

# THE OCEAN'S TURN?

GEOPOLITICS · SUSTAINABILITY · INNOVATION



THE FLETCHER  
SCHOOL

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GLOBAL CONTEXT**

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**TURN?  
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# Introduction

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The ocean is the origin of life. It covers 71% of the earth's surface. Yet, the way our lives are organized today it is easy to forget its presence. Even for those who live near a coast the ocean is little more than a source of food, a setting for a cruise, or a view from the beach. However, the ocean is integral to our lives and has the power to connect us, no matter where we live across the world.

An event on the ocean can send geopolitical shockwaves. In November 2018, three Ukrainian naval vessels were seized by Russian patrol crafts in the Kerch Strait, a stretch of water that connects the Black Sea to the Sea of Azov. After tensions arose at a series of G20 meetings, NATO and the European Union demanded action after Ukraine accused Russian FSB border guards of damaging two armed artillery boats and injuring 6 people on board. Elsewhere, a cyclone in the Bay of Bengal caused climbers on Mt. Everest to change course. When one considers the long-term effects of the changes in the ocean, there are more profound forms of transmission of oceanic events into life on land. Consider the rising temperature of sea water that directly threatens human health and habitation.

More broadly, the oceans have a profound impact on our day-to-day lives. Millions of tons of fish are caught from the ocean every year for human consumption, a vast majority of global trade volumes traverse across the ocean, and the ocean maintains enormous potential to help us meet our energy needs.

The conclusion is inescapable: we cannot afford to keep the ocean in the background. Our lives on land are deeply intertwined with whatever happens in the deep blue sea.

On September 28, 2018, The Fletcher School's Institute for Business in the Global Context (IGBC) brought together thought-leaders from across the globe on the Tufts' campus for *The Ocean's Turn?* conference. The Fletcher School's multidisciplinary focus, bringing together the communities of academia, government, business, and international and civil society organizations, made

the institution an ideal location for this conversation. The "Turn?" Series of conferences focuses on regions or countries that are experiencing passage through an inflection point, accompanied by uncertainties that affect the entire world.

The ocean is the quintessential arena for the convergence of many sectors—international politics, development, climate, and innovation. At *The Ocean's Turn?* conference, policymakers, business leaders, and researchers gathered to explore and chart the course for the future of our ocean by examining issues of sustainability, geopolitics, and innovation through an interdisciplinary lens. This report summarizes and builds upon these discussions. It outlines the pressing issues that are shaping the way humans think about the ocean today and the actions that must be taken to preserve this essential resource.

## What Does the Ocean Represent to Humans?

The ocean represents **the unknown**. Most of modern society's activities surrounding the ocean do not venture beyond coastal waters or well-delineated shipping routes. Despite growing environmental concerns, oceanic research and exploration lacks public enthusiasm. The tragedy of the Malaysian jetliner, MH370, that disappeared without a trace in 2014 is a reminder that in an era when our information gathering and space assets supposedly cover every corner of the globe an understanding of the ocean still remains out of our reach.

With improvements in technological innovation, the ocean will not stay unknown for long. Just as historic maritime explorations create scientific breakthroughs, our ability to harness the power of big data today makes the ocean an ideal platform for data gathering, analysis, and social advancements. If managed responsibly, the colossal amount of data produced by oceanic exploration will not only allow us to become better stewards of maritime resources, but also allow us to revolutionize our understanding of marine biology, oceanography, and the earth.

“The sea, particularly as a geopolitical entity, will continue to exert an enormous influence on how global events unfold. The ocean will haunt our policy and our choices in this turbulent 21st century.”

James Stavridis, *Dean Emeritus, The Fletcher School, Admiral, United States Navy (Retired)*

There are three principal ways the ocean has an impact on the human condition and international relations.

First, the ocean represents **opportunity for human progress**. It allows us to explore, innovate, and mitigate the crises we face on land. Through big data analysis and technologies in unmanned vessels, we can identify optimal locations for offshore wind and tidal farms to generate sustainable energy. More scientific and systematic aquaculture practices have the ability to resolve protein shortages in areas where meat is expensive or hard to come by and can reduce the carbon footprint associated with traditional agriculture. The Arctic’s melting ice will also open up new shipping routes that could dramatically increase the efficiency of global transportation. With our deepening understanding of the ocean, it is fair to expect that many more unforeseen opportunities will surface in the future.

Second, bordering on almost every major civilization, the ocean continues to be a **sphere for key geopolitical interactions**. Maritime expeditions have fostered trade, exploration of new territories and cultures, along with wars, violent clashes, invasions, and colonial expansions. Though our world is becoming increasingly interconnected due to the instrumental role of the ocean, the threat of conflict still looms. The South

China Sea is witnessing a naval competition that pits the two largest economies in the world, the United States and China, against each other. The geopolitical ramifications of this competition extend far beyond Asia. The Eastern Mediterranean is reliving the uncertainty of the Cold War as a resurgent Russia faces off against the United States and its allies—with the addition of the political turmoil that has swept across the bordering Syria, Libya, and Lebanon. To the North, the previously peaceful Arctic Ocean is becoming a new stage for geopolitical tension as states vie for security advantages, resource exploration, and economic dominance. Despite geopolitical instabilities, the importance of trade to the global economy creates incentives for respective stakeholders to resolve their differences peacefully. The ocean provides a platform for navigating critical international relationships, encompassing activities such as crisis management, dispute settlement, and cross-national cooperation.

Third, the ocean represents **life that is worthy of our preservation and protection**. The ocean is irreplaceable in the maintenance of earth’s increasingly fragile ecosystem. It is a primary source of oxygen and contains more biodiversity than the rainforest. Despite this, acute environmental threats to the ocean are burgeoning. The ocean is at risk of becoming our last-



Energy panel discusses burgeoning environmental effects on the ocean and how we can combat these issues.





**Lara Hronn Petursdottir**, Co-Founder, Pacific Northwest Ocean Cluster

resort dumping ground: millions of tons of plastics enter into the ocean each year, in addition to a myriad of other pollutants that flow from the rivers. Overfishing is driving certain species of fish into extinction and disrupting food chains. As a result, waste and lifelessness is besieging our last frontier. We cannot allow the ocean to lose its vitality because of human activities, especially as we've only scratched the surface of what it has to offer.

The remaining sections of this report are organized as follows: The first section contains a discussion about the challenges of collecting data and comprehending the mysteries of the ocean. The second section explores the maritime opportunities

that remain largely untapped and the innovations that can be unlocked through a better understanding of the ocean and its potential for business-building. The third section highlights the geopolitical dimensions of the ocean, including those that are emerging due to the impact of climate change. The fourth section touches on the growing challenges associated with pollutants, such as plastics, which are devastating consequences for the ocean. The final section concludes with a simple, but practical question: what can be done? ●

## SECTION ONE

# Challenging the Unknown?

The ocean is as alluring as it is enigmatic, primarily due to the fact that we have barely explored it. Despite tremendous advances in technology, 95% of the ocean has yet to be systematically studied. In fact, more people have been on the moon than to the deepest parts of the ocean. Such glaring disparities reveal the enormous gap in our understanding of the ocean. The closure of this gap should be the first step in developing a more holistic perspective.

### Innovation in Data-Gathering

New data-gathering methods offer a promising start in aligning perspectives on the ocean. New devices, platforms, and big data analysis allow us to comprehensively understand the earth's last frontier. The use of advanced technologies, such as high quality sensors and instant communication, make data gathering and transfer easier than ever before. Oceanic research no longer depends on a small group of researchers traveling on ships across the globe. Instead, scientists and analysts ashore can receive information in real-time, enhancing the efficiency of maritime exploration. One example is the commission of *Okeanos Explorer* by the National Oceanic and Atmospheric Administration of the

United States. The ship collects data on the deep ocean and is currently mapping out relevant areas in the Caribbean and the South Atlantic. What's especially noteworthy about its operations is its use of telepresence technology to send information and data to scientists on land. This new technology enhances the exposure of the ocean to the scientific community, providing a clearer window into the mysterious deep blue. However, the *Okeanos Explorer* remains the sole vessel dedicated to ocean exploration, showing that the ocean still receives inadequate attention.

Fortunately, the power of the market provides an encouraging remedy to this inattentiveness. With new technology, traditional maritime industries, such as shipping, can gather and share data with unprecedented efficiency. Thanks to the prevalence of internet capabilities on transport vessels it's becoming easier for vessels to share data if they are in different oceans. Such instantaneous forms of communication enable shipping operators to better monitor, analyze, and optimize shipping operations. Using predictive analyses, analysts can design superior shipping routes and voyage practices to avoid delays and accidents. A more systematic data-sharing network in the shipping industry will also improve safety for people and the





environment, in addition to preventing cargo loss. It will help draw immediate attention to maritime incidents such as piracy, vessels in distress, and oil leakages, minimizing response time and toll on human life and economic assets.

Shipborne sensors also have the potential to transform ship-design. From their offices, engineers and technicians can evaluate an ocean-going vessel's performance from the feedback of its engines and other components. This data is valuable for diagnosing operational problems and for ship-building. The usage of this information can facilitate the design and production of more capable and longer-lasting ship hulls and engines. In addition to efficiency and economic value, these new designs benefit the environment: better-designed engines hold the promise of reducing emissions in the shipping industry. The International Maritime Organization (IMO) has issued an ambitious regulatory proposal requiring the industry to reduce their CO2 emissions by 40% before 2030 and 70% before 2040. The industry currently emits about 900 million tons of CO2 every year. An enormous number of tasks must be fulfilled by the shipping industry before it reaches the IMO objective, but data-centric engineering serves as a solid starting point.

## Artificial Intelligence & Data Analysis

Closely related to the collection and utilization of big data is the processing of that data and artificial intelligence (AI). Aside from the timely processing of large sums of data, AI via onboard software can make vessels "smarter". Similar to self-driving vehicles, a "smart" ship controlled by AI can identify and avoid obstacles in navigation. Autonomous shipping has already proved to be more than just a concept. The electric-powered *Yara Birkeland*, due to be launched in 2020 in Norway, will become the world's first autonomous vessel for industrial use. It will have zero emissions and will eliminate the need for fuel and a crew, reducing annual operation costs by 90%. Moreover, its operation is expected to replace 40,000 truck drivers per year in Norway, a welcoming prospect for a country interested in decreasing its carbon footprint. Granted, the technology has yet to mature: the *Yara Birkeland's* construction costs three times more than a non-autonomous vessel of similar size and its cargo capacity is modest. Nevertheless, as the technology is perfected overtime autonomous shipping can be a reality in the not-too-distant future.

Meanwhile, the quest for "blue data" has stimulated a new industry whose primary mission is to extend maritime activities



**Ravijit Paintal**, CEO, Autonomous Marine Systems



**Laura Beane**, President and CEO, Avangrid Renewables

beyond the constraints of human limitation. Significant progress in automation and software development have created more unmanned surface vessels (USV) that are small in size but complex in ability. These USVs are capable of performing a variety of missions ranging from maritime patrol and surveillance to oceanic exploration. Most importantly, they can transform maritime activities from time-restrained and expeditionary to perpetual and longitudinal model. For the first time in history, we have the luxury of enhancing maritime exploration unfettered by human factors such as fatigue, fear of inclement sea conditions, and the need for constant logistics supply.

The world is witnessing the rise of USV as the next major maritime platform. In the United States, a tech startup named Automated Marine Systems (AMS) has implemented the innovative design. According to Ravijit Paintal, founder and CEO of AMS and a panelist at *The Ocean's Turn?* conference, AMS uses wind and solar-powered surface drones called "Datamarans" to navigate the oceans and collect and transmit hydrographic data, such as salinity and water quality. They carry on-board computers and navigational algorithms that follow commanded waypoints. Each Datamaran is capable of covering a large surface area. Five Datamarans can provide 5,000 square kilometers of coverage every day. Datamarans also revolutionize how nations protect their territorial seas and maritime interests

by addressing security issues in areas where traditional navies and law enforcements are inadequate. Datamarans maintain cost-benefit superiority. Constructing a Datamaran only costs one hundredth of the cost of dispatching an expeditionary ship.

New technology and big data can also be utilized to understand and protect the ocean's complex ecosystem. While a considerable part of the ocean's biosphere is still elusive to us, new methods, such as genome sequencing, can enable scientists to study many deep-sea species for the first time. Additionally, through collecting the Automatic Identification System (AIS) signals from fishing vessels, advanced software can illustrate different fishing intensities in ocean zones and map out deep-sea resource extraction activities. Onboard vessels, a variety of electronic monitoring devices are facilitating marine life protection. Advancing technology and data analysis are yielding greater benefits at a lower cost. They provide accurate information for fishing management and better acoustic detection for ships to avoid collisions with whales.

## **The Cyber Threat**

Data accumulation, utilization, and protection of the maritime sphere carries inherent risks that cannot be ignored. Data can be compromised by malicious actors if left unprotected,



# “A global warming of 2 degrees Celsius would probably commit us to 10 meters of sea-level rise.”

Philip Duffy, *President & Executive Director, Woods Hole Research Center*

wreaking havoc in the hyperlinked global economy. The level of risk involved is unprecedented. The challenges are no longer refined to what actually takes place on the ocean, such as navigation accidents and piracy, but instead include incidents on land, and to make matters more complicated, actions of distant actors in cyberspace.

The dramatic “NotPetya” cyber-attack in 2017 illustrated how the maritime sphere is susceptible to unforeseen cyberattacks. The devastating cyber-attack eventually caused about \$10 billion in global damage, in no small part due to its paralyzing effect on global shipping giant, Maersk, and the corresponding shock to the global supply chain. The NotPetya virus code infected the sprawling Maersk network from an unassuming IT update in the Ukrainian city of Odessa performed on a single laptop. From there, the virus quickly spread across Maersk assets worldwide, wiping out core corporate data, incapacitating business communications, and creating delays and confusions in ports. The fragile global supply chain, which often relies on just-in-time deliveries of perishable goods to remote destinations, paid heavily for its vulnerability to cyber threats. Ironically, Maersk was able to limit damage from the attack and recover only because container ships still have inferior technology to ports’ operation systems and an accidental power outage in Ghana unintentionally preserved a sole surviving data backup file. In other words, the consequences could have been far more severe had the ships acquired more advanced software beforehand.

The attack on Maersk was not an isolated incident. There have been multiple cyber-attacks targeting ports and ships for

illicit purposes. In fact, on the day of *The Ocean’s Turn?* conference at Fletcher, the port of San Diego was under attack from ransomware, becoming the second port targeted by cyber actions within a week. While economic damages were minimal compared to the Maersk attack, the attacks still disrupted the ports’ normal operations and services. On the ocean, hackers have proven capable of controlling a ship’s navigation by exploiting its exposed networks. These attacks are associated with activities ranging from aiding criminal organizations to smuggling contrabands to assisting piracy, an age-old maritime malpractice.

How will the maritime and insurance industries cope with emerging threats from cyberspace? This is literally a pressing trillion-dollar question. The application of IT technology and data processing in the maritime sector have greatly benefited the expanding global economy, yet at the same time it has introduced new risks on an unparalleled scale. The safety of the maritime bloodlines that connect the world is now at the whim of anonymous actors who can destabilize supply chains with pieces of code. More worrisome, however, is the lack of clarity surrounding the solutions. As Borianna Farrar, Vice-President-Counsel of Shipowners Claims Bureau, warned during the conference, the maritime insurance industry has yet to adapt to these new challenges and is entering into uncharted waters ripe for escalating risks. Meanwhile, much remains to be done in terms of cyber regulation and protection in the maritime sector. In this sense, we are sailing into a new unknown world that integrates the ocean and cyberspace, a voyage that necessitates our caution and diligence. ●



“We have huge challenges in front of us, for the globe and for the shipping industry, and we need to see how these challenges are going to play out.”

Stamatis Molaris, *Founder & Principal, Empire Group of Companies*





“The good news from [the climate science community] is that the potential, the capacity to extract energy from wind is essentially limitless.”

**Philip Duffy**

*President & Executive Director, Woods Hole Research Center*



## SECTION TWO

# Untapped Opportunity?

The ocean provides the necessary tools to solve some of the biggest challenges facing humanity today. Innovations in the sustainable farming of fish, crustaceans, and other organisms—also known as aquaculture—can help us solve food crises and put an end to overfishing. Offshore wind power can help us meet our energy needs while reducing our dependence on fossil fuels. With technological advancements at the helm, how far will we go to fully harness the power of the ocean?

### Aquaculture

Fish consumption has grown twice as much as the global population since the early 1960s. Fish provide around 3.2 billion people with nearly 20% of their animal protein needs. Though aquaculture already accounts for over half the fish eaten in the world, the amount of wild fish has remained relatively constant since the late 1980s and a third of commercial fish species are overfished. Many estimate that wild fish stocks are declining faster than the United Nations' data suggests. Even without increasing fish consumption and declining wild fish stocks, we are going to need to feed a population of 9.8 billion by 2050 and the status quo won't help us reach that target. Something needs to change.

Fish farming on “aquafarms”—using either mesh cages submerged in natural bodies of water or concrete enclosures on land—has often been the target of criticism by environmentalists, and rightfully so. Fish farms can pollute surrounding ecosystems by releasing uneaten feed, chemical treatments, and fish excrement into the environment. On ocean farms, active chemicals used to control diseases and parasites can be discharged into the water impacting local species,

while farms on land often fail to treat their wastewater prior to discharge. Additionally, aquafarms typically depend on small, wild-caught fish species like sardines and anchovies to feed the larger, farmed species. This leads to the overfishing of smaller fish used for feed. On average, it takes about 5 pounds of wild fish feed to produce 1 pound of farmed fish.

Technological advancements in aquaculture can help us reduce our dependence on wild fish stocks, meet the demands of increasing fish consumption, and feed our ever-growing population in a sustainable way. One example, raised by Marianne Naess of Nordic Aquafarms at *The Ocean's Turn?* conference, comes from the research and development of new technology to recycle and reuse water on land aquafarms, known as Recirculating Aquaculture Systems (RAS). RAS reuses water after it has gone through multiple treatment processes, reducing the need for new, clean water and severely limiting the discharge of nutrients and organic matter from farms into the environment. Aquaponic systems, a subset of RAS, combine aquaculture and hydroponics, allowing water to flow between an aquafarm and a plant bed. In a nutshell, the



Aquaculture Fish Farming



“The wave of the future is aquaculture and a lot of countries are doing some really superb things.”

Roger Berkowitz, *President & CEO, Legal Sea Foods*

plants filter the water for the fish and the fish fertilize the plants, using few inputs and generating very little waste. There is great potential to minimize detrimental environmental impacts with such innovative land farms.

There have also been several advancements in developing new types of feed for farmed fish to alleviate the burden of overfishing. Some firms are experimenting with the commercial production of microalgae through photosynthesis as a feedstock for aquaculture. Others have developed feed using a sustainable soy protein concentrate, insect-based protein, and most interestingly, methane conversion. Calysta, a silicon valley-based firm, has produced a feed called *FeedKind* using no animal or vegetable products, but instead a bacterium called methylococcus that is placed in fermentation tanks and fed methane to create dried pellets. A recent study performed by Calysta found that shrimp on a *FeedKind* diet had an equivalent or higher survival and growth-rate compared to fish fed sardines and anchovies.

Unlocking untapped opportunity in the world of farmed fish has become more likely with increasing interest from investors. There is a growing perception among private equity and venture capital firms, philanthropic investors, and large agribusinesses that contributing to aquaculture innovation is an impact investment. Aqua-Spark, a Netherlands-based global investment fund founded in 2014, is dedicated solely to sustainable aquaculture. The fund has invested in better infrastructure, like vertically-integrated farming platforms, which support the development of aquaculture in Africa. Meanwhile, Cargill—a major player in the agricultural services space—has invested in sustainable feed, providing \$30 million to Calysta in 2016 to fast-track *FeedKind*'s production.

Does this emerging technology have the potential to reduce the negative environmental effects of aquaculture? Seafood is more carbon efficient than any animal protein and with a growing population who consume more and more fish, we would do well to meet that consumer demand in a sustainable way. With decreased dependence on ocean aquafarms until we can better ensure limited detrimental impacts to the ocean ecosystem, re-vamped land aquafarms, and more sustainable feed, achieving this goal seems possible.

## Offshore Wind

Another opportunity for oceanic resources involves offshore wind energy. While world energy consumption is expected to grow about 28% between now and 2040, at least 80% of the energy currently used on a daily basis comes from fossil fuels, such as oil, natural gas, and coal, which produce large quantities of carbon dioxide (CO<sub>2</sub>) when burned. Increasing CO<sub>2</sub> emissions warm the planet by trapping heat in the atmosphere. The impending threat of climate change, which is causing drastic fluctuations in global temperature, wind patterns, and precipitation, coincides with our urgent need for carbon-free energy sources. In combination with other renewable energy sources, offshore wind turbines can help us combat climate change.

As Philip Duffy of The Woods Hole Research Center put it at conference, wind is a limitless and free source of energy. Turbines can be placed anywhere and once they have been installed, there are few maintenance or operational costs associated with generating wind power. Wind can also generate energy much more efficiently than other renewable sources, particularly solar. One 250-kilowatt (KW) wind turbine can



generate the same amount of energy as 2,500 solar panels—a soccer field’s worth—in the same amount of time.

Before the early 2000s, nearly all wind energy produced globally was produced by onshore farms because they require less advanced technology and infrastructure, yielding lower costs. Yet, we’ve seen more players in the offshore space because it is associated with significant benefits. Most importantly, the speed of wind tends to be faster and more constant offshore than on land, leading to greater, more seamless energy generation. Additionally, though costs associated with onshore structures are still lower, the cost of offshore turbines, including costs of installation and construction, are declining and will likely decrease further. In the United States, offshore wind project costs have fallen 75% since 2014.

One complication in the wind energy space at-large is the issue of acquiring appropriate transmission lines to deliver power to areas of high demand. Thankfully, research indicates that offshore turbines may have an accessibility advantage. In the United States, as in many other countries, the regions with the most energy-generating potential for onshore wind tend to be far from areas of high population density, requiring complex transmission solutions for power delivery. While transmitting energy from ocean turbines is complex in its own way, optimal offshore wind locations in the United States are along the coasts, near major cities, and areas of high energy need.

Unfortunately, the accessibility advantage won’t help offshore wind overcome its struggle with regulators. To utilize existing transmission lines or construct new ones, firms must undergo a lengthy, multi-agency approval process. This process can get political, especially when there are competing energy interests at stake. The Atlantic Wind Connection saw this dynamic play out in early 2013, when it released a multi-year plan to lay transmission lines off the coasts of New Jersey and New York that were capable of bringing 3,500 megawatts (MW) and 2,400 MW of power into the states, respectively. Yet, in part

because of an influx of cheap natural gas production, federal and state political leaders never got behind the proposal. Today, the consortium hopes smaller versions of the large project can be approved by individual states.

Despite these challenges, firms are charging ahead with the development of new technologies for offshore wind that could further increase efficiency, reduce costs, and garner the political support it needs. Floating wind farm technology will open up much larger areas of the ocean to development, as developers won’t be constrained by anchoring their structures to sea beds in shallow waters. Last year, the Norwegian company Equinor developed a 30 MW floating wind farm demonstration project, “Hywind”, off the coast of Scotland that is now operating successfully. Additionally, the emergence of autonomous drone technology and artificial intelligence (AI) will save firms time and money in basic maintenance costs for offshore farms. A fascinating example of such technology comes from a London-based firm, Bladebug, which has developed a robotic crawler (with the same name as the firm) that can operate even in very windy conditions, when flying drones may not be efficient.

There is no doubt that obtaining appropriate transmission for offshore wind is a true challenge that industry, government, and other partners will need to tackle head on. However, with increasing private sector interest in offshore wind, emerging technologies, and substantially lower costs, won’t all parties be incentivized to work together to find transmission solutions? It would appear that offshore wind is here to stay.

The changing landscapes of the aquaculture and offshore wind industries further underscore the truism that the ocean represents a vast landscape of untapped opportunity. The innovation in these two industries barely scratches the surface of all the possibilities that humans can explore to harness the ocean’s power. Working together to fully take advantage of ocean resources, we can change our current course, save our future, and protect our blue planet. ●

“We have yet to find a perfect way to generate electricity, and yet electricity-needs continue to grow.”

Laura Beane, *President & CEO, Avangrid Renewables*

## SECTION THREE

# Weathering the Geopolitical Storm?

The ocean has brought societies across the globe closer together. Historically, the ocean has been a reliable venue for commerce and diplomacy. Ancient Greece and the Roman Empire relied on the Mediterranean Sea to spread their influence. Explorers were motivated to reach the East by way of the sea, when the silk road spanning across Eurasia was disrupted by geopolitical rivalry between European Christendom and the Ottoman Empire. During China's Ming Dynasty, Admiral Zheng He led seven maritime expeditions that reached as far as Africa's east coast, promoting cultural exchanges and leaving a remarkable accomplishment in global seafaring history.

Fast-forward to the 21st century; the ocean is still indispensable to the international economy and in politics, perhaps more than ever. The fact that the ocean surrounds every continent, combined with the cost-effectiveness of merchant shipping, makes maritime transportation the preferred platform for global trade. According to the International Chamber of Shipping, around 90% of all world trade is carried-out by ships traversing the ocean. There are over 50,000 merchant ships in the world, employing over a million crew members. In 2017 this world fleet had a commercial value of \$829 billion. While impressive in itself, shipping is part of an even larger

ocean economy. Described as the "blue economy", it refers to economic activities conducted by the coasts or directly related to the ocean. The United Nations has estimated that the blue economy has an annual economic value of \$3-6 trillion, accounting for about 5% of the total global economy and supporting over 3 billion people's livelihoods. As the world continues to try to overcome the economic restraints imposed by fixed territory, the blue economy will continue to expand in size and importance.

## Sea Lines of Communication

The sheer volume of maritime trade makes some stretches of the ocean especially valuable. Commonly referred to as "Sea Lines of Communication (SLOCs)", they are composed of vital—even irreplaceable—sea routes that sustain the movement of goods for major economic centers on different continents. Perhaps the most important SLOC is the 550-mile long Strait of Malacca that borders Singapore, Malaysia, and Indonesia. As the shortest route connecting the Pacific and Indian Oceans, it allows around 40% of world trade to pass through every year, including the supply of energy to the gigantic East Asian market. Another major SLOC chokepoint is the Panama Canal that connects the Atlantic and Pacific







Oceans. About 15,000 ships pass through this narrow canal annually. Often, they have to line up on both ends of the canal to wait for their turn. On the other side of the planet, the Strait of Hormuz connecting the Persian Gulf to the Gulf of Oman serves as the world's maritime oil pipeline, with a third of the world's oil passing through every day.

Given the existence of these strategic SLOCs, it is no surprise that the ocean remains ripe for geopolitical competition. Major powers still regard the ocean as essential to their safety, prosperity, and influence. Shadows of international politics lurk around every major SLOC. The United States Navy frequently operates in the Strait of Hormuz, often in close proximity to forces of its regional rival, Iran. Recently, Panama shifted its statehood recognition from Taiwan to Mainland China, a major diplomatic victory for the People's Republic, as it aims to strengthen its clout in Central and South America, which necessitates unimpeded access to the canal. More unsettling, certain maritime regions have the potential to initiate shooting conflicts. Four major maritime hotspots fall into this category: the South China Sea, Eastern Mediterranean and the Black Sea, the Baltic Sea, and the Arctic Ocean. How will the different parties approach and solve their conflicts in these maritime hotspots? The answer to this pressing question will determine

if the ocean serves as a venue for peace or a source of hostility. Former Supreme Allied Commander of NATO, Admiral James Stavridis highlighted several geopolitical oceanic hotspots, defined by key rivalries, during his speech at *The Ocean's Turn?* conference.

## United States—China Rivalry

The South China Sea (SCS) arguably represents the most holistic challenge in terms of maritime security among the major hotspots. It reflects the competition between China and the United States, while directly affecting numerous regional powers such as Vietnam, the Philippines, and Taiwan. The SCS dispute has such geopolitical ramifications that powers outside its immediate vicinity, such as Japan, Australia and even France and the U.K., have begun sailing their naval vessels in the region. While the SCS is rich in natural resources and encompasses major shipping routes, the dispute is a strategic competition between a rising China and the United States alliance network.

For China, reclaiming its historical rights in the SCS is a stepping stone to its government's stated mission of national rejuvenation. To maximize its security and to restore the glory of Admiral Zheng He's era, China has been drastically modernizing

and expanding its fleet while taking an assertive stance on the maritime front. China's "Century of Humiliations" saw foreign invaders exploiting China's weakness at sea, leaving the country with a hypersensitive, historical memory to any perceived maritime challenge. Over the decades, this memory has crystallized into what can be named the "Malacca Mentality", a fear of being powerless, unable to prevent hostile forces from interrupting China's SLOCs near the Malacca Strait.

Consequently, China possesses a zero-sum view of the SCS, with a distrust of any other power that claims to uphold regional stability. Unfortunately, this distrust is shared by the United States, who has deemed its presence in the region constructive and legitimate since World War II and is suspicious of the true motives behind China's recent naval expansion. United States suspicions are manifested in China's island-building campaigns in recent years. Whereas China regards the campaigns as defensive measures against United States hegemony in its backyard, the United States and its allies view them as challenges to the regional status quo. The United States also views China's "Maritime Silk Road", a leg of China's "One Belt One Road" initiative, as a thinly-veiled attempt to extend its geopolitical influence far into the Indian Ocean. It is unrealistic to expect these glaring differences to be solved soon, as they



**Peter Chang**, CEO, Hanaqua Tech

are about competing worldviews and historical memories at their core, but it is imperative that China and the United States refrain from embarking on a collision course over the SCS.

## United States—Russia Rivalry

Insomuch as the Sino-United States competition in the SCS can be regarded as a relatively new phenomenon, another part of the ocean is experiencing the revival of age-old rivalry dating back to the Cold War. In the Eastern Mediterranean and the Black Sea, the United States and its NATO allies are confronting Russia, yet again, on the ocean. The United States Navy is determined to maintain a presence in the Black Sea, which it fears is increasingly dominated by Russia, particularly after Russia's annexation of Ukraine's Crimean Peninsula in 2014. As a response, Russia is strengthening its Black Sea Fleet to counter the Western presence, resulting in multiple instances where the two camps have operated closely to each other with aggressive maneuvers.

On the northern edge of the European continent, the Baltic Sea is equally filled with geopolitical rivalry. The Baltic Sea carries around 15% of the world's maritime cargo traffic and is rich in fishery resources. For the three NATO nations of Estonia, Latvia, and Lithuania, the Baltic Sea is their indispensable connection to the West. For Russia, it is a vital link to its enclave, Kaliningrad,



**Douglas Hsu**, Director-General, Taipei Economic & Cultural Office in Boston



“Oceans cover 71% of the planet and they’re an increasingly important resource, yet only 5% of oceans have been studied.”

Ravijit Paintal, CEO, Autonomous Marine Systems

and overall exports, with around 50% of its cargo shipping sailing through the Baltic. In light of Russia’s annexation of Crimea, NATO has bolstered its defense of the Baltic region as well. In any potential conflict between Russia and NATO, the Baltic maritime hotspot would be critical, as it would determine whether NATO can timely and successfully reinforce its three Baltic members.

## The Arctic

Further north, the Arctic Ocean is the maritime hotspot capturing the most attention. Ironically, this is primarily due to the fact that the Arctic region is becoming “hotter”: climate change has reduced the presence of sea ice in the Arctic Ocean, allowing new shipping routes to emerge and more resources to be extracted. If cargo traffic can sail through the North Pole area, the time it will take for a container ship to travel from East Asia to Europe or the Eastern seaboard of North America will be greatly reduced. In fact, the most favorable projection maintains the voyage can be completed in less than three weeks, yielding considerable times-savings over the existing southern routes that pass through the Malacca Strait or the Panama Canal. Although the varying sea ice levels year-to-year make the route too treacherous for most marine traffic to utilize at this point, the inevitable rise in Arctic temperatures will make the route practical in the coming decades.

In a sense, the Arctic Ocean is truly the last frontier within the last frontier. Climate change has stimulated a scramble for influence in the previously-undisturbed Arctic. Russia, which possesses a long Arctic coastline, has already announced its claim of underground Arctic territories and is heavily investing in infrastructure along the coast. It intends to tap into a large portion of the Arctic energy reserve, which is valued at about \$35 trillion in total, to supply between 20 and 30% of its total oil and gas production by 2050. The United States, usually enjoying the upper hand in the maritime domain vis-a-vis Russia, is undergoing a rude awakening regarding its serious shortage in Arctic operability. Compared to Russia’s forty icebreakers in service, the United States only has five, and the United States’s current Arctic infrastructures are incapable of supporting the sustained presence of its naval forces. Acknowledging the power disparity, the United States is scrambling to acquire more icebreakers and cooperate with its



Arctic partners, such as Canada and Norway, to increase its influence in the region. China, having neither territorial claim nor military presence in the region, is nonetheless an impactful Arctic actor as well. Using its financial clout, China has heavily invested in Greenland and Iceland, promising to extend its ambitious “Maritime Silk Road” project to the Arctic. This raises concerns in the West that it might seek strategic and military gains from its economic presence.

Despite the tension that is unfolding in the Arctic region, compared to the other three major hotspots, it offers the greatest opportunity to construct a positive, multinational collaboration system for peaceful development. The Arctic has not been the main battleground for any war and the harsh environment will continue to restrain large-scale military operations in the region. Moreover, the current cooperative model governing Antarctica serves as a beneficial precedent for similar regimes to be established in the Arctic. With all these potentials, will the Arctic become a much-needed zone of cooperation instead of another zone of conflict?

The same question matters for the entire ocean. The ocean is one of nature’s many gifts to human beings and it is up to our collective wisdom to prevent it from evolving into a platform for animosity. History has illustrated that the ocean can bring overwhelming collective benefits to society as a whole, when serving as a venue for peaceful interactions and commerce. Although the ocean may no longer be a powerful buffer separating hostilities, due to the advent of modern weaponry, we can hope its everlasting tranquility will be respected and maintained throughout our time and beyond. ●



“By 2050, there may be more plastic than fish in the ocean.”

**Lina Azuero**

*Corporate Sustainability Strategist, Dell*



## SECTION FOUR

# Life Worthy of Our Protection?

Our economy, security, and prosperity all require a healthy ocean. Yet, we're seeing some deeply concerning indications that the well-being of our ocean is in jeopardy. Every year, an estimated 8 million metric tons of plastic enters the ocean and is often ingested by animals, leading to their illness and death. Ocean "dead zones", which are areas with insufficient oxygen levels to support life, are doubling every ten years primarily due to pollution. We're also seeing huge population declines among certain marine species. In Australia, over the past decade, the number of large fish species (over 20 cm in length) has declined by 30%. The devastating impacts of human activity is taking its toll on the deep blue.

About half of the global carbon cycle is managed by ocean-residing organisms that consume carbon dioxide (CO<sub>2</sub>) and produce oxygen through photosynthesis, reducing the amount of CO<sub>2</sub> in the ocean and atmosphere. The ocean also controls global weather patterns and regulates atmospheric temperatures by storing heat and distributing solar radiation in its currents. Most importantly, the ocean hosts diverse ecosystems. Every year, almost 2,000 new marine species are discovered. On tropical coral reefs, there can be as many as 1,000 species per square meter. With this biodiversity, productivity is maximized to the benefit of humans, as each species has its own niche. For example, certain species of algae grow best in strong light, while others thrive in conditions with weak light. Thus, the two species can optimize photosynthesis without infringing upon the other's needs.

### **Ocean Plastic**

Given the state of our ocean and the life it supports, preserving the deep blue is of the utmost importance. Fortunately, there

are some encouraging signs that humans are starting to prioritize ocean protection. Certain private and public sector players are acknowledging the impact they've had and are working to reverse the damage. One focal point in recent years has been combatting ocean plastic waste. Increasing consumer awareness, stemming in part from powerful marketing campaigns with celebrity appearances and viral videos of plastic entangling animals, has helped bring single-use plastic, like plastic straws, to the forefront of this battle.

From a regulatory perspective, we've seen some major commitments from countries, states, and cities across the globe. Tourists at Peru's Machu Picchu produce an average of 14 tons of waste per day, a large portion of which is plastic bottles. As of 2019, tourists will no longer be able to bring single-use plastic into the lost city, nor to any of Peru's other natural and cultural protected areas. Meanwhile, bans on the retail use of plastic bags have been implemented in Chile, China, Kenya, and France, among other countries. In the United States, both California and Washington, D.C. have implemented partial bans on plastic straws.

These regulations only matter if private sector players are stepping up to do their part—and thankfully, many of them are. Companies are understanding that the true challenge is not only to develop a recyclable product, but to reverse engineer the plastic problem by collecting, deconstructing, and reusing the vast amounts of the material presently in the ocean. In order for firms to truly solve the problem, countries must maintain circular economies, with the full integration of collection and reuse. Such a cycle can be extremely difficult to establish in developing countries where waste collection, management, and recycling infrastructure may be virtually non-existent.



“The issue we have with plastics is not coming from the ocean, it is coming from land.”

**Michael Goltzman F'97**

*Vice President, Global Public Policy, Environmental, The Coca-Cola Company*

Fortunately, there is some innovative work happening in this space. To prevent plastic from entering the ocean, NextWave, a coalition of companies and organizations, employs individuals living along coast lines to collect discarded plastic within 30 miles of a coastal area or waterway. The collected plastic is then shipped to manufacturers for reuse. Large corporations, like The Coca-Cola Company, are also taking action by investing in sustainable resources and biodegradable plastic bottles. PepsiCo, Coca-Cola, Procter and Gamble, Danone, Unilever, and Dow, partnering with investment firm Circulate Capital, have committed to \$90 million in funding to address the plastic waste issue in Southeast Asia by improving collection on the ground and creating markets for collected material. A cutting-edge solution is also being developed by a Canadian company, Plastic Bank. The firm is using blockchain technology to allow locals in developing countries to trade collected plastic for goods and services, like cooking oil and health care.

Similarly, a strong commitment to reusing ocean plastic has emerged from the apparel industry and, as Vik Saran of New Balance explained at *The Ocean's Turn?* conference, firms need not forsake traditional design, nor quality control standards to develop sustainable products. Nike and New Balance have been using recycled plastic from water bottles in their shoes for

years. Most recently, Adidas partnered with an environmental organization called Parley to develop a shoe entirely comprised of ocean plastic. Adidas announced it had sold over a million of these shoes in March, 2018.

## **Cosmetic Pollutants**

There has been significant progress in combating ocean plastic waste, yet we've failed to allocate similar time and effort to other issues that are negatively affecting our deep blue lifeline. One major uphill battle involves preventing chemical pollutants from entering the sea, especially those found in our daily personal care products. Cosmetics are filled with synthetic chemicals that, when washed off, make their way down the drain and into the ocean. There is evidence that many of these chemicals are contributing to species die-off and environmental degradation. For one, studies have demonstrated that parabens—a class of preservatives that protects against bacteria—is a hormone disruptor in many different species of aquatic wildlife. The same is true of triclosan, another antimicrobial agent similar to parabens. Additionally, UV-filters, which absorb ultraviolet radiation in sunlight, have been associated with coral bleaching, while microbeads (tiny pieces of plastic) mainly found in exfoliating skin products are easily ingested by sea creatures.



# “We [the industry] have to catch up because consumers are aware of the plastic problem.”

Vik Saran, *Director of Materials, Asia, New Balance*

Limiting this chemical outflow into our ocean has been tackled tepidly by regulators and companies. In the United States, the Food and Drug Administration (FDA) has largely left the cosmetics industry alone, in part because the FDA is not empowered by law to regulate cosmetic ingredients. That could change in coming years if one of many legislative proposals becomes public law. In contrast, Canada and the European Union (E.U.) have banned and restricted hundreds of chemicals from cosmetics, while the E.U. has even included limits on the use of parabens. Bans on microbeads in health and beauty products are taking effect in a handful of countries, including the United Kingdom, Canada, New Zealand and the United States. Taken together, however, can these piecemeal restrictions in a select number of countries attain the level of impact we need to make significant changes to the mix of chemical pollutants in our ocean?

Looking at the private sector, most beauty companies have only paid lip service to the concept of cleaner, safer cosmetics, though some are beginning to shift gears. “Big beauty” tends to maintain some ambiguity around how it’s limiting chemical pollutants in its products. According to the senior director of skin care merchandising at Sephora, the firm’s “Clean at Sephora” initiative is “grounded in a ‘free of’ ingredient perspective,” yet the firm doesn’t specify free of what. When microbeads were swept up into the movement to combat ocean plastic, Johnson & Johnson and Proctor & Gamble voluntarily pledged to phase out their use. Yet, this may speak more to the power of the movement, rather than to a true commitment to changing the composition of cosmetic products.

The good news is that companies like Aveda, Neal’s Yard Remedy, and smaller, emerging firms, are taking action to appeal to the eco-conscious consumer. Some of these firms are focusing on including natural elements like avocado, coconut, or almond in their products. However, transitioning to these ingredients has its own sustainability challenges. Such an approach is not scalable without using vast amounts of crops for beauty products instead of for food, not to mention potentially deteriorating water scarcity. Making the shift away from chemical pollutants to sustainable ingredients must be done carefully. Keracol Limited, based in the United Kingdom, is an example of a smaller firm attempting to do just that. The company produces cosmetic products primarily using food waste and recently partnered with multinational retailer, Marks & Spencer, to sell a set of skincare products developed from wine producers’ wasted grape skins.

When it comes to fighting ocean pollution, consumer demand in shaping the policies of both governments and companies cannot be understated. The more frequently consumers prioritize ocean preservation the more concrete steps we’ll see. We have a long way to go, especially when it comes to chemical pollutants, but the ocean plastic movement is a clear illustration of what we are capable of when consumers, regulators, and firms get on the same page. It is also an indication that humans across the globe are finding it increasingly difficult to ignore how the ocean supports us—and how worthy of our protection it truly is. ●



Ocean Pollution

## SECTION FIVE

# What Can Be Done?



Though we're on the right track, there is still much to be done to fully develop our ocean perspective. In order for this perspective to materialize, the private sector, public sector and active citizens all need to do their part. With further action from each part of this trifecta, we will come closer to achieving the ocean's true potential.

To further strengthen the Blue Economy, **businesses** must continue promoting innovation. Further investment in game-changing technologies for autonomous vessels, offshore wind energy, and aquaculture are critical to bringing down costs and expanding use. Firms involved in the aquaculture space have a responsibility to innovate with the goal of minimal environmental damage at the forefront, giving equal weight to water treatment and reuse, the release of pollutants into surrounding ecosystems, and the well-being of fish. Specific to the maritime industry, as the Blue Economy becomes increasingly reliant on data analysis and internet technologies, it must make sure that cyber protection goes hand in hand with innovation. Industry safeguards should be routinely updated vis-a-vis cyber threats, since these threats fall outside of the traditional definition of risks.

For the **government's** part, the public sector must do a better job of creating the right incentives for private sector best practices and should ensure that regulation keeps pace with industry advancements. For one, policymakers across the globe must step up to ensure circular economies of re-use for plastic waste. Whether through more robust recycling programs or tax incentives for plastic-heavy firms who reuse

their material, there are many ways the government can support such action to the benefit of the ocean. Additionally, regulators should match the increasing industry interest in the further development of wind farms (especially offshore) and revamp the permitting process for the use and construction of transmission lines. Should the transmission approval process remain complex, the wind industry will surely be deterred to the detriment of clean energy as a whole.

The **public** is at the core of a comprehensive ocean perspective. The more people do their research in order to support firms that are breeding fish in sustainable aquaculture fisheries, or buy ocean-friendly cosmetic products, the more the private sector will align with these consumers. The more we vocalize our concerns about ocean protection to the government, the more the public sector will respond. Individuals also have a responsibility to develop eco-conscious habits, like refraining from using plastic straws and ensuring proper recycling. Though we may feel powerless at times, we the people have the tools to push businesses and government in the right direction, while taking the small steps that we can to make a difference at the individual level.

A better understanding of the ocean and the ability to harness its power will dictate our security and welfare during this century and beyond. The future of the ocean should not only concern those who live on the coasts or those whose livelihoods are deeply intertwined with the deep blue. Rather, as the origin of life on earth, the ocean deserves the attention of all. ●



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