Educating the Ocean Leaders of Today for the Ocean of Tomorrow

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Introduction

The ocean and coastal areas of the world are changing, but we—as societies, economies, and individual decision-makers—for the most part, are not. We are learning that the social-ecological coastal and ocean system of the coming decades will be significantly different from today—physically, energetically, chemically, and biologically. It will also be under rising pressure from social, economic, and technological developments brought about by hundreds of millions more people populating, further developing, and urbanizing these increasingly vulnerable areas. Present governance regimes that frame our laws, policies, and institutions at global and regional levels will have to adapt more quickly and in a more coordinated way than the piecemeal approach to adjusting current regulations taken to date.

So it is imperative that the International Ocean Institute (IOI) develop the capacity of ocean leaders on the magnitude and significance of these changes in the coastal and ocean system itself, on the growing pressure being exerted on its living and non-living resources, and on the evolving approach to ocean governance. We must also emphasize that the next generation of ocean leaders will be equipped with a deep sense of appreciation to take proactive planning decisions today; we must prepare them for this emerging reality and offer the theoretical knowledge and the practical skills and tools that can be applied in coastal nations around the world.

The IOI Training Portfolio

This is where the International Ocean Institute portfolio of training and capacity development courses in ocean governance comes in. It is also where the IOI must enhance, and rigorously build into its strategy and teaching orientation, the steps necessary to ensure that the professionals trained are equipped with ocean-focused vision, knowledge, and skills that will allow them to understand and motivate them to act on the growing evidence and projections.
on the changing ocean and coasts. They must also be fully prepared to take or actively promote practical steps now to adapt, protect, and sustain the coastal and ocean system in this near future of profound change. Carrying on as if these changes are minor or of debatable significance and require no changes on society’s part, does not seem like a rational plan.

The core of the 101 capacity development courses over the years has proven to be sound.\textsuperscript{1} They provide in-depth coverage of the legal, scientific, social, ethical, moral, economic, and ecological dimensions of ocean governance and address the holistic and interconnected nature of the ocean, coasts, and human well-being. The knowledge and skills imparted to participants—comprehension of the wider engagement in ocean governance beyond their areas of specialization; communication and negotiation skills; policy formulation and rule-making; sustainable ocean governance practices; and identifying current and, now more than ever, future challenges to ocean governance—prepares these ocean leaders for the ocean challenges of today and tomorrow. This has worked well for decades. But as detailed below, the ocean and coastal system is changing rapidly and fundamentally, and the 101 training and capacity development programs must similarly adapt and stay ahead of this curve.

The Changing Coasts and Ocean

Coastal and ocean areas are under assault from both the land and the sea. From the land, we continue to discharge carbon, nitrogen, and other emissions into the atmosphere and inadequately treated effluents and their constituent chemicals from cities, industries, and farms into our coastal waters.\textsuperscript{2} We destroy critical coastal habitats such as beaches, mangroves, coral reefs, and seagrass beds for coastal development and economic growth\textsuperscript{3} in a process referred to as ocean sprawl.\textsuperscript{4} We continue to deplete fish stocks, both legally and illegally at an alarming rate.\textsuperscript{5} And now, many coastal nations are expanding

\textsuperscript{1} \textit{“The International Ocean Institute,” Ocean Yearbook 31 (2017): xvi–xxii.}

\textsuperscript{2} A. Borja, et al., “Overview of Integrative Assessment of Marine Systems: The Ecosystem Approach in Practice,” \textit{Frontiers in Marine Science} 3, no. 20 (2016), doi.org/10.3389/fmars.2016.00020.

\textsuperscript{3} L.H. Pendleton, O. Thebaud, R.C. Mongruel, and H. Levrel, “Has the Value of Global Marine and Coastal Ecosystem Services Changed?” \textit{Marine Policy} 64 (2016): 156–158.

\textsuperscript{4} E.C. Heery, et al., “Identifying the Consequences of Ocean Sprawl for Sedimentary Habitats,” \textit{Journal of Experimental Marine Biology and Ecology} 492 (2017): 31–48.

\textsuperscript{5} Food and Agriculture Organization of the United Nations (FAO), \textit{The State of the World Fisheries and Aquaculture: Contributing to Food Security and Nutrition for All} (Rome: FAO, 2016).
or pursuing new ocean uses under the banner of a Blue Economy,\textsuperscript{6} whether reasonable or not, sustainable or otherwise.

A seminal report by the Organisation for Economic Co-operation and Development (OECD) on the ocean economy in 2030 highlights several important demographic, economic, social, environmental, technological, and governance trends, as well as major uncertainties and risks, that are influencing world developments and, by extension, the ocean economy and marine ecosystem health.\textsuperscript{7} The OECD reports that a wide range of global trends and macro-factors are set to influence the longer-term development of the ocean economy. We can expect that their combined effect will cut both ways. On the one hand, many of these developments hold out the promise of expanding economic, social, and health-related opportunities through ocean use; on the other, they point to a further increase in the pressures already weighing heavily on the ocean’s capacity and health. At the heart of expansion in the ocean economy are population growth, urbanization, and migration to and development of coastal areas. Rising incomes and the growing middle classes with higher-end dietary choices and consumer appetites are adding to the pressure. Ageing populations in developed countries will also continue to favor coastal areas for vacation and/or retirement homes and motivate the medical and pharmaceutical communities to accelerate marine biotechnological research into new drugs and treatments. All of this is bringing increased pressure on the coasts and the ocean. Indeed, our uses and abuses of the ocean to date have seriously compromised the very foundations of the ocean and coastal system and led to growing marine environmental degradation and the consequent costs of an under-performing ocean economy, loss of essential ecosystem goods and services (which largely sustain the former), increased use conflicts, and challenging legal questions.\textsuperscript{8}

\textbf{An Existential Threat}

The profound changes that are taking place on our coasts and in our ocean represent, quite frankly, an existential threat to our societies, economies, and ways of life. In addition to the traditional pressures discussed above, the ocean

\footnotesize\textsuperscript{6} United Nations Environment Programme (UNEP), \textit{Blue Economy: Sharing Success Stories to Inspire Change}. UNEP Regional Seas Report and Studies No. 195 (Nairobi: UNEP, 2015).

\footnotesize\textsuperscript{7} Organisation for Economic Co-operation and Development (OECD), \textit{The Ocean Economy in 2030} (Paris: OECD, 2016), doi.org/10.1787/978926425724-en.

\footnotesize\textsuperscript{8} Global Ocean Commission (GOC), \textit{The Future of Our Ocean: Next Steps and Priorities} (New York: GOC, 2016).
is now warming, rising, deoxygenating, and acidifying,\textsuperscript{9} and filling with plastic at an alarming pace.\textsuperscript{10} The Intergovernmental Panel on Climate Change highlights that storms are becoming more frequent and intense, and precipitation patterns and ocean currents are shifting. Coasts are also eroding at an accelerating pace, coastal aquifers are being inundated with salt water, fish stocks are overexploited and depleted, coral reefs are dying, and mangroves and seagrasses are being lost. We are also witnessing early-stage changes in the distribution, composition, and abundance of many living marine resources and system-changing regime shifts in several ocean ecosystems.\textsuperscript{11}

Our most vulnerable coasts, particularly deltas, estuaries, and low-lying coasts and islands, already under considerable stress, are now receiving the majority of a growing global population (2.2 billion more people by 2050). Coastal settlements are growing rapidly and are increasingly urban with all that entails (consumption, energy use, waste disposal, and subsidence). We are also aggressively modifying, developing, and armoring the coast to accommodate our growing societies and economies.\textsuperscript{12} Yet we cling stubbornly to the view that we can continue to live safely and even more intensively at the water’s edge, that we can develop and modify the coast and its social-ecological structure at will without consequences, and that the ocean will continue to provide the goods and services where and at levels we have traditionally relied upon them. These do not seem to be reasonable assumptions or sensible planning scenarios. Neither are they an acceptable \textit{status quo} in the 101 capacity development syllabi.

Common sense would have societies initiate and undertake proactive steps today, including, \textit{inter alia}, managed retreat from vulnerable coastal areas, protecting and restoring the coastal habitats that sustain and protect us, implementing future-oriented ecosystem-based fisheries management, developing alternative livelihoods, and preparing for climate migration.\textsuperscript{13} For the

\begin{itemize}
\item[9] Intergovernmental Panel on Climate Change (IPCC), \textit{Climate Change 2014: Synthesis Report, Contribution to Working Groups I, II and III to the Fifth Assessment Report of the IPCC} (Geneva: United Nations, 2014).
\item[10] M. Eriksen, et al., “Plastic Pollution in the World’s Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea,” \textit{PLoS ONE} 9, no. 12 (2014): e111913, doi.org/10.1371/journal.pone.0111913.
\item[11] United Nations, Division for Ocean Affairs and the Law of the Sea, Office of Legal Affairs, \textit{First Global Integrated Marine Assessment} (New York: United Nations, 2016).
\item[12] B. Neumann, A.T. Vafeidis, J. Zimmermann, and R.J. Nicholls, “Future Coastal Population Growth and Exposure to Sea-level Rise and Coastal Flooding—A Global Assessment,” \textit{PLoS ONE} 10, no. 3 (2015): e0118571, doi.org/10.1371/journal.pone.0118571.
\item[13] L.P. Hildebrand and N.A. Bellefontaine, “Ocean Governance and Sustainability” in \textit{Shipping Operations Management}, eds. I.D. Visvikis and P.M. Panayides (New York: Springer International, 2017), 231–248.
\end{itemize}
most part, unfortunately, we are moving in the opposite direction. What does this trajectory hold for our societies and economies, and what should be the training and capacity development priorities the IOI must emphasize and impart?

Future Orientation

Looking further into the future, the coasts will not be where or as they are today (eroded and flooded), coastal cities, large and small, as well as some island nations will be lost, the fish and other living marine resources that so many of our societies are tied to spatially and dependent on today will not be available to us (overexploitation, redistribution and regime shifts), and climate conditions will make many areas uninhabitable.\textsuperscript{14} How will society cope and how does the IOI prepare the ocean leaders for this future?

We do so by adding stronger emphasis in the IOI training curriculum on providing a more in-depth understanding of the conditions we will face in a future ocean. The curriculum must be updated and more future oriented to understand and present the profound changes the ocean system is undergoing and the steps we need to take today, to prepare for this new reality.

To test this approach, I posed a question in a course assignment in 2017 in the Master of Science specialization ocean sustainability, governance, and management at the World Maritime University, Sweden, a course inspired by the IOI capacity development course syllabi. The challenge posed and the question issued to the students was to research and document the projected changes to the coastal and ocean ecosystems of their country in 2050 and discuss what this will mean for the national economy, society, and communities. The second part of the assignment required them to develop a national plan of action that could respond to these projected changes and could be initiated today. The students found the future-orientation of this assignment challenging and highly relevant and explored it with open, but uncertain minds. While their findings made clear to them the significant scope of the changes coming to their national coastal zones (e.g., complete loss of beach systems and associated gross domestic product, flooding of communities and major infrastructure), their recommended goals were, at best, aspirational in scope (e.g., achieve a sustainable Blue Economy). And the recommended action was disappointingly timid (e.g., need for better education and stronger political will).

\textsuperscript{14} L.V. Weatherdon, et al., “Observed and Projected Impacts of Climate Change on Marine Fisheries, Aquaculture, Coastal Tourism, and Human Health: An Update.” \textit{Frontiers in Marine Science} 3, no. 48 (2016), doi.org/10.3389/fmars.2016.00048.
This exercise demonstrated that even when we are presented with, or discover for ourselves through research, the dramatic changes coming to most coastal and ocean social-ecological systems, we find it difficult to imagine and push for the bold actions that will be required to prepare us for these changes. Clearly, contemplation will not suffice. Therefore, the IOI portfolio of ocean governance capacity development courses must place much more emphasis going forward on providing an in-depth understanding of the profound changes that are coming to our coastal and ocean communities, societies, and economies. We must be working with our course participants on bold, but practical, actions that will prepare and empower them to lead the adaptation to the future ocean. In other words, the IOI courses need to be about ocean literacy—understanding the ocean’s influence on us and our influence on the ocean—with a focus on preparing for change.