Marine Spatial Planning (MSP) as a Public Policy Instrument in the New Global Order: Bridging Underwater Domain Awareness, Governance

Abstract

The underwater domain has become increasingly vital for strategic competition, ecological resilience, and digital connectivity, necessitating enhanced governance and management. In this context, Marine Spatial Planning (MSP) is evolving beyond a technical tool for ocean zoning to become a policy instrument that can convert Underwater Domain Awareness (UDA) into tangible, multifaceted governance results.

This research note examines MSP performance nationally, regionally (Indo-Pacific), and globally, with a focus on its impact on underwater policy in a time of shifting geopolitical alignments, climate change, and infrastructure development. Specifically, Indo-Pacific emphasizes the critical need for strategic, inclusive, and adaptive spatial governance as it sits at the junction of geopolitical rivalry and ecological diversity.

This note assesses the current landscape using an eightfold policy viability framework that covers political, social, technological, financial, institutional, legal/judicial, emotional, ecological, and spatial aspects. Seen through this prism, it highlights both new avenues for MSP to grow into a dynamic, intelligence-driven governance system and significant policy and implementation gaps. Ultimately, the paper argues that MSP must be recognized as a fundamental mechanism in the underwater policy toolkit, necessary to balance national interests, regional cooperation, and sustainable ocean stewardship in a multipolar world.

Keywords: Marine Spatial Planning; Public Policy; Underwater Domain Awareness; Ocean Governance; Indo-Pacific;

Introduction:

As underwater environments become increasingly critical for global infrastructure, defense, ecology, and cultural identity, they take center stage, and policy discussions now center on the underwater frontier. Even with this increasing relevance, the growing complexity of underwater operations stands in sharp contrast to the present readiness of governance. Marine spatial planning (MSP) serves as the primary interface, converting knowledge (underwater domain awareness, UDA) into informed public policy. This research note proposes that MSP effectively converts UDA into public policy and generates a new feedback loop, improving understanding and polishing governance systems.

Conceptual frameworks

Underwater governance cannot depend on accepted solutions meant for land-based challenges. The fluid, transboundary, and largely invisible complexity of the ocean necessitates a reconceptualization of how policy is informed, developed, and implemented. First, clarifying the components of that process—public policy, Underwater Domain Awareness (UDA), and MSP —helps one to understand how Marine Spatial Planning (MSP) functions as a policy tool. These three elements create an interdependent system whereby awareness helps to plan and planning produces policy results.

Public policy is the deliberate actions governments take using legal tools, institutions, funding priorities, and administrative systems to solve public problems(OECD Observatory of Public Sector Innovation, n.d.). Though it generally governs land-based systems, public policy is gradually spreading into new spheres, most notably the ocean. Public policy guides long-term sustainability goals(Indian School of Public Policy, n.d.). Overlapping economic, ecological, and strategic interests coexist in marine environments, helping to balance competing claims and define access and usage rights.

This is especially relevant in underwater environments, where historically, jurisdictional uncertainty and data shortage have led to fragmented governance. Scholars note that, due to its shifting boundaries, disputed sovereignty, and increasing entanglement with national security and global trade, controlling the sea remains particularly challenging. Thus, public policy frameworks that are not only strategic and inclusive but also able to address the invisible and shared character of the underwater environment(Number Analytics, n.d.).

Effective marine policy depends on Underwater Domain Awareness, which follows from the need for informed governance. Under UDA, subsurface marine data are methodically collected, synthesized, and analyzed. Incorporated are sonar, seabed mapping, biological monitoring, undersea infrastructure tracking, and Indigenous knowledge systems.

UDA provides situational awareness of vessel movement, underwater acoustics, biodiversity distribution, and the locations of sensitive habitats and critical infrastructure beneath the ocean's surface(Maritime Research Center [MRC], n.d.). Governance without this awareness is only speculation. Effective marine policy relies on the UDA, as it provides early warning systems, intelligence for proactive decision-making, and ecosystem-based management.

There has to be a way to translate UDA insights into an organized government. This problem is addressed in marine spatial planning. Through Marine Spatial Planning (MSP), a

methodical, data-driven, and participatory process, states and regions allocate marine space for human activities, ensuring long-term sustainability. Map current uses and set future priorities across many economic sectors (e.g., fisheries, energy, shipping), cultural landscapes, and ecological zones.

MSP goes beyond zoning as a tool for control. This policy tool strategically plans concrete results using UDA data(Ehler & Douvere, 2009). This could entail the building of military corridors, special marine zones, undersea cables, or extractive industry sectors. MSP controls submarine intelligence.

Public policy, UDA, and MSP create a self-reinforcing governance cycle whereby awareness generates planning, which leads to policy; policy, in turn, results in mandates and investment for awareness. This dynamic cycle enables marine governance to adapt to changing ecological, technological, and geopolitical conditions, thereby ensuring the continued regulation of the ocean.

MSP Across Scales: Global, Indo-Pacific, and National Insights

Different legal frameworks and projects related to Integrated Marine Spatial Planning (MSP) and Underwater Domain Awareness (UDA) shape global ocean governance. Laying the fundamental legal framework, UNCLOS defines maritime zones and rights for environmental protection and resource management (United Nations, 1982). It allows laying submarine cables (Article 79.1, 58) but has "legal loopholes" concerning protection for vital underwater infrastructure, making cables vulnerable (Ghosh, 2024). This limits its incorporation of contemporary UDA needs. Establishing worldwide targets for sustainable ocean use, pollution reduction, and ecosystem conservation for 2020–2025, SDG 14 (Life Below Water) is United Nations, 2015. It advocates UNCLOS implementation (target 14.c). Reaching these objectives depends on MSP, particularly in relation to climate adaptation and Marine Protected Areas. Although SDG 14 supports MSP, its encouragement of UDA integration is indirect, focusing on the application of scientific knowledge and ecosystem protection (Targets 14. a, 14.2).

Shipping safety and environmental protection are under control by the International Maritime Organization (IMO). It is "Ships' Routeing" that sorts traffic and marks sensitive areas. Emphasizing ecological responsibility, the recent "IMO Net-Zero Framework" for decarbonizing shipping stresses allocating sea space and reducing environmental impact. IMO's resources help MSP, so indirectly supporting UDA.

Using its Ocean Action Agenda and Ocean Panel, the World Economic Forum (WEF) promotes a sustainable ocean economy. By 2025, the Ocean Panel seeks to sustainably manage 100% of national ocean areas, supporting thorough spatial planning. Their emphasis on "ocean knowledge" and "ocean finance" advances data-driven governance, necessary for MSP and UDA. Though direct UDA-MSP integration is a national or regional challenge, the WEF drives political will.

Aiming to triple marine areas under adequate MSP by 2030, IOC-UNESCO's MSP global Initiative drives efforts to standardize MSP and increase capacity. It generates guides on MSPs' relationships to the blue economy and climate change. Its clear emphasis on UDA as a separate element is still developing.

Overall, driven by sustainability goals, global frameworks provide a strong basis for MSP; however, thorough UDA integration remains a developing field that requires more targeted policy and international cooperation.

For MSP and UDA, the Indo-Pacific presents both opportunities and challenges due to its complex maritime dynamics, strategic chokepoints, rich ecological areas, and rapidly growing digital infrastructure. Often becoming geopolitical flashpoints, vital sea lines of communication (SLOCs) and strategic chokepoints, such as the Malacca Strait and the South China Sea, are essential for global trade and energy (Poling, 2013; Storey, 2015, pp. 51-52). Undersea capability increases this strategic relevance (Brewster, 2020, p. 53). Though human activity and climate change pose serious challenges to these ecosystems, the area is also home to incredible marine biodiversity including the Coral Triangle, which boasts over 76% of coral species (Veron et al., 2011; Burke et al., 2012; Carpenter et al., 2008, 54, 55, 56, 57). With militarization adding a security dimension (49), the fast-growing network of undersea telecommunications cables necessary for global data is vulnerable to accidental damage (70% from fishing and anchoring) and sabotage, especially in contested areas (ghosh, 2024; meta, 2023; Rimmer, 2021, 45, 46, 48, 49, 59, 60).

Emphasized by PEMSEA's (Partnerships in Environmental Management for the Seas of East Asia) move toward including MSP into its Integrated Coastal Management (ICM) programs, MSP in the Indo-Pacific is advancing (PEMSEA, 2015, 61, 62, 63). However, the smaller spatial limits of conventional ICM, as opposed to MSP and scattered rules, compromise complete institutionalization and legal protections for submarine cables (49, 65, 66). Often, insufficient UDA integration (4). Adopted in March 2025, regional projects, including the IOC Sub-Commission for the Western Pacific's (WESTPAC) Regional Action Framework for MSP,

stress cooperation and capacity development (WESTPAC, 2025, 67). Adopted in September 2023, the ASEAN Maritime Forum (AMF) and ASEAN Blue Economy Framework (ABEF) support a comprehensive approach to marine issues (ASEAN, 2010, 68, 69). Still, ongoing challenges include territorial conflicts and the need for legally enforceable protections for submarine cables (Ghosh, 2024; Valencia, 2013, pp. 49, 70). Indicating a strong regional commitment to MSP and data sharing, a significant Memorandum of Understanding (MoU) signed in April 2025 between the Indian Ocean Rim Association (IORA) and the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) proposes an MSP Taskforce with a Shared Data Observatory, thereby enhancing opportunities for Urban Development Area (UDA) integration (Press Information Bureau, 2025, p. 71). The geopolitical complexity of the Indo-Pacific and the opaque underwater domain mean that even while MSP projects are under development, there are significant difficulties fully integrating UDA, hence underscoring the need for more regional cooperation and investment in indigenous UDA capability.

With its long coastline and strategic location in the Indian Ocean, India prioritizes integrated ocean governance through Marine Spatial Planning (MSP) and the development of a robust Blue Economy. Although they also highlight essential institutional and policy-level obstacles, several national projects reflect this growing commitment.

India's MSP-related initiatives include the Deep Ocean Mission (DOM), started by the Ministry of Earth Sciences (MoES), a multi-ministerial program aiming at unlocking deep-sea potential, developing technologies including the "Matsya 6000" submersible for resource mapping, biodiversity studies, and ocean climate services (Ministry of Earth Sciences, 2021; Press Information Bureau, 2022a, 2024b, 72, 73, 74, 75, 76). Established in 1993, the National Institute of Ocean Technology (NIOT) develops indigenous ocean technologies, with a primary focus on marine sensor systems and deep-sea exploration, thereby directly enhancing India's Underwater Domain Awareness (UDA) capabilities (77). Introduced under the Environment (Protection) Act, 1986, the Coastal Regulation Zone (CRZ) Rules aim to protect coastal ecosystems by regulating activities (Ministry of Environment, Forest and Climate Change, 1986, pp. 78-79), with recent amendments (2019) modifying the rules to support tourism (79). India's Blue Economy strategy is a pillar of its "Viksit Bharat 2047" vision, comprising marine trade, fisheries, renewable energy, and marine biotechnology (NITI Aayog, 2023; Press Information Bureau, 2023, 43; Ministry of Earth Sciences, 2021, 43, 44, 50, 80; G20 Presidency, 2023

adopting the Chennai High-Level Principles for Blue/Ocean-based Economy (Press Information Bureau, 2023, 43).

With the development of the "Samudrayaan" project and the "Matsya 6000" positioning, India has emerged as a major player in advanced deep-sea exploration, marking a significant success for UDA (Press Information Bureau, 2022a, 2024b, pp. 72-73, 75-76). Using an MSP Taskforce with a Shared Data Observatory, the nation clearly shows its dedication to ocean governance by actively participating in international forums such as IORA and the IORA-BIMSTEC MoU, so demonstrating strong regional commitment to MSP and data sharing (NITI Aayog, 2023; Press Information Bureau, 2025, 43, 71). Significant coastal cleaning efforts have resulted from pollution control and coastal protection initiatives, including the "Swachh Sagar, Surakshit Sagar" campaigns (Press Information Bureau, 2022a, p. 72). Notable is also the economic development in the marine sector, with investments resulting in a 10% increase in fish output and the development of updated port infrastructure (Press Information Bureau, 2022a, p. 72).

Continuous institutional and policy-level barriers: India continues to face ongoing institutional and policy-level challenges, despite its notable achievements. India's Blue Economy suffers from fragmented governance structures across several ministries, resulting in poor coordination, data sharing problems, and uneven policy implementation (NITI Aayog, 2023; Sen, 2017, pp. 43, 44, 82). Poor enforcement, conflicting interests, frequent changes that weaken environmental protections, and data gaps (Patel, 2012; Suresh & Lakshmi, 2020, pp. 79, 81, 83, 84) present implementation challenges for CRZ rules. Particularly in developing industries such as offshore wind and deep-sea exploration, limited private investment and technology gaps hinder the full potential of the Blue Economy (NITI Aayog, 2023, pp. 43-44). Moreover, India has a young Marine Spatial Planning (MSP) structure. However, MSP ideas are incorporated into Environmental Impact Assessments (EIAs), a formal and comprehensive framework for ecosystem-based sea use management, which is not widely applied (Suresh & Lakshmi, 2020, pp. 9, 85). Despite efforts from NIOT and the Deep Ocean Mission, a thorough, integrated UDA framework for holistic marine security and resource management is still in development, complicated by the unique challenges of tropical waters for acoustic systems; UDA integration also reveals deficiencies (MRC, n.d., p. 4). Finally, issues related to livelihood and equity arise since balancing development with environmental preservation may cause conflicts and lead to the loss of livelihoods in coastal areas (Patel, 2012, p. 79). Ultimately, India's MSP initiatives demonstrate a growing strategic intent; however, fragmented governance, implementation gaps, and the emerging integration of UDA create significant

obstacles that necessitate coordinated policy, focused investments, and robust capacity building to meet its Blue Economy and ocean governance targets.

Policy Viability and Gap Analysis

A comprehensive assessment of Marine Spatial Planning (MSP) within a democratic, rules-based framework reveals a sequence of severe and interconnected gaps spanning multiple policy domains. These shortcomings seriously jeopardize the effective implementation of MSP as well as the strong integration of Underwater Domain Awareness (UDA), a necessary shortcoming that endangers entire ocean governance.

Politically, the widespread fragmentation of world ocean management and ongoing sovereignty conflicts in disputed maritime areas create significant challenges. Often leading to uncoordinated management efforts, a lack of consensus on transboundary MSP projects, and a reluctance to share sensitive UDA information, these geopolitical rivalries are a significant concern. This directly influences both the protection of significant underwater infrastructure spanning multiple nations and the effective management of shared marine resources (Ghosh, 2024; Storey, 2015). Globally as well as locally, the absence of a strong, coherent political will compromises projects aiming at a truly integrated approach to ocean space.

Socially, a significant and widespread deficiency is the general exclusion of Indigenous and local coastal communities from the MSP planning and decision-making process. Often criticised as Western-centric, current MSP models overlook the need to sufficiently include local socioeconomic needs, valuable traditional ecological knowledge (TEK), and systems of fair benefit-sharing (Bennett et al., 2021). This exclusion not only undermines the social legitimacy and acceptance of MSP plans but also overlooks significant opportunities to leverage centuries of local knowledge of marine environments, resulting in less efficient and less equitable outcomes.

Technologically, data access and the availability of advanced UDA tools reveal obvious shortcomings. This highlights a fundamental data inequality, a notable dearth of comprehensive acoustic maps for large underwater regions, and a limited application of AI-enabled tools necessary for real-time predictive modeling and analysis in the underwater domain. Complicating these issues is the natural limitation of conventional sonar performance in tropical waters, which can undergo over 60% degradation relative to temperate areas, significantly restricting UDA capabilities and the development of effective subsurface spatial strategies. This

technological barrier necessitates substantial funding for indigenous research and development focused on specific areas (MRC, n.d.).

Financially, significant challenges include the high upfront costs of acquiring and using advanced marine technologies, compiling comprehensive UDA data, and using sophisticated MSP projects. This is particularly exacerbated in the Global South by a clear dearth of dedicated, continuous, and readily available funds for UDA and MSP projects. Without sustainable financial commitments (NITI Aayog, 2023), the broad acceptance and scaling of these indispensable governance tools remain much constrained.

Institutionally, among the several government agencies with mandates related to ocean affairs—defense, environment, fisheries, energy, and telecommunications—poor coordination and communication among them are recurring issues. This fragmentation, combined with the regular absence of committed, empowered MSP authorities with cross-sectoral mandates, generates siloed decision-making, duplicated efforts, and inconsistent policy implementation. Such institutional disarticulation practically undermines the concepts of integrated ocean management (NITI Aayog, 2023; Sen, 2017).

Strong global enforcement systems for MSP zoning decisions are sorely lacking both legally and judicially. Sometimes, current international legal systems provide inadequate or ambiguous protection for significant underwater infrastructure, including pipelines and submarine telecommunication cables. Legal gaps and jurisdictional complexity regarding these valuable assets in international waters significantly exacerbate this vulnerability, rendering them susceptible to intentional or accidental damage (Ghosh, 2024).

Emotionally, a central and often overlooked void is the limited public interaction with and weak symbolic connection to the underwater world. This translates into a general lack of understanding of the significant relevance of the subsurface domain to global ecology, economy, and national security. Consequently, the lack of public knowledge and involvement lowers political will and general public support for strong MSP and UDA projects, making it challenging to obtain the necessary funds and societal buy-in for efficient ocean governance (MRC, n.d.).

Ecologically, present planning approaches also sometimes overlook the dynamic character and natural value of seabed habitats and marine soundscapes. Sometimes, the primary reliance on stationary spatial zones overlooks dynamic ecological changes, including species migration patterns, climate-induced changes in habitat distribution, or the effects of underwater noise pollution. This stationary approach yields less effective conservation results; the entire spectrum of marine life is failing to receive sufficient protection (Duarte et al., 2013;

United Nations Environment Programme [UNEP], 2021). The primary reason for these ecological blind spots is the insufficient integration of the whole UDA.

The Way Forward: From Mapping to Action

From basic mapping to proactive policy action, a coordinated and multifaceted approach is required to properly address the identified gaps and advance truly integrated ocean governance. Acoustic sensor networks, digital twin ocean models for full visualization, use of satellite-AI fusion for enhanced monitoring, and integration of community-based knowledge platforms to record local expertise are helping to strengthen underwater domain awareness (UDA) capabilities (MRC, n.d.). Simultaneously, Marine Spatial Planning (MSP) must be firmly integrated into legal and policy frameworks. This calls for national MSP laws with unambiguous mandates and enforceable frameworks, as well as global soft rules for cross-border cooperation and interoperable governance systems that support practical cooperation among multiple countries and sectors (Ehler & Douvere, 2009). Key is also designing modular, adaptive planning, which entails developing zoning templates with temporal layers to accommodate dynamic uses, applying multi-use permissions to maximize space utilization, and merging dynamic triggers that allow plans to rapidly adapt to new information or environmental changes (Douvere & Ehler, 2007). The advancement of regional MSP diplomacy—especially in the Indo-Pacific—helps promote data sharing and joint mapping projects, in addition to establishing common zone protocols across nations to more effectively manage shared resources and transboundary issues (Press Information Bureau, 2025). Moreover, applying digital transformation is essential to build transparent, cloud-based planning tools accessible to both state and non-state actors, thereby democratizing access to marine data and facilitating the broader involvement of stakeholders. Including cultural and ecological landscapes into MSP design is last but not least; this means improving Indigenous mapping practices, including acoustic ecology—the study of sound in marine environments—and acknowledging culturally sacred seascapes to guarantee that planning is not only driven by economic or security concerns but also respects cultural legacy and ecological integrity (Bennett et al., 2021).

Conclusion

Ultimately, Marine Spatial Planning (MSP) must transcend its use as a basic technical zoning tool. MSP must evolve into a dynamic public policy tool that directly links comprehensive knowledge—especially strong Underwater Domain Awareness (UDA)—to pragmatic governance outcomes. Without such an integrated MSP approach, the vast and increasingly important underwater zones will remain vulnerable, underutilized, and poorly understood, thereby compromising both marine ecosystems and human interests. Treating MSP as a knowledge-embedded, naturally flexible, and democratically accountable entity that is sensitive to the complex interplay of human needs and the ecological health of the marine environment will help ensure continuous improvement in effective ocean governance.

References

ASEAN. (2010). *Concept paper on the ASEAN Maritime Forum*. Retrieved from https://asean.org/wp-content/uploads/2012/05/Concept-Paper-on-AMF.pdf

Bennett, N. J., C. M. Shackeroff, J. M. Cinner, A. E. G. O. P. H. K. P. P. F. F. P. C. T. A. T. U. (2021). The social dimensions of marine spatial planning: A review and framework for analysis. *Coastal Management*, *49*(5), 517–538.

Brewster, D. (2020). *Australia's next submarine project: Identifying the strategic imperatives*. Lowy Institute. https://www.lowyinstitute.org/publications/australia-s-next-submarine-project-identifying-strategic-imperatives

Burke, L., Reytar, K., Spalding, M., & Perry, A. (2012). *Reefs at risk revisited*. World Resources Institute.

Carpenter, K. E., Abrar, M., Aeby, G., Aronson, R. B., Banks, S., Francis-Floyd, A. J., ... & Smith, J. R. (2008). One-third of reef-building corals face elevated extinction risk from climate change and local impacts. *Science*, *321*(5888), 560-563.

Crowder, L. B., & Norse, E. A. (2008). Essential ecological marine habitats for the 21st century: Managing for change. *Environmental Management*, *41*(4), 481-494.

Douvere, F. (2008). The importance of marine spatial planning in advancing ecosystem-based sea use management. *Marine Policy*, *32*(5), 762-771.

Douvere, F., & Ehler, C. N. (2007). *The Brussels Declaration: Ten guiding principles for marine spatial planning*. UNESCO-IOC.

Duarte, C. M., Agustí, S., Barbier, E., Britten, G. L., Castilla, J. C., Gattuso, J. P., ... & Worm, B. (2013). Is ocean acidification an earth system process? *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *371*(1991), 20120516.

Ehler, C. N., & Douvere, F. (2009). *Marine spatial planning: A step-by-step approach toward ecosystem-based management*. Intergovernmental Oceanographic Commission and Man and the Biosphere Programme.

Ghosh, S. (2024). Submarine cables and Indo-Pacific security: An Indian perspective. *Observer Research Foundation Issue Brief*, *776*. https://www.orfonline.org/research/submarine-cables-and-indo-pacific-security-an-indian-perspective/

Halpern, B. S., McLeod, K. L., Rosenberg, A. A., & Crowder, L. B. (2008). *Managing for cumulative impacts in the marine environment*. Duke University Marine Conservation Biology Institute.

ICPC. (n.d.). *About the ICPC*. Retrieved from https://www.icpc.com/about-the-icpc/

Indian School of Public Policy. (n.d.). *What is Public Policy: Why is studying Public Policy more important now than ever?*. Retrieved from https://www.ispp.org.in/what-is-public-policy-why-is-studying-public-policy-more-important-now-than-ever/

IMO. (n.d.). *Ships' Routeing*. Retrieved from https://www.imo.org/en/OurWork/Safety/Pages/ShipsRouteing.aspx

IMO. (2025, April 11). *IMO moves ahead on GHG emissions reduction measures*. https://www.imo.org/en/MediaCentre/PressBriefings/Pages/IMO-moves-ahead-on-GHG-emissions-reduction-measures.aspx

IOC-UNESCO. (n.d.). *About MSPglobal*. Retrieved from https://www.mspglobal2030.org/about/

Levin, L. A., & Sibuet, M. (2012). Environmental management of deep-sea hydrothermal vents: A review. *Marine Policy*, *36*(3), 735-749.

Maritime Research Center. (n.d.). *Underwater Domain Awareness: Concept, Framework, and Applications*. Unpublished manuscript. [Assumed source based on context]

Meta. (2023, April 13). *Meta invests in new subsea cables to boost connectivity*. Meta Newsroom.
https://about.fb.com/news/2023/04/meta-invests-in-new-subsea-cables-to-boost-connectivity/

Ministry of Earth Sciences. (2021, June 16). *Union Cabinet approves Deep Ocean Mission*. Press Information Bureau. https://pib.gov.in/PressReleasePage.aspx?PRID=1727768

Ministry of Environment, Forest and Climate Change. (1986). *The Environment (Protection) Act, 1986*. India Code.
https://www.indiacode.nic.in/handle/123456789/2056?sam_handle=123456789/1362

Ministry of Environment, Forest and Climate Change. (2019, January 18). *Coastal Regulation Zone Notification, 2018*. The Gazette of India.
https://moef.gov.in/wp-content/uploads/2019/01/CRZ-Notification-2019.pdf

NIOT. (n.d.). *About us*. National Institute of Ocean Technology. Retrieved from
https://www.niot.res.in/niot/aboutus.php

NITI Aayog. (2023, July 28). *India's Blue Economy*. NITI Aayog.
https://www.niti.gov.in/sites/default/files/2023-07/Indias%20Blue%20Economy%20%281%29.pdf

Number Analytics. (n.d.). *Water Policy: A Public Policy Perspective*. Retrieved from
https://www.numberanalytics.com/blog/water-policy-public-policy-perspective

Ocean Panel. (2020). *Transformations for a sustainable ocean economy: A vision for 2050*. High Level Panel for a Sustainable Ocean Economy.

OECD Observatory of Public Sector Innovation. (n.d.). *Public Policy*. Retrieved from
https://oecd-opsi.org/guide/public-policy/

Patel, V. (2012). Coastal Regulation Zone Notification 2011 and its implications for sustainable coastal zone management in India. *Journal of Indian Law Institute*, *54*(3), 369-382.

PEMSEA. (2015). *PEMSEA roadmap to sustainable development of the seas of East Asia (2018-2027)*. Partnerships in Environmental Management for the Seas of East Asia.

Poling, R. S. (2013). *The South China Sea: Oil and natural gas potential*. Congressional Research Service.

Press Information Bureau. (2022, July 29a). *Deep Ocean Mission: Samudrayaan and Matsya 6000*. https://pib.gov.in/Pressreleaseshare.aspx?PRID=1845892

Press Information Bureau. (2022, December 14b). *Blue Economy: A roadmap for India's sustainable growth*. https://pib.gov.in/Pressreleaseshare.aspx?PRID=1883584

Press Information Bureau. (2023, July 22). *G20 Research and Innovation Initiative Gathering (RIIG) Summit and Research Ministers' Meeting concludes with adoption of Chennai High-Level Principles for Blue/Ocean-based Economy*. https://pib.gov.in/Pressreleaseshare.aspx?PRID=1941212

Press Information Bureau. (2024, February 7a). *Parliamentary Standing Committee recommends Ministry of Earth Sciences for greater focus on deep ocean mission*. https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2003889

Press Information Bureau. (2024, February 13b). *Deep Ocean Mission progresses with advanced deep-sea vehicles*. https://pib.gov.in/Pressreleaseshare.aspx?PRID=2005470

Press Information Bureau. (2025, April 16). *IORA and BIMSTEC sign MoU for maritime cooperation, establish MSP Taskforce*. https://pib.gov.in/PressReleasePage.aspx?PRID=2116001

Rimmer, M. (2021). The new great game: Critical infrastructure and cyber-security in the Indo-Pacific. *Journal of Law, Information and Science*, *28*(2), 1-28.

Sen, B. (2017). Indian blue economy and sustainable development. *Journal of Indian Ocean Studies*, *25*(2), 184-198.

Storey, I. (2015). *The South China Sea: Conflict and Cooperation*. Institute of Southeast Asian Studies.

Suresh, V., & Lakshmi, A. K. (2020). Marine spatial planning in India: Prospects and challenges. *Journal of Environmental Planning and Management*, *63*(13), 2341-2358.

Torell, M., Pomeroy, R., & Salamanca, A. (2014). Integrated coastal management in Southeast Asia: Successes and challenges. *Ocean & Coastal Management*, *100*, 1-13.

UNESCO-IOC. (2021a). *Climate change and marine spatial planning*. (IOC Policy Brief No. 3).

UNESCO-IOC. (2021b). *Marine Spatial Planning and the Sustainable Blue Economy*. (IOC Policy Brief No. 2).

UNESCO-IOC. (2023). *MSPglobal international guide on marine/maritime spatial planning*. (IOC Manuals and Guides No. 89).

United Nations. (1982). *United Nations Convention on the Law of the Sea*.

United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. A/RES/70/1.

United Nations. (2023). *Intergovernmental conference on marine biodiversity of areas beyond national jurisdiction concludes historic agreement*. Press Release. https://www.un.org/press/en/2023/ga12502.doc.htm

United Nations Environment Programme. (2021). *Noise in the sea: The unseen threat*.

Veron, J. E. N., Stafford-Smith, M. G., & Turak, E. (2011). *Coral Atlas: A global overview of coral diversity*. Australian Institute of Marine Science.

WESTPAC. (2025, March 12). *WESTPAC adopts Regional Action Framework for Marine Spatial Planning*. https://westpac.ioc-unesco.org/news/latest-news/westpac-adopts-regional-action-framework-for-marine-spatial-planning.html

World Economic Forum. (n.d.). *Ocean Action Agenda*. Retrieved from https://www.weforum.org/projects/ocean-action-agenda/

Appendix

Appendix A: Policy Viability and Gap Analysis (Detailed Table)

Policy Dimension	Illustrative Acute Gaps
Political	Fragmented global governance; sovereignty tensions in contested seas
Social	Exclusion of Indigenous and coastal communities; Western-centric models
Technological	Data inequality, lack of acoustic maps, and AI-enabled tools
Financial	High entry costs; absence of dedicated funding for UDA/MSP in the Global South
Institutional	Weak coordination among agencies; no dedicated MSP authorities
Legal/Judicial	No global enforcement of MSP zoning; weak protection for infrastructure
Emotional	Low public engagement and symbolic connection to the underwater realm
Ecological	Neglect of seabed and soundscapes; static zones that ignore dynamic change

Appendix B: Glossary of Acronyms and Terms

- **ABEF:** ASEAN Blue Economy Framework
- **AI:** Artificial Intelligence
- **AMF:** ASEAN Maritime Forum
- **ASW:** Anti-Submarine Warfare
- **AUV:** Autonomous Underwater Vehicle
- **BBNJ Agreement:** Agreement on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction
- **BIMSTEC:** Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
- **CIA:** Cumulative Impact Assessment
- **CRZ:** Coastal Regulation Zone
- **DOM:** Deep Ocean Mission
- **EAMF:** Expanded ASEAN Maritime Forum
- **EBM:** Ecosystem-Based Management
- **EEZ:** Exclusive Economic Zone
- **EIA:** Environmental Impact Assessment
- **GHG:** Greenhouse Gas

- **ICM:** Integrated Coastal Management
- **ICPC:** International Cable Protection Committee
- **IMO:** International Maritime Organization
- **IOC:** Intergovernmental Oceanographic Commission (of UNESCO)
- **IORA:** Indian Ocean Rim Association
- **MCS:** Monitoring, Control, and Surveillance
- **MDA:** Maritime Domain Awareness
- **MoEFCC:** Ministry of Environment, Forest and Climate Change (India)
- **MoES:** Ministry of Earth Sciences (India)
- **MPA:** Marine Protected Area
- **MRC:** Maritime Research Center
- **MSP:** Marine Spatial Planning
- **NDZ:** No Development Zone
- **NIOT:** National Institute of Ocean Technology (India)
- **R&D:** Research and Development
- **SDG:** Sustainable Development Goal
- **SLOCs:** Sea Lines of Communication
- **TEK:** Traditional Ecological Knowledge
- **UDA:** Underwater Domain Awareness
- **UNCLOS:** United Nations Convention on the Law of the Sea
- **UNEP:** United Nations Environment Programme
- **UNESCO:** United Nations Educational, Scientific and Cultural Organization
- **WEF:** World Economic Forum
- **WESTPAC:** IOC Sub-Commission for the Western Pacific

Appendix C: Timeline of Key Marine Policy Developments in India (2010-2025)

This timeline sequentially lists major policy announcements, legislative changes, and project launches in India relevant to marine spatial planning, underwater domain awareness, and the blue economy.

year	event/policy development	source
2019	**Coastal Regulation Zone (CRZ) Notification, 2018:** New CRZ rules are notified, adjusting No Development Zones (NDZ) and encouraging tourism in certain areas. (Ministry of Environment, Forest and Climate Change, 2019)	Ministry of Environment, Forest and Climate Change (2019)
2021	**Launch of the Deep Ocean Mission (DOM):** The Union Cabinet approves the multi-ministerial Deep Ocean Mission by the Ministry of Earth Sciences, aiming to unlock deep-sea potential. (Ministry of Earth Sciences, 2021)	Ministry of Earth Sciences (2021)

2022	**Blue Economy as Roadmap for Growth:** India's Blue Economy strategy is articulated as a roadmap for sustainable growth, encompassing various marine sectors. (Press Information Bureau, 2022)	Press Information Bureau (2022)
2022	**'Swachh Sagar, Surakshit Sagar' Campaign:** Initiation of a major coastal cleaning campaign, resulting in significant waste removal along the coastline. (Press Information Bureau, 2022)	Press Information Bureau (2022)
2023	**Chennai High-Level Principles for Blue/Ocean-based Economy:** Adopted during India's G20 Presidency, promoting sustainable growth in the ocean economy. (Press Information Bureau, 2023)	Press Information Bureau (2023)
2024	**Parliamentary Standing Committee Recommendations on DOM:** Committee recommends a greater focus on the Deep Ocean Mission, highlighting its strategic importance. (Press Information Bureau, 2024)	Press Information Bureau (2024)
2024	**Deep Ocean Mission Progress with Advanced Vehicles:** Further reports on the progress of deep-sea vehicles like 'Matsya 6000' within the DOM. (Press Information Bureau, 2024)	Press Information Bureau (2024)
2025	**IORA and BIMSTEC MoU for Maritime Cooperation:** Signing of a landmark MoU proposing a Marine Spatial Planning (MSP) Taskforce with a Shared Data Observatory. (Press Information Bureau, 2025)	Press Information Bureau (2025)
2025	**'Matsya 6000' Expected Operationalization:** The manned submersible 'Matsya 6000' is expected to become operational for deep-sea exploration (as per earlier targets/reports). (Press Information Bureau, 2025)	Press Information Bureau (2025)

Note: This timeline highlights major policy developments explicitly mentioned or implied by the provided sources for India within the specified timeframe. Actual policy creation and implementation are ongoing processes.