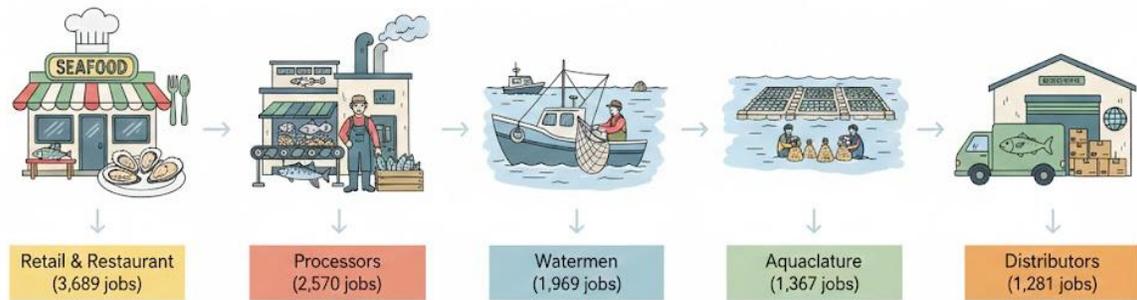


POLICY BRIEFING: SAFEGUARDING VIRGINIA'S SEAFOOD ECONOMY, ENVIRONMENT, AND PUBLIC HEALTH FROM MARITIME SHIPPING POLLUTION

THE VITAL ROLE OF VIRGINIA'S SEAFOOD ECONOMY

Virginia's seafood industry is a cornerstone of the Commonwealth's economy, a vital part of our cultural heritage, and a significant contributor to the nation's food supply. Its strategic importance extends far beyond the coastline, creating jobs and economic value throughout the state. This section quantifies the industry's substantial contributions, establishing a clear picture of the economic assets at risk from growing environmental threats in Virginia's coastal and marine waters.

According to the latest data from Virginia Tech and the Virginia Institute of Marine Science (VIMS), the Virginia **seafood industry contributes \$1.2 billion annually** to the Commonwealth's economy and sustains **7,200 jobs**. This economy generates **\$164.4 million in taxes** for federal, state, and local governments. The economic benefits also extend downstream; Virginia seafood products sold in retail stores and restaurants contributed an **additional \$458 million** in total output and supported **another 3,689 jobs** across the Commonwealth in the same year.



Furthermore, Virginia is a national leader in aquaculture. The Commonwealth is the **#1 producer of both eastern oysters and hard clams in the United States**. The farm gate value of this bivalve aquaculture—the net value of products when they leave the farm—reached \$81 million based on the most recent 2024 survey data. This total includes \$52 million from hard clams and \$29 million from eastern oysters, underscoring the sector's immense value. This vital economic engine, however, faces significant and growing threats from maritime pollution that jeopardizes the health of our waters and the future of this industry.

MARITIME POLLUTION: A DIRECT THREAT TO VIRGINIA'S ECONOMY AND MARINE ECOSYSTEMS

Water pollution from large commercial vessels that frequent Virginia's ports pose a direct and multifaceted threat to our marine ecosystems. This degradation undermines the viability of the seafood industry by harming the very species that form its foundation, from the iconic blue crab to the oysters and clams that make Virginia a national leader.

Virginia's marine life faces a "triple threat" of acidification, a chemical change in our waters that is detrimental to shellfish and other organisms. This threat is driven by three primary factors:

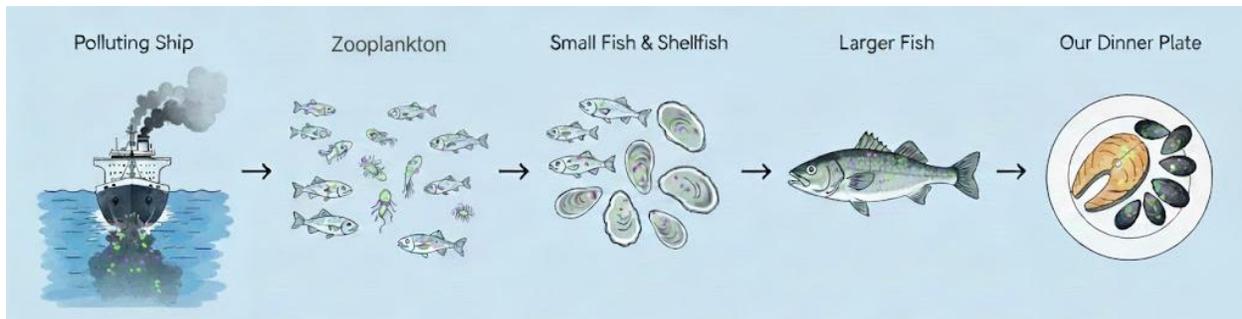
1. **Scrubber Discharge:** The direct release of highly acidic wastewater from ship exhaust gas cleaning systems, known as "scrubbers." This discharge can be up to 100,000 times more acidic than the surrounding seawater.

2. **Atmospheric Absorption:** The ongoing, global process where the ocean absorbs atmospheric carbon dioxide (CO₂), progressively lowering seawater pH.
3. **NO_x Emissions:** The emission of nitrogen oxides (NO_x) from ship exhaust contributes to the formation of acid rain, which further acidifies coastal waters.

This combination creates a "local hotspot" effect, where the global issue of ocean acidification is dangerously amplified by direct, localized pollution from ships in Virginia's own waters, accelerating the threat to our marine life.

The impact of acidification on Virginia's blue crab population is particularly alarming. Research supported by the Virginia Sea Grant program has revealed that increasingly acidic conditions cause delayed development and higher mortality rates in blue crab embryos and larvae. This developmental delay threatens their ability to catch the crucial ocean currents needed to return to the Chesapeake Bay, jeopardizing the future of the entire population. As UVA professor Stephen Macko noted, "with the acidity that's coming, there may not be sufficient time for crabs to adapt."

Beyond acidification, scrubber discharge water contains a toxic cocktail of other pollutants. This wastewater carries persistent, bioaccumulative chemicals, including heavy metals like vanadium, nickel, and zinc, as well as Polycyclic Aromatic Hydrocarbons (PAHs). These toxins build up in the fatty tissues of marine organisms, moving from the smallest plankton up the food chain to the very seafood that Virginians harvest, sell, and consume. A comprehensive report from the German Environment Agency found that even extremely low concentrations of this wastewater can harm marine life. Its ecotoxicological tests classified the discharge as ranging from "considerably toxic" to "extremely toxic." This **direct contamination of our food chain** is only one half of the public health threat; the same toxic fuel responsible for this water pollution is simultaneously degrading the air quality in our port communities.



Heavy metals from scrubber wastewater bioaccumulate and travel up the food chain, impacting both marine life and humans.

AIR POLLUTION FROM HEAVY FUEL OIL: PUBLIC HEALTH IMPACTS ON PORT COMMUNITIES

The environmental damage from shipping is not confined to the water. The widespread use of **Heavy Fuel Oil (HFO)—often described as the "dirtiest type of fuel"**—by large commercial vessels creates significant air quality and public health risks for the Virginians who live and work in and around our port communities.

The combustion of HFO is a primary vector for several harmful air pollutants with well-documented consequences for public health. The primary pollutants of concern include:

- **Fine Particulate Matter (PM):** These microscopic particles are a primary health threat. Far smaller than a dust mote, they can penetrate deep into the lungs and enter the bloodstream. Exposure to these particles is linked with **cardiovascular disease, cancer, and birth defects**, as they can potentially cross the placenta and affect a developing fetus. The EPA estimates that fine particulate is responsible for over 90% of air pollution-related health damages in the U.S.



Comparison of Heavy Fuel Oil (HFO) to cleaner Marine Gas Oil (MGO)

- **Sulfur Oxides (SOx):** SOx emissions are directly linked to **respiratory diseases**. While international regulations targeting sulfur have helped reduce these emissions, the continued use of HFO means they remain a significant pollutant. Maritime shipping emissions are responsible for 90% of the SOx on the East Coast with high concentrations in Norfolk.
- **Nitrogen Oxides (NOx):** These emissions are a key contributor to the formation of smog and acid rain. Exposure to NOx is also linked to respiratory diseases, including **asthma**.

Long-term exposure to this combination of air pollutants creates a substantial public health burden for port communities. According to a major study by the International Council on Clean Transportation (ICCT), shipping pollution is attributed to approximately **1,200 premature deaths annually** in the United States. This transfers the significant economic burden of these public health crises from the polluters directly onto the Commonwealth's taxpayers.

THE REAL TAXPAYER COST OF SHIPPING POLLUTION

The environmental degradation and public health problems caused by maritime shipping pollution translate into significant, though often hidden, economic costs. The international shipping industry externalizes these costs, leaving Virginia's taxpayers, businesses, and communities to bear the financial burden of the damage. Below is an **example of a single moderate-sized (3000 passenger) cruise ship with 50 port visits per year**.



On an aggregate scale, these costs are substantial. A case study of the Baltic Sea provides a clear example of the financial liability Virginia can avoid with proactive policy. Between 2014 and 2022, the **environmental damage caused by scrubber wastewater discharge in the Baltic Sea was estimated to cost over \$707 million**. This figure represents a tangible societal cost for cleaning up pollution, lost ecological services, and other damage that were not paid for by the ships that caused them.

This situation creates significant financial inequity. **The public is forced to shoulder the burden of not only environmental harm but also the increased healthcare costs** associated with treating respiratory illnesses,

cancers, and other conditions linked to air and water pollution. This imbalance is made worse by the fact that the vast majority of large commercial ships are foreign-flagged. Top flag states for ships with scrubbers include Panama, Liberia, and the Marshall Islands—countries known for lax regulations and tax avoidance. **These foreign-flagged vessels profit from using Virginia's ports but contribute little to the state revenues needed to mitigate the environmental and public health damage they cause.** This economic and environmental imbalance is allowed to persist due to fundamental failures in international regulations.

THE SCRUBBER LOOPHOLE: WHY SHIPS ARE STILL ALLOWED TO POLLUTE

A central paradox lies at the heart of international maritime regulations: despite increasingly strict rules aimed at cleaning up the air, ships are still permitted to burn the world's dirtiest fuel. This is made possible by a regulatory flaw commonly known as the "scrubber loophole," which effectively trades one form of pollution for another.

The International Maritime Organization (IMO) established Emission Control Areas (ECAs) to protect coastal communities from harmful air pollution. The entire U.S. coast is covered by an ECA, which mandates that ships must burn fuel with a very low sulfur content (0.1%). However, the IMO allows ships to use an "equivalent" method of compliance: an exhaust gas cleaning system, or "scrubber." A scrubber functions like a shower for the ship's exhaust, using large volumes of seawater to "wash" the sulfur oxides and other toxicants out of the smoke before it is released into the atmosphere.

The critical flaw in this approach is that the pollution does not disappear. **An open-loop system, used by 81% of the scrubber-equipped fleet, simply converts air pollution into a concentrated, toxic, and acidic wastewater that is then discharged directly into the Virginia waters.** This "air-to-water loophole" means that ships can continue to burn cheap, high-sulfur Heavy Fuel Oil while technically complying with air quality rules. This demonstrates a fundamental failure in the regulatory framework, which allows a compliance mechanism that merely transforms one form of pollution into another, defeating the primary goal of environmental protection. In doing so, ships transfer environmental harm from the air to the water, directly poisoning the marine ecosystems that Virginia's economy depends on. While this practice is permitted at the international level, a growing number of states and ports are taking independent action to close this loophole in their own waters, providing a clear path for Virginia to follow.

A PROVEN PATH FORWARD: REQUIRING CLEANER FUELS IN VIRGINIA WATERS

The solution to the dual threats of air and water pollution from shipping is clear, readily available, and has already been proven effective. By requiring all vessels in Virginia waters to use cleaner, low-sulfur fuels and prohibiting the use of HFO with scrubbers, the Commonwealth can protect its environment, economy, and public health. This is not a novel or untested idea but rather a well-established policy path with a growing consensus among leading states and ports.

Other U.S. jurisdictions have already implemented similar measures, providing a clear blueprint for the Commonwealth:

- **California** bans the use of scrubbers within 24 nautical miles of its coast.
- **Connecticut** prohibits the discharge of all scrubber washwater in its state waters.
- **Washington State** has prohibitions of scrubber discharge at the Port of Seattle and in the Salish Sea. Broader low-sulfur fuel legislation has been drafted for submission to the legislature.

These actions are part of a global trend. According to a 2023 report, **93 measures across 45 countries** have been implemented to regulate or ban the use of ship scrubbers, recognizing that transferring pollution from the air to the water is not a sustainable solution. **The scientific data underpinning these policy decisions is**

robust and credible, originating from peer-reviewed studies and authoritative reports published by government bodies like the German Environment Agency and respected non-governmental organizations such as the International Council on Clean Transportation (ICCT). The precedent set by these states, backed by a robust body of scientific evidence from respected international bodies, provides the Commonwealth with a legally and scientifically defensible path for action. By acting now, Virginia can align itself with this growing international consensus and implement a logical, defensible policy to safeguard its future.

CONCLUSION: A COMMON-SENSE POLICY FOR A CLEANER, MORE PROSPEROUS COMMONWEALTH – REQUIRE LOW-SULPHUR SHIPPING FUELS

The evidence is clear: pollution from maritime shipping poses a direct and significant threat to the Commonwealth of Virginia. Our billion-dollar seafood industry, the health of our precious marine ecosystems, and the well-being of Virginians in our port communities are all at risk from the toxic air and water pollution generated using Heavy Fuel Oil. Fortunately, a simple, proven, and readily available solution exists. **By requiring all ships using Virginia's ports and navigating our waters to operate on cleaner, low-sulfur fuels and prohibiting the discharge of toxic scrubber wastewater, we can eliminate this threat at its source.** Marine Gas Oil (MGO) with 0.1% sulfur content is readily available, and most ships can switch to cleaner fuels, thus **benefits to the health of Virginians and marine resources will be immediate.** This is a matter of both fairness and common sense. It is both just and reasonable to require the multi-billion-dollar international shipping industry to stop externalizing its environmental and public health costs onto Virginia's taxpayers, businesses, and natural resources, and instead operate in a responsible manner that protects the Commonwealth for generations to come.



SELECT SUPPORTING REFERENCES

American Lung Association. (n.d.). [Sulfur dioxide](#).

American Lung Association. (n.d.). [What Is Particle Pollution?](#)

Brown, K., Ptáček, S., & Gamble, J. (2025, January). [Poison in the water: The call to ban scrubber discharge](#).

C Arden Pope 3rd, et al. (2002, March), [Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution](#), JAMA 287: 1132–1141

Comer, B. (2020, June 18). [Scrubbers on ships: Time to close the open loop\(hole\)](#). International Council on Clean Transportation.

Ekstrom, J. A., et al. (2015). [Vulnerability and adaptation of US shellfisheries to ocean acidification](#). *Nature Climate Change*, 5(3), 207–214.

Emon, F. J. et al. (2023). [Bioaccumulation and bioremediation of heavy metals in fishes: A review](#). *Toxics*, 11(6), 510.

German Environment Agency. (2022, December). [Environmental impacts of discharge water from exhaust gas cleaning systems on ships](#).

Golbazi, M. and Archer, C (2023). [Impacts of maritime shipping on air pollution along the US East Coast](#), Journal of Atmospheric Chemistry and Physics, 23, 15057–15075.

Gonçalves, F. H., van Senten, J., Schwarz, M. H., & Hegde, S. (2023). [Economic contributions of the Virginia seafood industry and the effects of Virginia seafood products in retail stores and restaurants in 2023](#). Virginia Cooperative Extension.

Hermansson, A. L. et al. (2021). [Strong economic incentives of ship scrubbers promoting pollution](#). *Nature Sustainability*, 4, 322–329.

Institute of Shipping Economics and Logistics. (n.d.). [The world merchant fleet sails under a foreign flag](#).

International Council on Clean Transportation. (2023, June). [Global update on scrubber bans and restrictions](#).

Jepsen, M. (2020, February 21). [Blue crab blues: Will ocean acidification cause growing pains for baby crabs?](#) Virginia Sea Grant.

Mueller, N., Westerby, M., & Nieuwenhuijsen, M. (2023). [Health impact assessments of shipping and port-sourced air pollution on a global scale: A scoping literature review](#). *Environmental Research*, 216, 114460.

Rutherford, D., & Miller, J. (2019, March 22). [Silent but deadly: The case of shipping emissions](#). International Council on Clean Transportation.

U.S. Environmental Protection Agency. (n.d.). [Basic information about NO2](#).

U.S. Environmental Protection Agency. (n.d.). [Basic information about Particulate Matter \(PM\)](#).

U.S. Environmental Protection Agency. (n.d.). [Basic information about Sulfur Dioxide](#).

Virginia Institute of Marine Science. (2017). [Virginia continues to lead in clam and oyster aquaculture](#).

Virginia Marine Products Board. (n.d.). [About Virginia seafood](#).

Virginia Marine Products Board. (2024). [2024 Seafood industry fact sheet](#).

Virginia Marine Products Board. (2024, August 27). [Virginia continues to lead the East Coast in seafood landings!](#)

Wikipedia (n.d.). [Flag of convenience](#)

Winnes, H., & Fridell, E. (2009). [Particle emissions from ships: dependence on fuel type](#). *Journal of the Air & Waste Management Association*.