

The International Regulation of Innocent Passage in Maritime Areas Crowded with Offshore Energy Installations

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Abstract:

As the global tide turns toward renewable offshore energy, the face of territorial seas has been dramatically altered by the spread of energy installations, redrawing the balance between of coastal sovereignty and freedom of navigation. This change has raised unprecedented legal problems, making traditional notions such as “innocent passage” and “marine obstructions” inadequate to deal with the changing maritime reality. This work points out gaps in the 1982 United Nations Convention on the Law of the Sea (UNCLOS), specifically the vagueness surrounding the regulation of safety zones and the lack of harmonized standards for the interpretation of navigational harm. Based on an in-depth legal analysis, the work suggests revising Article 60 of UNCLOS and adopting an ancillary protocol to enhance transparency and regulate passage in installation-congested areas.

Key words: Innocent passage; freedom of navigation; offshore energy installations; maritime sovereignty; Legal gaps in UNCLOS.

1-Introduction:

Out on the distant horizon, the waves no longer frame the seascape alone. Instead of the unbroken expanse of blue serenity, “steel forests” of sea-based wind farms now rise in horizontal lines as far as the eye can see—a new visual regime redrawing human engagements with the sea. The ocean, once imagined as a vast domain of liberty and openness, is now a platform where environmental, economic, sovereign, even geopolitical interests converge—a battlefield pitting energy giants against sea lanes.¹

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¹ Kraska James, Maritime power and the law of the sea, Vol. 9, Number 1, Autumn, Oxford University Press, New York, 2022, p. 114.

With the growing climate emergency over the past years, more and more states have intensified the search for their sea spaces for renewable energy production. Global offshore wind farms are on track to add 380 gigawatts by 2030 under the 1.5°C trajectory in the most recent projections by the International Renewable Energy Agency (IRENA), from the previous level of 63 gigawatts in the year 2022—with 60% of this development concentrated in the North Sea and South China Sea.² However, this change in technology brings along with it heightened legal complexities. These colossal constructions, resisting conventional legal typologies by virtue of allowable height and depth,³ are imposing a new reality that clashes with established principles of navigational freedom. The Convention, once drafted in an era when threats were envisioned as “tanks on deck”,⁴ now strains under the challenge of the legal repercussions of turbines reshaping the international sea lanes.

On the one hand, the 1982 United Nations Convention on the Law of the Sea (UNCLOS) provides coastal States with sovereign rights to construct installations in their exclusive economic zones (EEZs).⁵ Conversely, it maintains freedom of navigation as an underlying principle and enshrines the right of passage through the territorial seas as long as the passage of ships is innocent.⁶ The dual heritage has given rise to a fundamental dilemma: UNCLOS lacks express provisions regulating the relationship between contemporary energy installations and navigation entitlements. The Convention was originally drafted over forty years ago and has inadequate rules regulating the operational effects of the current offshore energy schemes. Evidence for the gap is especially prominent in the North Sea, where surveillance records show hundreds of ships violating exclusion zones around turbines weekly,⁷ increasing the chances of collisions causing spills of as much as 100,000 tons of oil.⁸ At the same time China’s exploitation of

² IRENA, World energy transitions outlook 2024, 1.5°C PATHWAY, Abu Dhabi, November 2024, p. 52, Figure 2.6. Available at: <https://fr.slideshare.net/slideshow/irena-world-energy-transitions-outlook-2024/273226084#52> (accessed 13 March 2025).

³ Myron H. Nordquist, Satya N. Nandan, and James Kraska, United Nations Convention on the Law of the Sea 1982: A commentary, Vol. II. Brill | Nijhoff, Leiden - Netherlands, 2012, p. 210.

⁴ Kraska James, op.cit, p. 114.

⁵ United Nations, Treaty Series "The United Nations Convention on the Law of the Sea (UNCLOS) 1982", Art. 56, Montego Bay, 10 December 1982, p. 43. Available at: https://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf (accessed 16 March 2025).

⁶ Art. 17 and 87, The UNCLOS 1982, Ibid, pp. 30 – 57.

⁷ The Scottish Government, Sectoral Marine Plan for Offshore Wind Energy - Regional Locational Guidance, St Andrew’s House, Edinburgh – Scotland, December 2019, p. 321. Available at: <https://sgavmst.dk/media/juwllsp1/sectoral-marine-plan-offshore-wind-energy-regional-locational-guidance.pdf> (accessed 17 March 2025).

⁸ C. Van der Tak, Y. Koldenhof, and J. van Doorn, BE-AWARE, Technical Sub-report 7: Offshore Installations Oil Spill Risk Analysis, Table 8-4, Belgium, 18 March 2014, p. 35. Available at: https://www.bonnagreement.org/site/assets/files/1129/be-aware_technical_sub_report_7_offshore.pdf (accessed 17 March 2025).

offshore energy infrastructure as a legal instrument to project influence in the South China Sea has heightened regional geopolitical tensions.⁹ At the same time, detours to avoid turbine fields are raising the costs of shipping due to lengthened routes.¹⁰

Therefore, the exponential growth of offshore energy initiatives is redrawing the international energy map—precipitating a seismic change in the global legal landscape. Underlying this transformation is an urgent challenge: How can the sovereign rights of coastal States to develop renewable energy infrastructure within their EEZs be balanced against the international obligation to safeguard freedom of navigation, in the absence of a detailed legal framework to regulate this overlap?

To answer this question, the paper takes on a comparative analytical approach by looking at the current rules under UNCLOS and their real-world implementation. It compares developments of North Sea and South China Sea as diverging case studies. The work goes on the premise of the basic hypothesis that the law as it stands today does not attain a balance commensurate with freedom of navigation and the sovereign rights of states in the context of offshore energy, and the imbalance in the law imperils maritime security and global cooperation. The goal of the paper is to highlight these legal failings and to advance integral approaches which might undergird the development of a better-balanced and sustainable legal regime in response to the ongoing evolutions.

2- The Legal Framework of Innocent Passage in the Context of Offshore Energy Installations

On the lines of contact between maritime sovereignty and freedom of navigation, offshore wind farms are becoming latent legal minefields. Seas once crossed by vessels according to long-standing international usage are now charged with unresolved contradictions: Are the offshore turbines shielded as an extension of coastal State jurisdiction, or must they avoid obstructing the right of passage—even under the guise of safety? This conceptual tension lies not in minutiae, but at the very core of the legal edifice itself. Without precise definitions, the operational reality intersects the textual ambiguity to engender a fresh terrain of legal issues that international law was never designed to address. How, therefore, does international law balance the right to anoint offshore facilities with the duty to uphold freedom of passage? And are such phrases as

⁹ Mohd Haris Abdul Rani, *Energy Dominance in the South China Sea: Legal and Geopolitical - Battles over Strategic Resources*, International Journal of Research and Innovation in Social Science (IJRISS), Vol. VIII, Iss. XII, December 2024, pp. 3310- 3311. Available at: <https://rsisinternational.org/journals/ijriss/Digital-Library/volume-8-issue-12/3308-3316.pdf> (accessed 17 March 2025).

¹⁰ Royal HaskoningDHV, *Spatial study North Seas 2030 – Offshore wind development* (Final Report, RHDHV-BI4271), North Seas Energy Cooperation/ Rijkswaterstaat, 03 November 2022, p. 28. Available at: <https://www.noordzeeloket.nl/publish/pages/205865/spatial-study-north-seas-2030-offshore-wind-development-v2.pdf> (accessed 17 March 2025).

“innocent” and “obstruction” still good enough in the age of the offshore wind turbine? These are the issues addressed in the subsections below.

2.1- The Concept of Innocent Passage and Implementation Challenges in the Context of Offshore Energy Installations

Part II of the 1982 UNCLOS codifies the law of innocent passage as the linchpin of free maritime navigation through the territorial sea. Article 18(1) stipulates that innocent passage constitutes the continuous and expeditious passage through the territorial sea without anchoring or stopping save as made necessary by force majeure or distress. Additionally, Article 19(1) states that passage is not innocent where passage threatens the peace, good order, or security of the coastal State or involves any activity in violation of international law.¹¹

However, the practical application of the above principle is now faced with hitherto unprecedented challenges due to the growing presence of non-traditional offshore installations, e.g., wind farms. For instance, the development of the “Hornsea 3” project in the North Sea has forced ships to deviate over long distances and delay sea voyages.¹² This has raised questions about the extent to which the principle of “continuity” in Article 18(2) is respected, and whether this can be considered “unlawful obstruction” under Article 24(1) of the Convention.¹³

In parallel, legal debates have emerged over whether the term “harm” and whether they encompass indirect harm such as economic costs arising from forced route changes. While Professor Nordquist posits that harm must be materially apparent and direct,¹⁴ the case law of the International Court of Justice (ICJ), and in particular its 2018 ruling on compensation in the case of *Nicaragua v. Costa Rica*, has left an opening for the possible extension of the term to encompass indirect environmental harms.¹⁵

¹¹ Art. 18 (1) and 19, The UNCLOS 1982, op.cit, pp. 30 – 31.

¹² DONG Energy Power, Hornsea Project Three Offshore Wind Farm, Preliminary Environmental Information Report: Annex 7.1 – Navigational Risk Assessment, Part. 1, Vol. 5, London, July 2017, p. 50. Available at:

<https://cdn.orsted.com/-/media/www/docs/corp/uk/hornsea-project-three/how03peirvolume-5-annex-71-nra-part-1.pdf> (accessed 18 March 2025).

¹³ Art. 18 (2) and 24 (1), The UNCLOS 1982, op.cit, pp. 30 – 33.

¹⁴ Nordquist, M. H., Rosenne, S., & Yankov, A. (Eds.), United Nations Convention on the Law of the Sea 1982: A Commentary, Part. II: Territorial sea and contiguous zone (Art. 19), Vol. IV, Martinus Nijhoff, Dordrecht - Netherlands, 1991, p. 190. Available at: <https://dokumen.pub/download/united-nations-convention-on-the-law-of-the-sea-a-commentary-9781472561688-9781849461924-9781782252399.html> (accessed 18 March 2025).

¹⁵ International Court of Justice, Judgment: Certain Activities carried out by Nicaragua in the Border Area (*Costa Rica v. Nicaragua*) (Compensation), para.42. The Hague, 2 February 2018, p. 28. Available at: <https://www.icj-cij.org/files/case-related/150/150-20180202-JUD-01-00-EN.pdf> (accessed 18 March 2025).

2.2- The Legal Classification Quandary of Offshore Energy Installations

The legal classification of offshore wind turbines presents a complex challenge. Article 60 of the UNCLOS allows coastal States to construct “installations or structures” for economic purposes within their EEZs and grants them regulatory authority, including the right to establish safety zones of up to 500 meters.¹⁶ However, this limit does not reflect the actual dimensions of modern turbines, which may reach heights of up to 260 meters.¹⁷ In practice, such safety zones may also interfere with navigational freedoms as guaranteed under Article 58(1) of the Convention.¹⁸

Conversely, Article 80 addresses “artificial islands,” which, unlike natural islands, do not generate maritime zones like those produced by natural islands and are subject to the same regime as installations under Article 60.¹⁹ In this context, the arbitral tribunal in the South China Sea Arbitration (PCA 2016) examined China’s artificial structures built on Mischief Reef. The tribunal found that while the original purpose of these structures was economic (e.g., shelters for fishermen), they later evolved into artificial installations within the meaning of Article 60. It concluded both that these constructions violated the Philippines’ sovereign rights and conferred no additional maritime entitlements upon China.²⁰ This ruling unequivocally confirmed that no offshore installations—including wind turbines—may be lawfully used to bolster territorial claims in disputed maritime areas.²¹ The case thus highlights the intricate legal nature of classifying modern offshore infrastructure, particularly when used for energy production.

Here, Prof “Nieuwenhout” comments that artificial energy islands—structures conceived for the production and distribution of power—represent peculiar problems of classification under UNCLOS. Without the existence of a clear legal standard, such islands do not align neatly with traditional categories, which calls for a more refined legal interpretation to distinguish them from both installations and islands.²² A closer look at their legal status reveals that the functional purpose of these structures also plays

¹⁶ Art. 60 (Paragraph 5), The UNCLOS 1982, op.cit, p. 45.

¹⁷ Dogger Bank Wind Farm, first campaign to install turbines at world’s largest offshore wind farm is underway, Dogger Bank Wind Farm Official website, Press Release, 3 August 2023. available at: <https://doggerbank.com/press-releases/first-campaign-to-install-turbines-at-worlds-largest-offshore-wind-farm-is-underway/> (accessed 18 March 2025).

¹⁸ Art. 58, The UNCLOS 1982, op.cit, p. 44.

¹⁹ Art. 80, The UNCLOS 1982, Ibid, p. 55.

²⁰ PCA Case No. 2013-19 (South China Sea Arbitration), Final Award, 12 July 2016, paras. 1036–1037, pp. 414–415. available at: <https://docs.pca-cpa.org/2016/07/PH-CN-20160712-Award.pdf> (accessed 19 March 2025).

²¹ Mohd Haris Abdul Rani, op.cit, pp. 3310- 3311.

²² C. Nieuwenhout & L.M. Andreasson, The legal framework for artificial energy islands in the Northern Seas, *International Journal of Marine and Coastal Law*, Vol. 39, 2024, pp. 43–45. available at: https://brill.com/downloadpdf/view/journals/estu/39/1/article-p39_3.pdf (accessed 20 March 2025).

a pivotal role in determining their classification under the Convention. While coastal States have exclusive jurisdiction over installations in their EEZs, the structures in question are not regarded as islands unless they are populated or are capable of supporting human habitation. Thus, where the predominant function is the production of energy alone, such a functional constraint proves to be the defining criterion of their legal nature.

A recent analytical study indicates the adoption of a dual approach to adapting the legal status of offshore energy facilities installations. Under this model, mobile units (e.g., Floating Production Storage and Offloading units (FPSOs) or Floating Storage Units (FSOs) are considered ships when mobile and as industrial installations once fixed in position - when at anchor. Static energy-producing platforms are otherwise considered as fixed structures under Articles 60 and 80 of the Convention and are not considered ships.²³ This approach thus reinforces the “dual legal status” principle, which distinguishes between the legal regime applicable during mobility and that applicable once the unit is anchored, thereby underscoring the imperative to adapt legal classifications according to the installation's usage pattern.

2.3- The Limits of Innocent Passage Regulation and Its Overlap with Navigational Freedoms

Article 21, paragraph 1(b) of the UNCLOS confers upon the coastal state the right to make laws regulating passage for the protection of its maritime installations. But this regulation is bounded by Article 24(1) which states that coastal States shall not adopt any regulatory measures that will hamper or impede innocent passage.²⁴ This paradox was noted in the case of "Virginia G" decided by the International Tribunal for the Law of the Sea when it agreed that regulatory or enforcement measures by the coastal State need to be "necessary and proportionate" to Convention-mandated legitimate objectives.²⁵ Based on this principle, therefore, the key legal issue is how far coastal States can lawfully establish extended safety zones around offshore turbines without breaching the principle of navigational freedoms.

Recent academic writing argues that the 500-meter limit on safety zones set in Article 60(5) above is not an absolute constraint within the territorial sea. It can be

²³ Demir İsmail, Legal Status of Offshore Energy Installations, Dehukamder, Vol. 5, Iss. 2, Ankara-Türkiye, 2022, pp. 9–18. available at: <https://dergipark.org.tr/en/download/article-file/3912232> (accessed 20 March 2025).

²⁴ Art. 21 (Paragraph 1/b) and Art. 24 (Paragraph 1), The UNCLOS 1982, op.cit, pp. 31-33.

²⁵ International Tribunal for the Law of the Sea (ITLOS), M/V Virginia G (Panama v. Guinea-Bissau), Judgment, Case No. 19, paras. 266- 269, Hamburg-Germany, 14 April 2014, pp. 80-81. available at: https://www.itlos.org/fileadmin/itlos/documents/cases/case_no.19/judgment_published/C19_judgment_140414.pdf (accessed 21 March 2025).

exceeded if justified by operational necessity so long as the extension remains functionally appropriate and proportionate to the risks addressed.²⁶

3- Practical Challenges to Innocent Passage in Maritime Areas Crowded with Offshore Energy Installations

The 1982 UNCLOS captures the principle of freedom of navigation—also in areas beyond full sovereignty — but it hardly elaborates on challenges that the rapid expansion of offshore energy projects, precisely in the renewable sector, has introduced, creating unprecedented challenges for movement by sea vessels and especially regarding the right of innocent passage. Challenges do not remain only technical or physical such as the risk of collision or route deviation; but also entail complex legal implications demonstrating how weak current legislation is in achieving a balance between the rights of coastal States and the principles of navigational freedom. This section examines the most significant of these practical challenges, with a focus on navigational difficulties arising from the increasing density of offshore energy installations.

3.1- Security Considerations as a Restrictive Factor on Freedom of Navigation in areas of marine energy facilities

The operational challenges confronting innocent passage within busy maritime areas full of offshore energy facilities go beyond traditional navigational challenges; they increasingly involve complex security challenges. Recent security studies affirm that offshore installations, especially wind farms and subsea cables, are becoming possible targets for cyber-attacks, sabotage, or even hostile action by States via so-called grey zone operations. These risks are further amplified by the fact that the majority of these installations remain inadequately safeguarded, and thus equipping maritime surveillance systems and security patrols around them becomes a crucial addendum to ensuring freedom of navigation. In this context, a 2023 report by the United Nations Institute for Disarmament Research (UNIDIR) concluded that "securing maritime energy infrastructure is not optional, but rather a necessity parallel to freedom of navigation".²⁷

This security vulnerability is particularly acute in regions with weak Maritime Domain Awareness (MDA) systems, where there are no good information setups to watch ship movements or detect new dangers. The latest 2024 evaluations indicate a continuing information shortfall that directly affects the safety of offshore installations—

²⁶ Marthen Napang, Farida Patittingi, Ruslan Hambali & Marcel Hendrapati, Safety Zones Around Offshore Installations, *International Journal of Global Community*, Vol. 2, Iss. 2, Riksawan Institute, Indonesia, July 2019, pp.143-149. available at: <https://journal.riksawan.com/index.php/IJGC-RI/article/download/39/35> (accessed 21 March 2025).

²⁷ Christian Bueger, Timothy Edmunds, and Jan Stockbruegger, *Securing the Seas: A Roadmap for Enhancing UN Maritime Security Governance*, Geneva: United Nations Institute for Disarmament Research (UNIDIR), 1st ed., Switzerland, 2024, p. 59. available at: https://unidir.org/wp-content/uploads/2024/11/Securing_the_seas_web-1.pdf (accessed 22 March 2025).

most significantly in the South Atlantic, where not having a special regional coordination center has left big holes in reporting, response, and deterrence.²⁸

In reply to these growing threats, some coastal States have invoked security concerns to impose limits on navigation in the vicinity of offshore energy installations, most often invoking environmental or national security considerations. The latter practices have triggered much debate as to their consistency with the rules of international maritime law.

Recent years have seen a rise in prohibitions or restrictions on navigation around offshore energy facilities—predominantly wind farms—in the name of marine environmental protection or national security during the past decade. However, the majority of them have been imposed without an open expression of reliance on a customary international law basis for such measures. This is true especially in certain offshore wind farms along the U.S. coastline, where exclusion zones have been established in anticipation of perceived dangers.

An example of a high-profile case is the Empire Wind 1 project, in which the U.S. Coast Guard created 55 temporary security zones, with a 500-meter radius each around individual turbines.²⁹ These were warranted as needed to "protect life and the marine environment", These zones were justified under domestic laws such as the Energy Policy Act of 2005 and the Outer Continental Shelf Lands Act, without referencing UNCLOS or the principle of freedom of navigation within the EEZs. Importantly, 39 of 42 public objections to these restrictions were rejected because the comments were said to fall "outside the scope of the regulatory decision." This case illustrates how coastal authorities may increasingly assert broad regulatory powers under the banners of security and environmental protection—potentially at the expense of well-established principles of international maritime law.³⁰

3.2- The Legal Ambiguity Surrounding Safety Zones Around Offshore Energy Installations

Although the UNCLOS does recognize the coastal State's right to define safety zones up to 500 meters in width around installations constructed pursuant to Article

²⁸ Christian Bueger, Information Sharing for the Atlantic: Developing Blue Economy, Addressing Maritime Insecurities, Policy Brief for the Digital Atlantic Initiative, University of Copenhagen, 1st ed., Denmark, 2024, pp. 7–9. available at: <https://www.transatlantic.org/wp-content/uploads/2024/06/Bueger-2024-Information-Sharing-for-the-Atlantic.pdf> (accessed 22 March 2025).

²⁹ United States Customs and Border Protection (CBP), Department of Homeland Security, Amendment to the CBP Regulations, Federal Register, Vol. 90, No. 69, Rules and Regulations, Washington-U. S. A., 11 April 2025, pp. 15401, 15403-15404. available at: <https://www.govinfo.gov/content/pkg/FR-2025-04-11/pdf/2025-06188.pdf> (accessed 01 May 2025).

³⁰ United States Customs and Border Protection (CBP), Ibid, pp. 15402, 15403-15407.

60(5)—as previously noted—it does not require them to do so, nor does it provide detailed criteria for their regulation or notification. This legal gap has resulted in disparities in national practices: whereas some States follow the 500-meter rule, others have independently created "expanded exclusion zones" on grounds of security or environmental concerns, without regional or international coordination. As a result, foreign vessels may find themselves navigating through areas considered restricted, which may not be clearly marked on official marine maps nor communicated in the IMO Routeing Systems at all,³¹ potentially undermining the principle of innocent passage as put forth in Articles 17 and 24 of the UNCLOS.

In this regard, a study conducted by the German Maritime Security Institute reports that some installations in the North Sea have 500-meter safety zones around them, which however do not appear on official navigation charts or are not disseminated via the usual international channels. This lack of visibility increases the risk of collision or navigational confusion.³² Accordingly, the absence of uniform standards and of effective forums for the exchange of maritime information between coastal states and foreign ships is what creates the environment that in turn gives rise to security and navigation related tensions. Therefore, the security of offshore energy installations cannot be achieved without an international information framework that regulates advance warning and regularly updates their surrounding safety zones around them.³³

3.3- Absence of a Mandatory Regulatory Framework for Establishing Alternative Navigational Routes

The 1982 UNCLOS does not obligate coastal States, when developing major projects in maritime areas, to indicate alternative routes of navigation where there is assured safe passage for commercial or military vessels. In lieu of setting out explicit requirements, the Convention provides only general principles, e.g., the obligation not to interfere with the freedom of international navigation. This regulatory gap has led to an increasing number of uncoordinated route deviations by vessels, particularly where there is high offshore wind farm growth.

Specialized field studies have demonstrated the actual impact of this regulatory deficiency on navigational safety. A statistical study of the ships operating in the Thames Estuary of the United Kingdom concluded that the construction of the "Greater Gabbard" wind farm offshore induced a massive shift in vessel routes. Cardinal marks were used to create a minimum one nautical mile safe distance from the wind farm edge; however, in

³¹ Christian Bueger and Timothy Edmunds, *Maritime Security and the Wind: Threats and Risks to Offshore Renewable Energy Infrastructure*, Ocean Yearbook, Vol. 38, Brill Nijhoff, Leiden/Boston, 2024, p. 435. available at:

https://brill.com/downloadpdf/view/journals/ocyo/38/1/article-p433_16.pdf (accessed 22 March 2025).

³² Christian Bueger, Timothy Edmunds, and Jan Stockbruegger, *op.cit.*, p. 30-32.

³³ Christian Bueger, Timothy Edmunds, and Jan Stockbruegger, *Ibid.*, p. 32-33.

many instances, ships navigated at distances as little as half a nautical mile, due to the lack of pre-planned alternative routes. Similarly, the study showed that the Thanet offshore wind farm contributed to increased navigational traffic density along its perimeter, raising collision probabilities due to reliance solely on visual guidance without dedicated regulated routes.³⁴

These findings reinforce the findings of the NorthSEE project on the growing transboundary issues in the North Sea. The project report found that national policies governing the spatial planning of offshore installations are not guided by uniform standards for the coordination of maritime routes, but rather rely on varying local risk assessments, leading to the fragmentation of sea lanes and a loss of regional consistency.³⁵ As a result, various studies have implied that specialists in maritime navigation and port authorities must be engaged in early offshore energy project planning, since they have an imperative role to play in the mitigation of navigational risks and improving the accuracy of sea lane design—as also underscored by the Thames Estuary study.³⁶ The NorthSEE project also recommends the adoption of mandatory mechanisms for coordinating sea lanes at the regional level, securing continuity of vessel traffic and reducing the impacts of uncoordinated wind farm expansion.³⁷

3.4- Ambiguity in Legal Liability for Collisions or Maritime Accidents

When maritime incidents occur—such as a vessel colliding with an offshore energy installation—a fundamental question is raised about the attribution of legal responsibility, and this occurs within the context established by the 1982 UNCLOS. Despite the fact that the Convention establishes the right of navigation as well as the right of coastal States to prescribe "safety zones" around their offshore installations, it does not provide clear guidance regarding incidents that occur either due to an ambiguous definition of the limits of such zones or due to the unavailability of certain information in official nautical charts concerning the locations of such installations. It

³⁴ Rawson, Andrew and Rogers, Robert, Edward, Assessing the Impacts to Vessel Traffic from Offshore Wind Farms in the Thames Estuary, (Figure 2. Comparison of vessel traffic at Greater Gabbard Wind Farm and Figure 3. Comparison of vessel traffic at Thanet Wind Farm), Scientific Journals of the Maritime University of Szczecin, Vol. 43, Iss. 115, Akademia Morska w Szczecinie, Poland, 2015, pp. 103-105. Available at: https://eprints.soton.ac.uk/426239/1/16_zn_am_43_115_rawson_rogers_org044_2_.pdf (accessed 23 March 2025).

³⁵ NorthSEE Project, A North Sea Perspective on Shipping, Energy and Environmental Aspects in Maritime Spatial Planning (MSP Perspectives from the North Sea), SIMNORAT Final Conference, Brest - France, Jan 2019, pp. 4-5. Available at: https://zenodo.org/records/3257422/files/19_SIMNORAT_Final_Conf_MSS_Wright.pdf (accessed 23 March 2025).

³⁶ Rawson, Andrew and Rogers, Robert, Edward, op.cit, pp. 107.

³⁷ NorthSEE Project, op.cit, p. 2-5.

also does not clearly define the legal consequences of events within such areas or potential errors in their delineation or boundary declarations.³⁸

This problem is exacerbated when the coastal State fails to notify the maritime community or publish the location of its offshore installations in formal navigation databases, charts, or by means of “Notices to Mariners”, as recommended by the International Maritime Organization (IMO) in Resolutions A.671(16)³⁹ and A.672(16),⁴⁰ which emphasize the importance of precise reporting of offshore installations and their associated safety zones. Such an omission raises legal questions about the extent of the coastal State’s responsibility, and does not automatically place the burden of responsibility on the ship that caused the accident. Rather, it creates a legal vacuum that may lead to complex international disputes over who is to be held liable in the event of the absence or inadequacy of information.

Conversely, another legal question arises regarding the extent to which foreign vessels are obligated to ensure the safety of navigation, especially in the context of a lack of specific information regarding the location of installations or the boundaries of safety zones. This creates a practical conflict between the freedom of navigation doctrine under Article 58 of the UNCLOS Convention and the safety of navigation requirements.⁴¹ Accordingly, responsibility becomes dual in nature — shared between the coastal State that did not provide adequate notification, and the vessel that did not sufficiently exercise due diligence. The majority of relevant legal studies emphasize the importance of the coastal State's obligation to publish the location of maritime installations and their safety zones through internationally recognized means, approved by the International Maritime Organization, such as Notices to Mariners, light signals, and radio warnings, in order not to subject international navigation to any harm,⁴² and to transfer responsibility to ships that sail without complying with their navigational duties.

³⁸ Art. 60 (Paragraph 5-7), The UNCLOS 1982, op.cit, p. 45.

³⁹ IMO, Resolution A.671(16), Annex: Recommendation on Safety Zones and Safety of Navigation Around Offshore Installations and Structures, London, IMO, 30 November 1989, para. 1, p. 7. Available at:

[https://www.wcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/AssemblyDocuments/A.671\(16\).pdf](https://www.wcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/AssemblyDocuments/A.671(16).pdf) (accessed 24 March 2025).

⁴⁰ IMO, Resolution A.672(16), Annex: Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone, IMO, London, 6 December 1989, para. 2.4 and 3.8, pp. 6-7. Available at:

[https://www.wcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/AssemblyDocuments/A.672\(16\).pdf](https://www.wcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/AssemblyDocuments/A.672(16).pdf) (accessed 24 March 2025).

⁴¹ Art. 58, The UNCLOS 1982, op.cit, p. 44.

⁴² Anyanova, Ekaterina, Offshore wind energy and the rules of international law: Phasing out nuclear power, *International Journal of Public Law and Policy*, Vol. 1, No. 3, Inderscience Publications, Switzerland, 2011, p. 303. Available at:

<https://doi.org/10.1504/IJPLAP.2011.043857> (accessed 24 March 2025).

4- Regulatory Gaps in Safeguarding Freedom of Navigation Within Offshore Energy Installation Zones – and Pathways to Address Them

Despite the fact that the UNCLOS provides a general balance between the rights of coastal states to have offshore facilities installed in their EEZs and those of other states to navigation freedom, the current regulatory reality reveals tangible legal gaps threatening this balance, particularly in light of the fast pace of the development of offshore renewable energy installations, such as wind farms and floating platforms for the production of green hydrogen. Freedom of navigation, as a cornerstone of the international legal order governing the seas, is nowadays more and more endangered with the emergence of energy installations, often located in strategic sea lanes or dual-purpose areas, in the absence of a coherent international framework to ensure effective inter-State coordination or to establish similar regulation standards to reduce the impact of such installations on sea traffic .

In spite of the existence of some regional initiatives, they remain non-binding in nature and lack harmony with the global rules instituted by the nature of international commercial navigation.

4.1- The Insufficiency of Integration Among International Legal Frameworks

Though the rapid development in the use of maritime space for renewable energy purposes has revealed a structural flaw in the international system of rules for coordinating between maritime navigation activities and those related to the establishment and operation of marine energy facilities. This deficiency is manifested in two broad points:

4.1.1- Divergence in Regional Standards

This divergence is arguably most evident in the contrast between the system of regulations that have been adopted within the European Union and those that exist in the United States. The EU, for instance, employs Directive 2014/89/EU on Maritime Spatial Planning, under which Member States are required to develop integrated maritime plans that consider both economic and environmental sea space uses, including the allocation of areas for the construction of offshore energy installations.⁴³

Although the Directive encourages coexistence among different maritime activities and requires consideration of economic, social, and environmental factors while making plans, it lacks harmonized standards for navigational safety around offshore installations,

⁴³ European Parliament and Council, Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning. Official Journal of the European Union, L 257/135, 28, Publications Office of the European Union, Luxembourg, August 2014, pp. 135–145. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0089> (accessed 25 March 2025).

leaving the matter to the discretion of Member States.⁴⁴ Comparative studies have shown that some of these States adopt rigid regulatory models, such as through the imposition of fixed navigational exclusion areas surrounding installations regardless of vessel type or environmental conditions.⁴⁵ This can lead to restrictions on freedom of navigation without clear dynamic justification and raise questions regarding their consistency with the principles of the UNCLOS.

In contrast, the United States is adopting a more flexible approach, as is seen in the "Empire Wind 1" offshore wind farm. Temporary maritime safety zones are used only as and when needed during periods of active construction and are selectively enabled dynamically based on technical and environmental factors. Navigational stakeholders are permitted to request transit permits where necessary. Furthermore, federal regulatory agencies such as the Bureau of Ocean Energy Management (BOEM) require developers to conduct comprehensive assessments of navigational safety risks, taking into account variables such as vessel traffic density, wind speed, and surrounding weather and environmental conditions, reflecting a risk-based, dynamic regulatory approach.⁴⁶

Nevertheless, this model remains unsupported by a binding international framework, and its application is limited to domestic use or through bilateral agreements, without becoming a settled norm in international maritime law. To address this divergence in regional standards, there is a need to harmonize regulatory principles by creating a joint EU-US code of maritime safety and navigation standards, or alternatively, that the recommendations of the IMO be developed to encompass a more "dynamic" model that adapts to changing environmental and navigational conditions so that it can better facilitate its applicability on the international stage.

⁴⁴ Jay, Stephen; Flannery, Wesley; Vince, Joanna; Liu, Wen-Hong; Xue, Guifang Julia; Matczak, Magdalena; Zacha, Jacek; Janssen, Holger; van Tatenhove, Jan; Toonen, Hilde; Morf, Andrea; Olsen, Erik; Suárez de Vivero, Juan Luis; Rodríguez Mateos, Juan Carlos; Calado, Helena; Duff, John; Dean, Hanna., *International Progress in Marine Spatial Planning*, In *Ocean Yearbook* 27, (eds. Aldo Chircop, Scott Coffen-Smout, Moira McConnell), Martinus Nijhoff Publishers, Leiden-Netherlands, 2013, p. 174.

⁴⁵ Schupp, Maximilian Felix; Bocci, Martina; Depellegrin, Daniel; Kafas, Andronikos; Kyriazi, Zacharoula; Lukic, Ivana; Schultz-Zehden, Angela; Krause, Gesche; Onyango, Vincent; Buck, Bela H., *Toward a Common Understanding of Ocean Multi-Use*, *Frontiers in Marine Science* 6, no. 165, Frontiers Media, Lausanne, Switzerland, 2019, p. 7. Available at: <https://www.frontiersin.org/journals/marine-science/articles/10.3389/fmars.2019.00165/pdf> (accessed 25 March 2025).

⁴⁶ United States Customs and Border Protection (CBP), op.cit, pp. 15403-15409. and United States. Department of the Interior, Bureau of Ocean Energy Management, *Information Guidelines for a Renewable Energy Construction and Operations Plan (COP)*, Version 4.0., D.C.: BOEM, Washington, 27 May 2020, pp. 17, 27–32. Available at: https://www.boem.gov/sites/default/files/documents/about-boem/COP%20Guidelines_Technical_Corrections.pdf (accessed 25 March 2025).

4.1.2- The Absence of a Mechanism for Harmonizing International Standards

Article 60 of the UNCLOS 1982 permits coastal states to establish safety zones around installations within their exclusive economic zone, provided such zones are not greater than 500 meters "save as permitted by generally accepted international standards or as recommended by the competent international organization".⁴⁷ However, the Convention does not provide standard operating parameters to decide on the scope of these zones or on the vessel entry requirements therein. This has led to significant discrepancies among States in determining navigational routes and methods of access and departure from installations.⁴⁸ Recent research has shown that such disparities and lack of uniformity in law have a tendency to restrict international shipping movement and force vessels to change their usual path, incurring higher operating expenses due to attached risks and longer transit.⁴⁹

The lack of a unified interpretation of the UNCLOS provisions relating to energy installations also hinders efforts by states to harmonize their domestic laws with maritime safety requirements, negatively impacting the consistency required in implementing the principle of freedom of navigation as an international customary rule. The legal gap is exacerbated by the IMO's failure to issue a binding global code of conduct governing interactions between ships and offshore energy installations outside territorial waters. Despite its limited guidance—e.g., Resolution A.671(16), containing a series of recommendations of a non-binding nature regarding the delimitation of safety zones surrounding offshore facilities—this guidance lacks legal force and does not specifically refer to renewable energy installations.

To address this shortcoming, a need arises for legal and institutional initiatives, most importantly: amending the text of Article 60 of the UNCLOS through an Additional Protocol that includes clear operational parameters for the establishment of safety zones, and launching an initiative under the supervision of the IMO to adopt a legally binding code that unifies technical and regulatory standards relating to safety zones around offshore energy installations, thereby enhancing maritime safety and respect for the freedom of navigation.

⁴⁷ Art. 60 (Paragraph 5), The UNCLOS 1982, op.cit, p. 45.

⁴⁸ Olivia Woolley, *Renewable Energy and the Law of the Sea*, in James Harrison (ed.), *Emerging Technology and the Law of the Sea*, Cambridge University Press, Cambridge, United Kingdom, 2022, pp. 15–30. Available at: <https://durham-repository.worktribe.com/output/1625401> (accessed 27 March 2025).

⁴⁹ Raza Ali Mehdi, Jens-Uwe Schröder-Hinrichs, Jeroen van Overloop, Henrik Nilsson, and Jonas Pålsson, *Improving the Coexistence of Offshore Wind Farms and Shipping: An International Comparison of Navigational Risk Assessment Processes*, *WMU Journal of Maritime Affairs*, Vol. 17, No. 3, Springer, United Kingdom, 2018, pp. 399–400. Available at: <https://doi.org/10.1007/s13437-018-0149-0> (accessed 27 March 2025).

4.2- Deficiencies in International Institutional Coordination

The current reality reflects a clear institutional shortfall in coordinating maritime navigation in areas hosting offshore energy platforms, as evidenced by the following:

4.2.1- The lack of binding implementation mechanisms for maritime coordination within international institutions

Although Article 60 of UNCLOS grants coastal States the authority to regulate the establishment of offshore installations within their exclusive economic zones, and whereas Regulations V/10 and V/11 of the SOLAS Convention provide a framework of Ships' Routeing and Ship Reporting Systems,⁵⁰ these frameworks do not provide binding international enforcement measures to create alternative shipping routes around such installations. The NorthSEE project analysis revealed weak institutional coordination among coastal States, which led to "higher costs for maritime industries and compromised environmental objectives" in the North Sea.⁵¹

4.2.2- Limited Mandate of the IMO and the Lack of Enforcement Mechanisms for Its Recommendations

The IMO has issued Resolution A.671(16) in 1989, recommending the establishment of safety zones around fixed offshore structures. This resolution, however, is non-binding and its operational nature lacks any monitoring or enforcement mechanism, thus lowering its impact in the real world due to the growing complexity of disputed uses of the sea.⁵²

4.2.3- Absence of a Joint International Coordination Platform

There is no permanent institutional body bringing together coastal States, maritime companies, energy organizations, and safety specialists to harmonize navigation charts and exchange security information systematically. International experiences—such as NorthSEE and Norsaic—have demonstrated the importance of temporary technical initiatives that are unavoidable, yet these remain limited in their impact unless reinforced by effective international implementation mechanisms and platforms. One comparative study concluded that cross-border coordination in the North Sea is "limited to the mere exchange of

⁵⁰ IMO, International Convention for the Safety of Life at Sea (SOLAS), Chapter V – Regulation V/10 & V/11: Ships' Routeing and Ship Reporting Systems, London, 1974, pp. 1–2. Available at: <https://www.wcdn.imo.org/localresources/en/OurWork/Safety/Documents/Ships%20routeing/Regulation%20V-10And11-ShipsRouteingAndShipReportingSystems.pdf> (accessed 28 March 2025).

⁵¹ NorthSEE Project, North Sea Region Climate Change Assessment and Maritime Spatial Planning Recommendations, Final Report, 2020, p. 28. Available at: <https://www.sustainable-projects.eu/images/publications/sub-north-see-project-findings-brochure-WEB-200420.pdf> (accessed 28 March 2025).

⁵² IMO, Resolution A.671(16), op.cit, pp. 6 - 10.

information",⁵³ with no common institutional mechanisms or integrated maritime spatial planning between the involved States.

4.2.4- Failure of Regional Initiatives to Achieve Practical Harmonization

Despite the 2016 signing of the Political Declaration on North Seas Energy Cooperation—which focused on enhancing offshore electricity interconnection and maritime spatial planning under a voluntary framework, with the aim of developing an offshore electricity grid based on technical and political cooperation⁵⁴—this declaration was legally non-binding in nature, and this has led to implementation variation between states, most notably within the European Union, due to the variety of priorities in every state and the lack of common executive will. In this context, the 2020 North Sea Agreement illustrated efforts at harmonization of maritime standards, such as conservation of the Esbjerg Seaway in conjunction with Germany, Denmark, and Belgium. but it also revealed the weakness of the institutional framework for such cooperation. The executive mechanism was limited to a non-legally binding consultative body lacking binding transboundary powers, which discourages harmonization of maritime traffic standards between coastal states in the region.⁵⁵

To surmount the deficiencies mentioned above, certain practical measures can be proposed, most notably the development of a binding international implementation framework through the adoption of a code under the auspices of the IMO, solely dedicated to organizing navigational charts and traffic management systems in offshore energy zones. It is also proposed to launch an independent international coordination body comprised of the interested coastal States, international maritime organizations such as the ICS, and renewable energy organizations such as IRENA. This body should be granted technical and legal powers to update navigation charts and manage cross-border crises. In addition, it is important to integrate strategic systems inspired by successful regulatory models in Europe and the United States, via a cooperative project that effectively addresses issues such as the suspension of maritime traffic during the construction process and the assurance of safety during operation—without compromising the principle of freedom of navigation.

⁵³ Froukje Maria Platjouw, “Marine Spatial Planning in the North Sea—Are National Policies and Legal Structures Compatible Enough? The Case of Norway and the Netherlands”, *The International Journal of Marine and Coastal Law*, Vol. 33, No. 1, Brill Nijhoff, Netherlands, 2018, p. 77. Available at: <https://doi.org/10.1163/15718085-12320075> (accessed 30 March 2025).

⁵⁴ Political Declaration on Energy Cooperation between the North Seas Countries, North Seas Energy Cooperation, 6 June 2016; reaffirmed October 2022, pp.1–2. Available at: <https://www.kefm.dk/media/7140/political-declaration-on-energy-cooperation-between-the-north-seas-countries.pdf> (accessed 30 March 2025).

⁵⁵ Noordzeeloket, *The North Sea Agreement: Going those extra miles for a healthy North Sea*, Ministry of infrastructure and water management, The Hague, 2020, pp.18, 35-51. Available at: https://www.noordzeeloket.nl/publish/pages/182605/north_sea_agreement.pdf (accessed 30 March 2025).

5-Conclusion:

From Innocent Passage to the Energy Transition — Towards a New Maritime Framework. This study reveals the features of a deep structural shift affecting the traditional rules governing innocent passage through territorial seas. In light of the massive expansion of marine spaces for renewable energy generation, contemporary legal challenges are no longer limited to the classical tension between sovereignty and freedom of navigation. They now emerge from a new operational reality shaped by "steel turbine forests" that have remapped maritime geography — and the legal balance that accompanies it.

Given this new reality, the 1982 UNCLOS now appears to be an instrument devised for an earlier era, facing technical as well as geopolitical challenges that were not foreseen by its drafters. Concepts such as "innocent passage," "harm," and "obstacles" are no longer sufficient to regulate the growing interactions between vessels and offshore installations — particularly in EEZs, which have become a stage for overlapping energy, environmental, and navigational interests.

The comparative analysis of the European experience, the American model, and South China Sea geopolitics highlights the legal vacuum resulting from the absence of binding international standards on safety zones, alternative shipping routes, and reporting obligations. This vacuum jeopardizes navigational safety and undermines the principle of equality in the use of the seas. Additionally, emerging challenges — such as cyber threats or the use of offshore energy installations as tools for geopolitical expansion — further undermine the current legal order.

Based on this diagnosis, the study does not stop at describing the problem, but calls for a new legal framework built on three pillars:

1 .Amending Article 60 of UNCLOS to explicitly include modern energy installations of a special nature, with a redefinition of safety zone parameters in a dynamic manner responsive to the distinctive characteristics of each undertaking.

2 .The adoption of an additional protocol to complement the Convention that would establish transparency, simplify reporting procedures, and mandate the development of alternative navigational routes, under the supervision of the IMO.

3 .The establishment of an international multilateral coordination body, comprising representatives of United Nations and specialized agencies, with the mandate to monitor risks, update navigation charts, and resolve technical transboundary disputes.

Ultimately, "the sea cannot tolerate walls — but it does need traffic signals" Law, then, must take the form not of a restraint upon the freedom of navigation, but of a safeguard

against disorder and arbitrariness. In the midst of the roar of turbines, the haste of ships, and the silence of outdated legal norms, the outline of a new maritime contract is emerging — one that no longer views offshore installations as obstacles, but as signposts of a civilizational transition — a transition that demands a legal order that is flexible in its governance, firm in its destination, and fair in its balance between sovereignty and freedom.

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