond high school, Virginia offers career and technical, collegiate, and professional development opportunities that provide training and education to further support maritime occupations. For more detail on these, see Appendix A.

Closing

Virginia's place as a leader in the maritime industry is unlikely to change due to its geographic advantage, sustained investment, and naval dominance. The industry itself is expected to remain stable due to sustainable long-term planning, capital development, and naval contracts; and maritime occupations are expected to grow. The educational landscape in Virginia and broad nature of maritime occupations offer multiple entry points and a multitude of opportunities for professional training and development.

⁴³ <https://www.virginiabusiness.com/article/the-future-of-shipbuilding/>

⁴⁴ <https://www.as.edu/>

⁴⁵ <https://www.tcc.edu/programs/maritime-technologies/>

⁴⁶ <https://www.auto.edu/programs/maritime-welding/>

Appendix A: Virginia College and Professional Development Programs Related to the Maritime Industry

College preparation in Marine Science is offered by the following Virginia institutions:

- William and Mary's School of Marine Science⁴⁷ offers advanced degrees in Marine Science at the M.A., M.S., and Ph.D. level, as well as an undergraduate minor.
- Hampton University in Hampton, Virginia⁴⁸ offers an undergraduate Marine Biology and Biological Oceanography degree program.

College and professional certifications in Naval and Ocean Engineering are offered by the following institutions:

- Virginia Polytechnic Institute and State University⁴⁹ offers undergraduate and graduate degree programs in Ocean Engineering.
- The American Society of Naval Engineers in Alexandria⁵⁰ offers a Naval Engineering Certificate program.
- The Society of Naval Architects and Marine Engineers in Alexandria⁵¹ offers preparation courses for the Naval Architecture and Marine Engineering Exam.

Mariner preparation training can be found at the following institutions:

- The Mid-Atlantic Maritime Academy (MAMA) in Norfolk⁵² is a career and technical training center for merchant mariners and those who seek professional training in one or more of over 90 deck and engineering courses approved by the U.S. Coast Guard.
- Chesapeake Marine Training Institute in Hayes⁵³ provides mariner courses approved by the USCG.
- Trident Group Training in Virginia Beach⁵⁴ provides training in maritime security.
- National Seafarer Academy in Vienna⁵⁵ offers a wide variety of maritime training and services approved by the USCG.
- Marine Emergency Response Group in Woodbridge⁵⁶ offers several programs, including Maritime Consulting, Crewmember Training, Operator Training and USCG License Courses.
- QMII University in Ashburn⁵⁷ offers maritime security courses.

⁴⁷ <https://www.vims.edu/education/graduate/index.php>

⁴⁸ <https://science.hamptonu.edu/mes/>

⁴⁹ <https://www.aoe.vt.edu/>

⁵⁰ <http://www.navalengineers.org/Education/Naval-Engineering-Certificate>

⁵¹ <https://www.sname.org/home>

⁵² <https://mamatrains.com/>

⁵³ <https://www.chesapeakemarineinst.com/>

⁵⁴ <https://www.gotridentgroup.com/sea/>

⁵⁵ <https://natsea.talentlms.com/index>

⁵⁶ <http://mergllc.com/>

⁵⁷ <https://www.qmii.com/>

Collegiate training and professional certifications in marine logistics, port, and supply chain management are available at the following Virginia Institutions:

- Old Dominion University's Strome College of Business Maritime Institute in Hampton Roads⁵⁸ provides education, training, and research in maritime, ports and logistics management. It offers a B.S. in Business Administration and in Maritime and Supply Chain Management (MSCM); an M.B.A. in Maritime & Port Management; an M.S. in Maritime Trade and Supply Chain Management; and a graduate certificate in Maritime, Ports and Logistics Management.
- Virginia Commonwealth University (VCU) in Richmond⁵⁹ offers undergraduate and graduate programs in Supply Chain Management.
- American Association of Port Authorities in Alexandria⁶⁰ offers a Professional Port Manager (PPM) Certification.
- Manufacturing Skill Standards Council in Alexandria⁶¹ offers a Certified Logistics Technician (CLT) program.

⁵⁸ <https://www.odu.edu/business/center/port>

⁵⁹ <https://business.vcu.edu/academics/supply-chain-management-and-analytics/>

⁶⁰ <https://www.aapa-ports.org/>

⁶¹ <https://www.msscusa.org/>