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Reagan Aylmer

State Obligations Under International
Law for the Environmental Regulation
of Space Object Reentries in Areas
Beyond National Jurisdiction

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Foreword

This thesis concluded my Master's degree in Law at the University of Oslo, where it was submitted in May 2026. Apart from some light editorial changes, the text appears here as it was originally submitted.

The high seas and outer space are both areas beyond national jurisdiction, each subject to a foundational prohibition on national appropriation and each governed by its own legal regime. To date, however, these two bodies of law have developed largely in isolation from one another. Yet they are physically connected by an increasingly routine practice: the controlled and uncontrolled reentry of space objects into the ocean. With the growth of commercial spaceflight and satellite mega-constellations, splashdown disposal in remote ocean areas, most famously the "spacecraft cemetery" surrounding Point Nemo, has become the space industry's default end-of-life solution, largely unexamined by international environmental law.

The topic of this thesis is the obligations that international law imposes on launching and responsible States with respect to the environmental regulation of such reentries. In particular, I consider whether the Agreement on Marine Biological Diversity of Areas Beyond National Jurisdiction (the BBNJ Agreement), which entered into force on 17 January 2026, closes the normative gap between international space law and the law of the sea, with particular attention to its environmental impact assessment framework, read alongside UNCLOS, the Outer Space Treaty corpus, and customary international law.

I am sincerely and wholeheartedly grateful to my supervisor, Professor Alla Pozdnakova, whose excellent guidance, generous support, and flexibility made this research both possible and a genuine pleasure. Her insight and encouragement have shaped not only this thesis, but the direction of my research beyond it.

Finally, thank you to my partner Maximilian for his unwavering support and patience throughout this project, to my son Leander, who provided a unique and humorous toddler's perspective on these topics, and to the newest member of our family, Alastair, whose timely arrival provided excellent motivation to finish this thesis early.

Tromsø, 2 July 2026

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1 Introduction

The high seas and outer space share more than a conceptual affinity as global commons beyond national sovereignty. Each is governed by a distinct corpus of international law, with individual foundational texts such as the United Nations Convention on the Law of the Sea (UNCLOS)¹ and the 1967 Outer Space Treaty (OST)² respectively, and both affirm the shared nature of the zones, rooted in a prohibition on national appropriation of the zone itself. Yet, these two legal domains have evolved in isolation from one another to date, despite the routine descent of space objects through the atmosphere and into the ocean in areas beyond national jurisdiction (ABNJ).

The past decade has seen exponential growth in commercial spaceflights and satellite mega-constellations.³ This, in turn, has led to a sharp increase of both space objects, including debris, in and around Earth's orbit, with the European Space Agency estimating that approximately 15,800 tons⁴ of space objects are currently circling the globe.⁵ Mitigation options for end-of-life space objects are limited, and rely heavily on the controlled and uncontrolled reentry into areas beyond national jurisdiction (ABNJ), principally the high seas, driving a surge in high seas reentries over the past five years.⁶ Industry practice has long operated under assumptions that the remoteness and distance from human civilization of well-used splashdown sites such as Point Nemo in the South Pacific renders environmental harm negligible.⁷ Indeed, the European Space Agency's "Zero Debris Charter" outlines the Agency's ambitious goal to halt the generation of space debris by 2030 by utilizing splashdowns as the responsible solution to achieving this.⁸ Legal scrutiny on environmental impacts ended at national borders, centred on potential liability and harm to human life.

While the rate of the space debris re-entries and splashdowns is rapidly increasing, it is not a new concern. Already in 2001, in the debates surrounding the deorbiting of the Russian space station MIR, the Rio Group of Latin American States raised formal concerns before the United Nations Committee on the Peaceful Uses of Outer Space, arguing that the splashdown practice risked turning the South Pacific Ocean from a "common province into a dumping site for dangerous materials."⁹ Although the concerns produced no binding legal response or resolution, the question they raised has not gone away.

¹ United Nations Convention on the Law of the Sea, adopted December 10, 1982, opened for signature at Montego Bay, Jamaica, entered into force November 16, 1994, 1833 U.N.T.S. 3.

² Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, adopted January 27, 1967, opened for signature at London, Moscow, and Washington, D.C., entered into force October 10, 1967, 610 U.N.T.S. 205.

³ Mia M. Bennett, "Orbital Debris Requires Prevention and Mitigation across the Satellite Life Cycle," *Communications Engineering* 4, no. 1 (2025): 95, <https://doi.org/10.1038/s44172-025-00430-5>.

⁴ Includes space objects.

⁵ European Space Agency, *ESA Space Environment Report 2025* (Noordwijk: ESA, 2025), 12.

⁶ *Ibid.* Between 2020 and 2023, there was an increase of 500% of re-entry of unmanned space objects. Currently, the average number of intact satellites or rocket bodies re-entering Earth's atmosphere is over 3 per day.

⁷ Antonio García, "The Spacecraft Cemetery at the Loneliest Point on Earth," *LBV Magazine*, October 24, 2025, <https://www.labrujulaverde.com/en/2025/10/the-spacecraft-cemetery-at-the-loneliest-point-on-earth/>.

⁸ European Space Agency, "Zero Debris Charter" (March 2024), https://www.esa.int/Space_Safety/Zero_Debris_Charter.

⁹ Vito De Lucia, "Splashing Down the International Space Station in the Pacific Ocean: Safe Disposal or Trashing the Ocean Commons?," *EJIL: Talk!*, February 23, 2022, <https://www.ejiltalk.org/splashing-down-the-international-space-station-in-the-pacific-ocean-safe-disposal-or-trashing-the-ocean-commons/>.

The entry into force of the Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction (the BBNJ) in January 2026 marks a transformative moment in the evolving international environmental law landscape.¹⁰ In particular, the BBNJ operationalizes and clarifies responsibility to protect the global commons through mandatory Environmental Impact Assessment (EIA) procedures and area-based management tools. Its entry into force raises many questions on the environmental impact of the space sector, including if splashdown operations will forthwith be subject to binding procedural obligations that operators have historically operated without.

Employing the non-appropriation principle as a foundational normative bridge, this thesis analyses that question within the broader architecture of international law, examining how the governance of outer space and the high seas are increasingly linked by the physical reality of space object reentry.

1.1 Research Question

This paper seeks to address the central question: “What obligations does international law impose on launching/responsible states with respect to the environmental regulation of space object reentries in areas beyond national jurisdiction and does UNCLOS, in particular the BBNJ, close the normative gap between international space law and international environmental law?”

Four sub-questions structure the analysis in Parts 2 and 3. The first concerns the empirical and legal baseline: what environmental harm, if any, is caused by the reentry and splashdown of space objects in the high seas, and to what extent is that harm legally recognised under existing international frameworks? The legal analysis that follows examines the scope of the EIA obligation and the urgency of closing the normative gap, both of which depend on legally cognisable potential for environmental harm.

The second question addresses the existing obligation landscape: what duties do launching States bear under the OST, customary international law, and UNCLOS with respect to environmental harm caused by space object reentries in ABNJ? The third asks to what extent the BBNJ’s EIA obligation applies to splashdown operations, and how compliance with that obligation differs from previous practice. The fourth is the thesis’s ultimate evaluative question: is current splashdown practice consistent with binding international environmental law? Each of these questions is answered in sequence across Parts 1 through 3, with the fourth drawing conclusions from the analysis.

1.2 State of the Field and Identified Normative Gap

1.2.1 The Physical and Regulatory Context

Space object reentry is built into the planned lifecycle of many current and future space objects. As the “end-of-life” solution for defunct satellites and even space stations, large pieces of debris re-enter on both controlled and uncontrolled trajectories that frequently terminate in the high seas. Toxic chemicals, including unspent fuel, and other materials are deposited upon impact directly into oceanic ecosystems which are often understudied and poorly understood.¹¹

¹⁰ *Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction*(BBNJ), opened for signature June 19, 2023, entered into force January 17, 2026, UN Doc. A/CONF.232/2023/4, UNTS 56940.

¹¹ Kaineg, Sophie. "The Growing Problem of Space Debris," *Hastings Environmental Law Journal* 26 (2020): 277.

The governing legal architecture derives from two discrete regimes. International space law, anchored in the 1967 Outer Space Treaty (OST) and the 1972 Liability Convention primarily addresses post-impact compensation rather than prevention or mitigation.¹² Article VII OST¹³ and the Liability Convention impose either fault-based liability (for damage in outer space or airspace) or absolute liability (for damage on Earth's surface or to aircraft) on "launching States." These are defined as States that launch or procure the launch of a space object, or from whose territory or facility the launch occurs, and constitutes a pecuniary regime oriented toward damage redress.¹⁴

Distinctly, Article VI OST establishes broader State responsibility for all "national activities in outer space," whether governmental or non-governmental.¹⁵ It requires authorisation and continuing supervision to ensure conformity with the OST. This conduct-based duty imputes wrongful acts to the State irrespective of actual damage. Consequently, potential EIA obligations under the BBNJ may vest in both launching States (per the Liability Convention's scope) and authorising/supervising States (per Article VI). Detailed delineation of these regimes, however, falls outside this thesis's scope, which limits analysis to establishing the attribution baseline for marine impacts.

The OST's Article IX, which requires states to pursue activities "with due regard" for the interests of others and to avoid "harmful contamination" of outer space, was drafted with the space environment in mind and has not extended to reentry's marine environmental consequences.¹⁶

1.2.2 The Role of UNCLOS and Customary International Law

UNCLOS Articles 192 and 194 impose obligations to protect and preserve the marine environment and to take all measures necessary to prevent pollution from "any source." The breadth of that language is arguably capable of capturing satellite splashdowns and reentry debris. Yet state practice has not systematically applied these provisions to space-related activities, and the treaty's jurisdictional framework, which divides the oceans into zones of varying state authority, creates ambiguity where the high seas are concerned.

The International Court of Justice, in *Pulp Mills on the River Uruguay* (2010), affirmed that the obligation to conduct an EIA before undertaking activities with potential significant transboundary environmental harm has crystallised as a rule of customary international law.¹⁷ This obligation is not contingent on any specific treaty regime. Whether routine splashdown operations fall within its scope, given their transboundary character and potential for significant environmental impact, is a question that requires additional systematic legal analysis.

1.2.3 The Normative Gap

This thesis examines a structural, rather than merely procedural, normative gap arising at the intersection of international space law and the law of the sea: the descent of space objects from one global commons into another exposes the failure of their respective legal frameworks to address one another coherently. This paper argues that the BBNJ's recent entry into force offers the opportunity to better address and clarify this gap.

¹² *Convention on International Liability for Damage Caused by Space Objects*. Opened for signature March 29, 1972, entered into force September 1, 1972, 961 U.N.T.S. 187.

¹³ Outer Space Treaty, art. VII.

¹⁴ Liability Convention, art. I(c).

¹⁵ Outer Space Treaty, art. VI.

¹⁶ Outer Space Treaty, art. IX.

¹⁷ *Pulp Mills*, Judgment, I.C.J. Reports 2010, p. 14, <https://www.icj-cij.org/case/135>.

The normative gap identified in Section 1.2 operates on three distinct dimensions, each addressed in turn in Parts 2 and 3. The first is a jurisdictional gap. International space law allocates responsibility through the concept of the "launching State,"¹⁸ which retains jurisdiction and control over a space object throughout its operational life.¹⁹ As Cheng has demonstrated, however, the attribution of "international responsibility" under Article VI OST to the "appropriate State" for a given "national activity" is not straightforward: the treaty text does not define what constitutes a national activity, nor does it identify with precision which State is the "appropriate State" responsible for authorising and supervising it.²⁰ The law of the sea allocates responsibility through the concept of the flag State and, more broadly, through the State exercising "jurisdiction or control" over an activity. These categories are analogous but not identical, and their overlap in the splashdown context has, to date, never been authoritatively resolved. A State may be the launching State under the OST without being the licensing State for the activity's oceanic phase, and vice versa; leaving open the possibility that no single State bears unambiguous legal responsibility for the marine environmental consequences of a controlled reentry.

The second dimension is substantive. The OST framework imposes no obligation to assess, mitigate, or monitor the marine environmental impacts of splashdown operations. The UNCOPUOS Space Debris Mitigation Guidelines²¹ and the IADC guidelines²² address orbital sustainability and casualty risk to people and property on the Earth's surface. These non-binding recommendations define remote ocean areas as the safest available disposal option precisely because no human beings live there, not because the marine environment is protected. The 2025 revision of the IADC Guidelines gestures toward environmental concerns for the first time, acknowledging that ground environmental pollution from reentries "should be prevented or minimized," yet provides neither binding standards nor implementation mechanisms.²³ The result is that the single most heavily used spacecraft graveyard on Earth, the South Pacific Oceanic Uninhabited Area, where over 260 space objects have been deposited since the 1970s,²⁴ has never been the subject of a systematic environmental assessment under any applicable legal framework.²⁵

The third dimension is institutional. UNCOPUOS and UN Office for Outer Space Affairs (UNOOSA) carry no marine environmental mandate, while UNCLOS and the BBNJ govern ABNJ with no formal interface to the space governance regime. The absence of any joint body, information-sharing mechanism, or coordination process compounds the substantive gap, producing an absence of data, applicable standards, and oversight at the precise intersection that demands all three.

¹⁸ Outer Space Treaty, arts. VI, VIII.

¹⁹ *Convention on Registration of Objects Launched into Outer Space*, adopted November 14, 1974, entered into force September 15, 1976, 1023 U.N.T.S. 15, art. II.

²⁰ Bin Cheng, "Article VI of the 1967 Space Treaty Revisited: 'International Responsibility', 'National Activities' and 'the Appropriate State'," *Journal of Space Law* 26 (1998): 7–15.

²¹ United Nations Committee on the Peaceful Uses of Outer Space, *Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space* (Vienna: United Nations, 2010), UN Doc. A/62/20, annex.

²² Inter-Agency Space Debris Coordination Committee (IADC), *IADC Space Debris Mitigation Guidelines*, IADC-02-01 (rev. 2021).

²³ Inter-Agency Space Debris Coordination Committee (IADC), *IADC Space Debris Mitigation Guidelines* (2025 revision), UN Doc. A/AC.105/C.1/2025/CRP.9, accessed April 3, 2026, https://www.unoosa.org/res/oosadoc/data/documents/2025/aac_105c_12025crp/aac_105c_12025crp_9_0.html.

²⁴ Chelsea Muñoz-Patchen, "Regulating the Space Commons: Treating Space Debris as Abandoned Property in Violation of the Outer Space Treaty," *Chicago Journal of International Law* 19, no. 1 (2018): 233–59, <https://chicagounbound.uchicago.edu/cjil/vol19/iss1/7>.

²⁵ García, "The Spacecraft Cemetery at the Loneliest Point on Earth."

The urgency of addressing this gap is compounded by two concurrent developments. First, the volume of space activity, and with it, the frequency of splash-down operations, is increasing exponentially. SpaceX's Starlink megaconstellation alone accounts for approximately forty per cent of current satellite reentries;²⁶ and the planned 2030 deorbit of the International Space Station represents a litmus test for the governance gap at a scale that cannot be ignored.²⁷ Second, understanding of the fragility and ecological significance of deep-sea ecosystems has advanced considerably since the OST was adopted in 1967. The continued usage of the spacecraft cemetery at Point Nemo is based on the assumption the area is an ecological void. As scientific understanding of deep-ocean environments improves, such claims warrant urgent reexamination with particular attention to the possible cumulative contamination introduced by more than half a century of unmonitored debris deposits. The BBNJ's entry into force provides the legal mechanism through which this intersection of increasing activity and increasing knowledge can be properly governed.

1.3 Methodology

Using a doctrinal legal method as its primary analytical mode, this thesis seeks to provide systematic interpretation and analysis of positive legal sources - principally treaties, customary international law, judicial decisions, and authoritative secondary sources - with a view to identifying, clarifying, and critically evaluating the content of applicable legal obligations. The analysis deliberately avoids a policy-analytic approach; its aim is to determine what obligations currently exist under positive international law and whether they are being met, rather than to propose what obligations should exist.

The following resources inform the analysis:

- **Primary treaty sources** comprise the 1967 Outer Space Treaty; the 1972 Liability Convention; the 1975 Registration Convention;²⁸ the 1979 Moon Agreement;²⁹ the 1982 UNCLOS; and the 2023 BBNJ, with particular attention to Articles 27–39 (Part IV EIA provisions), Article 5 (relationship clause), and Article 6 (general obligations). The space law instruments govern the orbital phase of space activities but are silent on marine environmental protection and contain no EIA provisions; UNCLOS and the BBNJ supply the applicable environmental framework, formulated in terms general enough to engage activities not contemplated at the time of drafting.
- **Customary international law** is engaged through the EIA obligation affirmed as a rule of general international law in *Pulp Mills* (ICJ, 2010) and the no-harm rule articulated in the Trail Smelter arbitration. Both were established in contexts unrelated to space activities and their application to the splashdown context requires interpretive extension, which is justified in the relevant sections below.
- **General principles of international law**, including the precautionary principle, the duty of due diligence, and the principle of common but differentiated responsibilities, provide interpretive and gap-filling tools applicable across the

²⁶ Tereza Pultarova, "How Much Do SpaceX's Reentering Starlink Satellites Pollute Earth's Atmosphere?," Space.com, October 17, 2024, <https://www.space.com/spacex-starlink-reentry-pollution-damage-earth-atmosphere>.

²⁷ "What Is Point Nemo, the Remote, Watery Satellite Graveyard Where the ISS Will Go to Die?," *Live Science*, December 1, 2023, <https://www.livescience.com/planet-earth/rivers-oceans/what-is-point-nemo-the-remote-watery-satellite-graveyard-where-the-iss-will-go-to-die>.

²⁸ Convention on Registration of Objects Launched into Outer Space. Adopted November 14, 1974. Entered into force September 15, 1976. 1023 U.N.T.S. 15.

²⁹ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies art. II, opened for signature Dec. 18, 1979, 1363 U.N.T.S. 3.

primary treaty sources. It should be noted, however, that these principles operate at a high level of generality and their precise normative reach at the intersection of space law and the law of the sea remains contested, with limited scholarly authority specifically addressing how they apply to the reentry of space objects into the marine environment. Accordingly, this thesis does not engage these principles as independent sources of obligation; rather, they function as interpretive and gap-filling tools supplementing the primary treaty analysis. This reflects a genuine methodological challenge: the absence of settled doctrinal consensus on how principles such as the precautionary approach and common but differentiated responsibilities operate at the space–marine interface means that reliance upon them as autonomous bases of legal obligation would exceed what the existing sources can sustain.

- **Subsidiary sources**, including decisions and advisory opinions of international courts and tribunals, most notably *Pulp Mills*,³⁰ *Certain Activities*,³¹ the ITLOS Seabed Mining Advisory Opinion,³² and the ITLOS and ICJ Climate Change Advisory Opinions,³³ are used to establish the content of customary obligations and to interpret treaty provisions. While none addresses space activities as such; their relevance lies in the general principles they articulate, applied here by analogy to the splashdown context. The ILC Articles on State Responsibility (2001)³⁴ and the Articles on Prevention of Transboundary Harm (2001)³⁵ similarly provide the general secondary-rules framework within which breaches of BBNJ and UNCLOS obligations are analysed, without modification.

Additionally, the UNCOPUOS and IADC Space Debris Mitigation Guidelines are employed primarily to demonstrate the limits of the existing space law framework. Neither addresses marine environmental impacts, imposes EIA requirements, nor creates legally binding obligations. Their relevance lies not in what they require but in what they omit: the systematic absence of marine environmental provisions from the space debris mitigation framework is itself evidence of the normative gap this thesis argues the BBNJ fills. That the 2025 IADC revision acknowledges ground environmental pollution from reentries for the first time confirms an emerging environmental awareness within space governance, while simultaneously illustrating the distance between those tentative acknowledgements and the procedural obligations imposed by Part IV of the BBNJ.

Academic doctrine is drawn from two bodies of scholarship that have developed largely independently: international space law literature, which does not address marine environmental obligations; and international environmental law scholarship, which does not address space activities. This synthesis is novel; academic sources serve to establish the doctrinal content of applicable principles, not to substitute for the legal rules themselves.

³⁰ *Pulp Mills on the River Uruguay* (Argentina v. Uruguay), Judgment, I.C.J. Reports 2010, p. 14 (cited in full supra n. 17). Subsequent citations use the short form.

³¹ *Certain Activities Carried Out by Nicaragua in the Border Area* (Costa Rica v. Nicaragua), Judgment, I.C.J. Reports 2015, p. 665.

³² *Responsibilities and Obligations of States with Respect to Activities in the Area*, Advisory Opinion, ITLOS Case No. 17 (February 1, 2011).

³³ *Request for an Advisory Opinion Submitted by the Commission of Small Island States on Climate Change and International Law*, Advisory Opinion, ITLOS Case No. 31 (May 21, 2024); *Obligations of States in Respect of Climate Change*, Advisory Opinion, I.C.J. Case No. 187 (July 23, 2025), <https://www.icj-cij.org/sites/default/files/case-related/187/187-20250723-adv-01-00-en.pdf>.

³⁴ International Law Commission, *Responsibility of States for Internationally Wrongful Acts* (2001), in Report of the International Law Commission on the Work of Its Fifty-Third Session, UN Doc. A/56/10, Supp. No. 10.

³⁵ International Law Commission, *Draft Articles on Prevention of Transboundary Harm from Hazardous Activities* (2001), UN Doc. A/56/10, Supp. No. 10, annex.

Several methodological challenges arise from the nature of this inquiry. The intersection of international space law and international environmental law in the specific context of the BBNJ has received limited scholarly attention to date, and State practice is either absent or insufficiently developed to provide reliable indications of *opinio juris* on the central questions. This thesis therefore proceeds largely through treaty interpretation and doctrinal analysis, relying on primary norms and judicial decisions as the primary inputs. Where treaty provisions are ambiguous, for example, whether “planned activities” in Article 28 BBNJ extends to deliberate deorbit manoeuvres with uncertain final impact points, or whether the “not undermine” clause in Article 5 could be read to exempt space activities from the EIA framework, this thesis states its interpretive choice explicitly, following the VCLT Article 31 methodology of ordinary meaning, context, and object and purpose.³⁶

The absence of literature on space debris within the BBNJ context, and the untested applicability of its EIA provisions, present a methodological challenge. This thesis therefore draws heavily on general international environmental law scholarship and foundational studies of State responsibility and due diligence that, while not addressed to space activities specifically, provide the doctrinal architecture within which the specific legal questions may be resolved.

1.4 Scope and Limitations

The thesis focuses exclusively on existing and emerging State obligations under public international law; questions of private liability, domestic regulatory implementation, and comparative national space law fall outside its scope. The analysis is confined to areas beyond national jurisdiction (ABNJ), the high seas and the deep seabed known as “the Area,” defined under UNCLOS as all parts of the sea not included in the territorial sea, internal waters, or exclusive economic zone of any State, and the seabed and ocean floor beyond the limits of national jurisdiction respectively, together constituting the marine spaces over which no single State exercises sovereign rights.³⁷ Questions of State obligations in relation to reentries occurring within territorial waters or exclusive economic zones present distinct legal issues that are not addressed here.

1.5 The Applicable Legal Frameworks: An Overview

Before turning to the substantive analysis in Parts 2 and 3, it is necessary to introduce the three principal legal frameworks whose interaction this thesis examines: UNCLOS, the BBNJ, and the OST corpus. This section provides that orientation; deeper analysis of specific provisions follows in the subsequent Parts.

1.5.1 UNCLOS: The Constitution of the Oceans

The United Nations Convention on the Law of the Sea (UNCLOS), adopted in 1982 and entering into force in 1994, is widely recognised as the “constitution of the oceans.”³⁸ It establishes the jurisdictional architecture of the global ocean, dividing maritime space into zones of varying State authority, internal waters, territorial seas, contiguous zones, exclusive economic zones (EEZ), the continental shelf, the high seas, and the deep seabed (the Area), and allocates rights and obligations accordingly. For present purposes, the most significant provisions are those in Part XII (Protection and Preservation of the Marine Environment).

³⁶ *Vienna Convention on the Law of Treaties*, May 23, 1969, 1155 U.N.T.S. 331, art. 31.

³⁷ UNCLOS, arts. 1(1), 86; BBNJ, art. 3.

³⁸ United Nations, “Oceans and the Law of the Sea,” accessed April 26, 2026, <https://www.un.org/en/global-issues/oceans-and-the-law-of-the-sea>.

Article 192 imposes a general obligation on all States to protect and preserve the marine environment. Article 194 requires States to take all measures necessary to prevent, reduce, and control pollution of the marine environment from “any source,” language broad enough to capture pollution originating from space objects. Article 204 requires States to monitor the risks or effects of pollution, and Article 206, crucially, requires States to assess the potential effects of planned activities when they have “reasonable grounds for believing” that those activities “may cause substantial pollution of or significant and harmful changes to the marine environment.”³⁹ These provisions are obligations of the highest generality, applying to all States party and in relation to activities “under their jurisdiction or control.” UNCLOS is also the parent instrument of the BBNJ, which was adopted as an implementing agreement and must be interpreted in light of the Convention.

1.5.2 The BBNJ: Operationalising Environmental Governance Beyond National Jurisdiction

The BBNJ under UNCLOS on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction (the BBNJ) was adopted in June 2023 and entered into force in January 2026. It addresses four main clusters: marine genetic resources; area-based management tools; environmental impact assessments (Part IV, Articles 27–39); and capacity-building. This landmark Agreement is the first legally binding international instrument specifically designed to govern human activities in ABNJ from an environmental perspective.

For present purposes, Part IV (Articles 27–39, EIA obligations) and Article 6 (general substantive standard) are the primary focus, analysed in Parts 2 and 3. Article 5 governs the BBNJ’s relationship with other applicable instruments - a central interpretive question addressed in Part 2.

1.5.3 The Outer Space Treaty Corpus: The International Space Law Framework

International space law rests on five UN treaties negotiated under the Committee on the Peaceful Uses of Outer Space (UNCOPUOS) between 1967 and 1979. The foundational instrument is the 1967 Outer Space Treaty (OST).⁴⁰ The OST establishes: the prohibition on national appropriation of outer space (Article II); freedom of exploration and use (Article I); the obligation to conduct activities with “due regard” for others and to avoid harmful contamination (Article IX); and the attribution of international responsibility to States for national space activities, including those of non-governmental entities (Article VI). Article VIII establishes the registration-jurisdiction nexus: the State of registry retains jurisdiction and control over a space object wherever located. These provisions collectively constitute the “launching State” framework, which is further elaborated by the 1972 Liability Convention (absolute liability for damage caused by space objects on the Earth’s surface)⁴¹ and the 1975 Registration Convention.⁴²

Supplementing the treaties are the UNCOPUOS Space Debris Mitigation Guidelines (2007) and the IADC guidelines (2007, rev. 2021). These non-binding instruments require operators to minimise debris creation in orbit and to plan for end-of-life disposal, including controlled reentries targeting remote ocean zones to minimise risk to persons and property. Critically, they contain no requirement for any environmental impact assessment of the marine ecosystem consequences of

³⁹ *United Nations Convention on the Law of the Sea (UNCLOS)*, December 10, 1982, 1833 U.N.T.S. 397, art. 206

⁴⁰ Outer Space Treaty.

⁴¹ Liability Convention, art. II.

⁴² Registration Convention, art. II.

reentries. The interaction between this framework and the UNCLOS/BBNJ framework is the central analytical challenge of Parts 2 and 3.

2 The Legal Framework: State Obligations at the Intersection of Space Law and the Law of the Sea

2.1 Due Diligence and the Environmental Impact Assessment Obligation in Public International Law

Before analysing how the EIA obligation operates within the specific framework of the BBNJ, it is necessary to situate it within the broader architecture of public international law. The basis for the EIA obligation can be seen as a procedural expression of a more fundamental duty of due diligence that has emerged as a general principle of international environmental law, applicable independently of any specific treaty regime. Understanding this foundation of *opinio juris* affirms that launching States cannot escape the EIA obligation simply by pointing to a gap in any particular treaty text.

2.1.1 The Due Diligence Standard in International Environmental Law

The due diligence standard in international law requires States to take all appropriate measures to prevent transboundary or common-area harm from activities under their jurisdiction or control. It is a standard of conduct rather than of result: it does not require that no harm occur, but that the State exercise the level of care that a government acting diligently would be expected to deploy in similar circumstances.⁴³ The standard is graduated to the severity and likelihood of potential harm: where the risk of significant environmental damage is high, the diligence required increases correspondingly, calibrated to the best available scientific standards at the time.⁴⁴ The general relationship between due diligence and State responsibility is addressed in the broader international law literature.⁴⁵

The due diligence standard in international environmental law has been progressively established through a series of landmark judicial and advisory opinions. The foundational expression of the no-harm rule, that States may not use or permit use of their territory in a manner causing injury to another State or to areas beyond national jurisdiction, emerged from the Trail Smelter arbitration⁴⁶ and is now reflected in Principle 21 of the Stockholm Declaration (1972) and Principle 2 of the Rio Declaration (1992). The ICJ subsequently confirmed the general obligation of States to ensure that activities within their jurisdiction and control do not damage the environment of other States or of areas beyond national control.⁴⁷ The ITLOS Seabed Mining Advisory Opinion (2011) confirmed that the due diligence obligation extends to States sponsoring activities in the Area, requiring the standard of conduct necessary to prevent marine environmental harm and establishing the obligation to conduct EIAs as a component of that duty.⁴⁸

The most consequential judicial development is the ICJ's holding in Pulp Mills that the obligation to conduct an EIA before undertaking activities with the potential for significant transboundary environmental harm has "now become a require-

⁴³ Malaihollo, "Due Diligence in International Environmental Law," 121–55; Crawford, Brownlie's Principles, chap. 20.

⁴⁴ Sands and Peel, *Principles of International Environmental Law*, 4th ed., 603–607; Riccardo Pisillo Mazzeschi, "The Due Diligence Rule and the Nature of the International Responsibility of States," *German Yearbook of International Law* 35 (1992): 9.

⁴⁵ Birnie, Boyle, and Redgwell, *International Law and the Environment*, 3rd ed., 137–42; Dupuy, "Due Diligence," 369; Crawford, Brownlie's Principles, chap. 20.

⁴⁶ *Trail Smelter Case (United States v. Canada)*, 3 R.I.A.A. 1905 (1938, 1941).

⁴⁷ *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion, I.C.J. Reports 1996, p. 226, para. 29.

⁴⁸ *Responsibilities and Obligations of States (ITLOS)*, paras. 110, 115, 141.

ment under general international law."⁴⁹ That holding is not contingent on any specific treaty regime and applies wherever activities carry the potential for significant environmental harm. It has been confirmed and extended in subsequent jurisprudence: *Certain Activities* (ICJ, 2015) affirmed the obligation's application to cumulative impacts; and the ITLOS *Climate Change Advisory Opinion* (2024) held that the due diligence obligation under UNCLOS Article 194 requires States to take all necessary measures, including procedural steps such as EIA, to prevent, reduce, and control climate change-related harm to the marine environment.⁵⁰

2.1.2 'Jurisdiction or Control' as a Common Organising Concept Across UNCLOS, BBNJ, and the OST

A critical point of convergence between the three applicable legal frameworks remains that all three employ some variant of a "jurisdiction or control" nexus to attribute regulatory responsibility to States. Through this lens, the frameworks can be interpreted as sharing a common structure of attribution even if their substantive obligations differ.

Under UNCLOS Article 192 and Article 194(1), States are required to take measures to prevent marine pollution in relation to activities "under their jurisdiction or control." The BBNJ's Article 6 and Article 28(1) employ the identical phrase. The OST's Article VI allocates international responsibility to States for national space activities, whether by governmental or non-governmental entities,⁵¹ a responsibility that is operationalised through the Article VIII registration-jurisdiction nexus, which confers on the State of registry "jurisdiction and control" over a space object.⁵² The precise scope of this allocation, and in particular the meaning of "national activities" and the identification of the "appropriate State," remains a matter of scholarly debate.⁵³ The Liability Convention and the Registration Convention further specify that the "launching State", the State that launches, procures the launching of, or from whose territory a space object is launched, is the State that bears this jurisdictional responsibility. In all three frameworks, therefore, the critical question is not which treaty applies in the abstract, but which State exercises effective jurisdiction or control over the activity in question; that determination will in most cases yield the same answer across all three instruments simultaneously.

The ITLOS *Seabed Mining Advisory Opinion* is instructive here. The Tribunal held that the sponsoring State's obligation of due diligence, including the obligation to require EIAs, applies by virtue of the jurisdictional nexus between the State and the activities of the entities it sponsors. This reasoning maps directly onto the splashdown context: the State that licenses a commercial launch operator, approves its reentry plan, and issues a splashdown authorisation is exercising jurisdiction or control over that activity within the meaning of all three frameworks. Thus, the obligation of due diligence, including the EIA obligation, follows from that jurisdictional nexus, regardless of whether the obligation is grounded in UNCLOS, the BBNJ, or customary international law independently.

⁴⁹ *Pulp Mills*, I.C.J. Reports 2010, para. 204

⁵⁰ *Obligations of States in Respect of Climate Change*, Advisory Opinion, I.C.J. Case No. 187 (July 23, 2025).

⁵¹ Outer Space Treaty, art. VI.

⁵² Outer Space Treaty, art. VIII; Registration Convention, art. II.

⁵³ Cheng, "Article VI," 7, at 15; Von der Dunk, "The Origins of Authorisation," 3–28; Hobe et al., *Cologne Commentary*, vol. I, art. VI.

2.1.3 The EIA Obligation: Content and Standard

The content of the EIA obligation as a matter of customary international law has been progressively elaborated through judicial decisions and State practice.⁵⁴ While Article 206 of UNCLOS establishes the foundational obligation requiring States to assess potential effects of planned activities that may cause substantial pollution or significant and harmful changes to the marine environment, its normative strength remains modest. The text does not specify a standard of "reasonable grounds," offer threshold criteria, or prescribe procedural frameworks for conducting the assessment. *Pulp Mills* established the minimum requirements: the EIA must be conducted before the activity is authorised; it must assess the potential significant transboundary or common-area impacts; and it must be disclosed to affected parties. Subsequent decisions have added further content: the obligation extends to cumulative impacts,⁵⁵ the EIA must use the best available scientific evidence and techniques;⁵⁶ and where scientific uncertainty exists, the precautionary approach requires that the absence of full scientific certainty not be used as a reason to postpone preventive measures.⁵⁷ These customary requirements are, however, general in character: they leave States wide discretion as to the specific content and procedure of any given assessment, and impose no institutionalised mechanism for ensuring transparency or accountability.⁵⁸

The BBNJ's Part IV framework addresses this deficit directly. As Tanaka has observed, Article 27(a) explicitly designates the operationalisation of UNCLOS's EIA provisions in ABNJ as an objective of Part IV, and Article 28(1) constitutes "an important innovation" in placing a clear, treaty-based obligation on parties to ensure that the impacts of planned activities under their jurisdiction or control in ABNJ are assessed before authorisation.⁵⁹ The BBNJ does not create the EIA obligation *ex novo*; rather, it gives the pre-existing customary obligation specific and procedurally complete content, elaborating the EIA process across six discrete stages, from preliminary screening through scoping, impact assessment, publication, decision-making, and monitoring, and subjects each stage to oversight by the Scientific and Technical Body.⁶⁰ This is the basis on which this thesis argues that the BBNJ constitutes the primary applicable framework for splashdown EIAs: it provides, in addition to UNCLOS and customary law, the most specific and institutionally robust expression of the obligation available to States conducting activities in ABNJ.

2.2 Preliminary Question: Does the BBNJ Preserve or Displace the Existing Framework?

Article 5 of the BBNJ, its relationship clause, provides that its text shall be "interpreted and applied in a manner that does not undermine relevant legal instruments and frameworks and relevant global, regional, subregional and sectoral bodies" and that "promotes coherence and coordination" with them.⁶¹ The "not undermine" formulation has attracted sustained scholarly attention, not least because its meaning was never agreed upon during negotiations: different delega-

⁵⁴ For additional legal analysis, see Neil Craik, *The International Law of Environmental Impact Assessment: Process, Substance and Integration* (Cambridge: Cambridge University Press, 2008)

⁵⁵ *Certain Activities* (Costa Rica v. Nicaragua), I.C.J. Reports 2015, para. 104.

⁵⁶ *Request for Advisory Opinion* (ITLOS, Case No. 31, 2024).

⁵⁷ Rio Declaration on Environment and Development, Principle 15, UN Doc. A/CONF.151/26/Rev.1 (vol. I) (1992); BBNJ, Preamble.

⁵⁸ *Pulp Mills*, para. 205; Tanaka, "Reflections on the EIA in the BBNJ," 92–93.

⁵⁹ Tanaka, "Reflections on the EIA in the BBNJ," 92, 95; BBNJ, art. 27(a); art. 28(1).

⁶⁰ BBNJ, arts. 28–37;

⁶¹ BBNJ, art. 5.

tions attached different interpretations to the phrase, ranging from not duplicating existing mandates to not impairing the effectiveness of existing measures, and the phrase was deliberately left ambiguous precisely to secure consensus.⁶² That ambiguity carries significant interpretive consequences. Article 5 is best understood as a regime complex management clause, a device for navigating the relationship between overlapping governance architectures, rather than a provision conferring veto power on any pre-existing sectoral body.⁶³ A more transformative reading holds that "not undermine" should operate as a floor rather than a ceiling, and that the BBNJ's conservation objectives require moving beyond passive non-interference toward affirmative ecosystem-based governance.⁶⁴ In the negotiations of the BBNJ, this point was supported by states with large fishing and sectoral interests with a goal of retaining the authority of existing bodies such as regional fisheries management organizations, and it became a foundational element of the BBNJ's political architecture.⁶⁵ The "not undermine" clause is accordingly designed to prevent the BBNJ framework from regulating activities already governed elsewhere, not to exempt those activities from BBNJ oversight where the existing framework is substantively silent on the relevant impact.⁶⁶

The "not undermine" clause must be addressed at the outset because it is the most likely defence that a launching State or operator might invoke, namely that the OST, the UNCOPUOS Space Debris Mitigation Guidelines, and the IADC framework already constitute a "relevant legal instrument or framework" governing splashdown operations, and that the BBNJ therefore has no application to activities already regulated under that regime. That argument has genuine doctrinal force. Article 5 was drafted with the explicit purpose of preserving the authority of pre-existing sectoral regimes; UNCOPUOS is precisely the kind of "relevant global body" the clause was designed to protect; and the Space Debris Mitigation Guidelines represent the settled product of decades of technical standard-setting within that body. A court or tribunal giving Article 5 its fullest possible scope might conclude that the UNCOPUOS framework constitutes an applicable instrument whose non-application to marine impacts reflects a deliberate policy choice rather than an inadvertent gap.

The interpretive approach in this section follows Article 31 of the VCLT, which requires that treaty provisions be interpreted in good faith in accordance with the ordinary meaning of their terms, in their context, and in light of the treaty's object and purpose.⁶⁷ Applied to Article 5, this means the relationship clause must be read in light of the BBNJ's overarching objective: the conservation and sustainable use of marine biological diversity in ABNJ. It follows that the object and purpose of the BBNJ would not permit States to exclude from the EIA framework activities with significant potential marine environmental impacts simply because those activities are regulated by another instrument that does not address those impacts. The novel character of the space-marine interface means that State practice and treaty history provide limited guidance; in such circumstances, the purposive

⁶² Andrew Friedman and Robert Blasiak, "Beyond 'Not Undermining': Possibilities for Global Cooperation to Improve Environmental Protection in Areas beyond National Jurisdiction," *ICES Journal of Marine Science* 76, no. 2 (2019): 452–56, at 453.

⁶³ David Langlet and Anna Bianca Vadrot, "Not 'Undermining' Who? Unpacking the Emerging BBNJ Regime Complex," *Marine Policy* (2022), <https://doi.org/10.1016/j.marpol.2022.105241>.

⁶⁴ Vito De Lucia, "Rethinking the Conservation of Marine Biodiversity beyond National Jurisdiction: From 'Not Undermine' to Ecosystem-Based Governance," *ESIL Reflections* 8, no. 4 (2019), <https://esil-sedi.eu/esil-reflection-rethinking-the-conservation-of-marine-biodiversity-beyond-national-jurisdiction-from-not-undermine-to-ecosystem-based-governance>.

⁶⁵ Friedman and Blasiak, "Beyond 'Not Undermining,'" 453; Langlet and Vadrot, "Not 'Undermining' Who?"

⁶⁶ Pascale Ricard, "The Advent of the 2023 'BBNJ' Agreement: A Preliminary Legal Analysis," *Environmental Policy and Law* (2024), <https://doi.org/10.3233/EPL-239014>.

⁶⁷ *Vienna Convention on the Law of Treaties*, art. 31.

reading carries particular weight, and the weight of scholarly opinion holds that "not undermine" does not operate as a blanket exclusion clause and cannot bear the interpretive weight the launching State argument requires.⁶⁸

2.2.1 The EIA Obligation Pre-Exists the BBNJ

The first ground for rejecting the displacement argument is structural. Article 5(2) requires the BBNJ to be interpreted and applied in a manner that does not undermine relevant instruments and frameworks. But the core obligation to conduct an EIA is contained in Article 206 of UNCLOS itself, not in the BBNJ.⁶⁹ The BBNJ operationalises and procedurally elaborates an obligation that is already binding under UNCLOS as treaty law, and independently under customary international law as affirmed by the International Court of Justice in *Pulp Mills on the River Uruguay*.⁷⁰

The "not undermine" clause cannot be read to override a pre-existing UNCLOS obligation; such a reading would have the implementing agreement subordinate the parent Convention, which is neither grammatically nor structurally coherent. The clause addresses the BBNJ's relationship with *other* bodies and instruments, not its relationship with UNCLOS itself. The BBNJ is concluded under UNCLOS, and its provisions are to be interpreted in light of UNCLOS, not as derogating from it. Invoking Article 5 to displace UNCLOS Article 206 would invert the implementing-agreement/parent-Convention hierarchy; the BBNJ was adopted to operationalise that very obligation, and its relationship clause cannot be read to diminish it.

2.2.2 Space Law Does Not Address Marine Environmental Impacts

The second ground is substantive: the OST and the associated UNCOPUOS guidelines do not address the marine environmental consequences of splashdowns at all. They regulate the space environment the sustainability of orbital use, the mitigation of collision risk, and the liability framework for surface damage to persons and property.⁷¹ The OST framework was designed for an era in which the primary concerns were the weaponisation of space, the appropriation of celestial bodies, and the attribution of liability for objects falling from orbit.⁷² The marine ecosystem of the high seas was not among the values the OST was designed to protect, and no subsequent space law instrument has addressed that gap.

Recent research has helped advance understanding as to what the gap means in practice. Reentry survivability analysis indicates that metallic components — aluminium alloys, stainless steel, and titanium — routinely survive ablation and reach the ocean surface intact.⁷³ The use of highly toxic propellants such as hydrazine in launch vehicles raises concerns about marine environmental harm upon reentry and splashdown, yet existing research on the marine environmental effects of spaceflights remains piecemeal, and the risks and extent of environmental degradation from accelerating splashdown operations are subject to significant scientific uncertainty.⁷⁴ The spacecraft cemetery at Point Nemo is not an ecological void: the area supports marine life including abyssal fauna and microbial com-

⁶⁸ Friedman and Blasiak, "Beyond 'Not Undermining,'" 453–54; De Lucia, "Rethinking the Conservation of Marine Biodiversity," 3–4; Tanaka, "Reflections on the EIA in the BBNJ," 92.

⁶⁹ UNCLOS, art. 206.

⁷⁰ *Pulp Mills*, I.C.J. Reports 2010.

⁷¹ Outer Space Treaty, art. VII, Space Debris Mitigation Guidelines (2021) and Liability Convention.

⁷² Frans von der Dunk, ed., *National Space Legislation in Europe: Issues of Authorisation of Private Space Activities in the Light of Developments in European Space Cooperation*, vol. 6, *Studies in Space Law* (Leiden: Nijhoff, 2011), 3–28.

⁷³ Shareefdeen and Al-Najjar, "Pollution Effects," 5127–41.

⁷⁴ Alla Pozdnakova, "Pollution of the Marine Environment by Spaceflights," in *The Environmental Rule of Law for Oceans*, ed. Froukje Maria Platjouw and Alla Pozdnakova (Cambridge: Cambridge University Press, 2023), chap. 10.

munities, and the ocean floor likely hosts a multiplicity of vulnerable ecosystems.⁷⁵ Yet international space law is entirely silent on any duty to conduct an environmental impact assessment before authorising a splashdown. COPUOS holds no marine environmental law-making mandate, and the resulting framework remains fragmented and insufficient to address the marine environmental consequences of spaceflights, a gap that arguably calls for resolution through a global instrument on biodiversity in areas beyond national jurisdiction.⁷⁶

The BBNJ attempts to reconcile contrasting views by providing that it promotes coherence and coordination with existing bodies but does not undermine them.⁷⁷ In the present context, however, "coherence and coordination" with the space law regime means treating it as the applicable law for the orbital phase of a space object's life, and the BBNJ and UNCLOS as applicable for the end-of-life oceanic phase. These are sequential, not competing, regulatory domains. There is no conflict to resolve because the two regimes do not purport to govern the same thing. The structural point can be put more precisely: Article 5 protects existing frameworks from being undermined — but only where those frameworks actually regulate the matter in question. Space law's complete silence on marine environmental impacts means there is no applicable framework to protect in the relevant domain. The BBNJ does not displace the space law regime; it fills a genuine regulatory vacuum that the space law regime has never occupied.

This characterisation rests on object-and-purpose interpretation under VCLT Article 31 rather than on inferences from drafting silence alone. Where a specialised body lacks competence over the subject matter in question, such as marine environmental impact assessments, the general framework with that competence applies.⁷⁸ UNCOPUOS has no marine environmental mandate and has never purported to exercise one; it cannot therefore constitute the "relevant global body" within the meaning of Article 5 for purposes of assessing marine impacts of splashdown operations.⁷⁹

2.2.3 The Significance of the Absence of a Space Activities Carve-Out

Article 29 of the BBNJ permits States to satisfy their EIA obligations through assessments conducted under other relevant instruments, provided those assessments meet an equivalency standard.⁸⁰ Space activities benefit from no sector-specific carve-out analogous to those available for high seas fisheries, shipping, or seabed mining, an absence which is legally significant. Furthermore, Article 5 does not clearly exclude space activities from the BBNJ framework and, read in conjunction with UNCLOS Article 206 and the customary EIA obligation, the BBNJ applies to planned splashdowns in ABNJ that may cause significant adverse marine environmental impacts.⁸¹

Article 5 does not operate as a blanket exclusion of activities regulated elsewhere. Read together with Article 29(3), it establishes not only a defensive constraint, the BBNJ framework must not undermine existing sectoral regimes, but a positive obligation to promote coherence between BBNJ EIA standards and those

⁷⁵ Vito De Lucia and Viviana Iavicoli, "From Outer Space to Ocean Depths: The 'Spacecraft Cemetery' and the Protection of the Marine Environment in Areas beyond National Jurisdiction," *California Western International Law Journal* 49, no. 2 (2018): 368–70.

⁷⁶ Pozdnakova, "Pollution of the Marine Environment by Spaceflights," 81, 84, 91–92.

⁷⁷ BBNJ, art. 5(2); De Lucia and Iavicoli, "From Outer Space to Ocean Depths."

⁷⁸ *Responsibilities and Obligations of States with Respect to Activities in the Area*, Advisory Opinion, ITLOS Case No. 17 (February 1, 2011), para. 148.

⁷⁹ UNCOPUOS, *Space Debris Mitigation Guidelines*, UN Doc. A/62/20, annex; BBNJ, art. 5(2).

⁸⁰ BBNJ, art. 29.

⁸¹ *Vienna Convention on the Law of Treaties*, art. 31; De Lucia, "Rethinking the Conservation of Marine Biodiversity," 3–4.

of other relevant bodies.⁸² States Parties who are also members of UNCOPUOS are accordingly under an obligation to advocate within that body for space-specific EIA guidelines compatible with BBNJ standards. The "not undermine" clause is therefore better understood as a floor, not a ceiling, of the BBNJ's engagement with existing frameworks.⁸³

A final objection concerns State practice. Oceanic splashdowns are routinely authorised without marine EIA. NASA's ISS Transition Report, the primary planning document for the largest splashdown in history, targets Point Nemo without reference to any high seas assessment obligation under applicable marine frameworks;⁸⁴ ESA's Zero Debris Charter endorses controlled ocean disposal as responsible end-of-life practice without engaging the BBNJ framework;⁸⁵ and commercial operators proceed without assessment of marine environmental impacts.⁸⁶ This practice does not, however, generate permissive counter-custom, for two reasons. First, all such practice predates the BBNJ's entry into force on 17 January 2026; pre-entry-into-force conduct cannot negate obligations that did not yet exist, and the pre-existing customary obligation under UNCLOS Article 206 was equally not discharged by that practice.⁸⁷ Second, the obligations at issue are in part erga omnes obligations under UNCLOS Part XII and not susceptible to derogation through consistent unilateral State practice.⁸⁸ The compliance gap evidenced by current State conduct is therefore a finding about implementation, not about the existence of the legal obligation.

2.2.4 Rebutting Practice-Based Defences

The legacy practice argument, that decades of consistent State practice targeting the high seas for controlled reentry demonstrates acquiescence in the absence of any EIA obligation is, in the author's opinion, unpersuasive. The practice predates the BBNJ's entry into force and cannot negate treaty obligations that did not yet exist. More fundamentally, the EIA obligation does not originate in the BBNJ: it follows from the duty of due diligence as a matter of general international environmental law and is a necessary corollary of the principle of prevention under UNCLOS Article 206.⁸⁹ Legacy practice accordingly failed to discharge a pre-existing binding obligation; and the absence of a consistent and uniform international approach to EIA for spaceflight activities does not establish acquiescence in the absence of obligation, it reflects, rather, a pattern of underutilization of existing legal requirements that may itself constitute infringement of the due diligence standard.⁹⁰

A second argument may purport that the voluntary guidelines set forth by the IADC Space Debris Mitigation Guidelines and the ESA Zero Debris Charter provide an adequate environmental framework, rendering BBNJ EIA compliance unnecessary. However, voluntary technical guidelines cannot substitute for binding due diligence obligations confirmed by international tribunals.⁹¹ Further, neither instrument contains any provision for marine EIA, public notification, or scientific

⁸² BBNJ, arts. 5(2), 29(3)

⁸³ Friedman and Blasiak, "Beyond 'Not Undermining,'" 453–54; De Lucia, "Rethinking the Conservation of Marine Biodiversity," 3–4.

⁸⁴ National Aeronautics and Space Administration, *International Space Station Transition Report*, January 2022, https://www.nasa.gov/wp-content/uploads/2015/01/2022_iss_transition_report_final_tagged.pdf; De Lucia, "Splashing Down the ISS," para. 5.

⁸⁵ ESA, "Zero Debris Charter."

⁸⁶ De Lucia and Guo, "Assessing before Sinking," 1–29.

⁸⁷ *Vienna Convention on the Law of Treaties*, art. 18; UNCLOS, art. 206;

⁸⁸ ILC, *Responsibility of States*, art. 48(1)(b); UNCLOS, arts. 192, 194.

⁸⁹ UNCLOS, art. 206; Pozdnakova, "Pollution of the Marine Environment by Spaceflights," 88–90.

⁹⁰ Pozdnakova, "Pollution of the Marine Environment by Spaceflights," 90

⁹¹ ILC, *Responsibility of States*,

review — the minimum procedural content required for equivalency under the BBNJ.⁹²

A third argument may claim that the ISS 2030 deorbit represents an early application of a still-forming governance framework and should not be assessed against fully crystallised legal obligations. This “nascent regime” argument has limited temporal force but cannot excuse prospective non-compliance. The BBNJ is in force and its EIA obligations bind States Parties; the ISS deorbit is a planned future activity, precisely the category of conduct to which Article 28(1) applies, and its operational timeline provides both the lead time and institutional capacity to render compliance entirely feasible.⁹³

2.3 Scope of the BBNJ's EIA Framework: Are Splashdowns "Planned Activities"?

The application of Part IV is restricted to "planned activities under their jurisdiction or control that take place in areas beyond national jurisdiction."⁹⁴ The threshold question is therefore whether a splashdown operation satisfies two definitional requirements: it must be a *planned activity*, and it must *take place in ABNJ*.

Splashdowns are, by design, targeted at the high seas, with a critical mass of planned reentries aimed at the South Pacific Oceanic Uninhabited Area, which lies in ABNJ. The legal characterisation of the reentry's terminal phase as "taking place in ABNJ" is confirmed by the physical reality that the space object impacts and deposits material in the high seas. The overall test under Article 28(1) is whether the activity would take place in ABNJ, not whether the *effects* are confined to ABNJ⁹⁵ and on this point, splashdowns unambiguously qualify.

The first question requires additional considerations, as the BBNJ does not define "planned activity" in Part IV, though Article 1 provides definitions for other terms. The ordinary meaning of "planned" under VCLT Article 31 connotes a deliberate, prospective action, one that is anticipated and authorised in advance.⁹⁶ Controlled splashdowns meet this definition unambiguously: they are planned months or years before execution, require authorisation from national space agencies and launch licensing bodies, and are recorded in advance in debris mitigation plans submitted to UNCOPUOS.⁹⁷ They are therefore not accidents, they are scheduled disposals. This distinguishes them clearly from uncontrolled reentries, a distinction the chapter addresses separately, and firmly places them within the natural meaning of "planned activities."

The question of whether an *uncontrolled* reentry, where the final landing point is determined by atmospheric drag rather than operator intent, constitutes a "planned activity" is more difficult. This chapter argues that even uncontrolled reentries initiated by a deliberate deorbit manoeuvre retain the character of a planned activity for the purposes of Article 28, since the relevant planning decision, to initiate deorbit, is made by the operator and authorised by the State.⁹⁸ The uncertainty as to the precise splashdown coordinates does not negate the character of the activity as planned; it bears instead on the scope and methodology of the EIA, which must address a landing probability distribution rather than a fixed location.⁹⁹

⁹² BBNJ, art. 29(4)(b).

⁹³ BBNJ, art. 29(4)(b); Inter-Agency Space Debris Coordination Committee, *IADC Space Debris Mitigation Guidelines*, IADC-02-01 (rev. 2021);

⁹⁴ BBNJ, art. 28(1).

⁹⁵ *Ibid.*

⁹⁶ VCLT, art. 31(1); Tanaka, "Reflections on the EIA," 95–96.

⁹⁷ UNCOPUOS, *Space Debris Mitigation Guidelines*, UN Doc. A/62/20,

⁹⁸ Outer Space Treaty, art. VI;

⁹⁹ BBNJ, arts. 30(1), 33(2).

2.4 The Launching State and 'Jurisdiction or Control': Reconciling the OST and BBNJ Allocation Frameworks

Some ambiguity exists between the space law framework and the BBNJ concerning the allocation of regulatory responsibility for splashdown operations. Under international space law, that allocation operates through multiple overlapping concepts. Article VI OST provides that States Parties "bear international responsibility for national activities in outer space... whether such activities are carried on by governmental agencies or by non-governmental entities," and requires "authorization and continuing supervision by the appropriate State Party" in respect of non-governmental activities.¹⁰⁰ Article VIII OST separately confers on the State of registry "jurisdiction and control" over a space object wherever located, while the Liability Convention introduces the "launching State" as the primary vehicle for liability allocation in the event of damage.¹⁰¹

Under the BBNJ, the primary obligation-bearing category is the Party exercising "jurisdiction or control" over the relevant activity. This standard corresponds most directly to the Article VIII registration-jurisdiction nexus, though Article VI's "appropriate State" concept, encompassing the authorising State irrespective of registration, may be the more relevant concept for commercial operators whose licensing arrangements do not align with their State of registry.¹⁰²

The asymmetry between the frameworks lies not in their allocation of responsibility but in its purpose: the OST framework allocates liability for damage after the fact, while the BBNJ EIA obligation is preventive, attaching before authorisation.¹⁰³ For commercial operators, this distinction has practical significance; the State that authorises a reentry plan under Article VI OST simultaneously becomes, by virtue of that authorisation, the Party exercising "jurisdiction or control" for the purposes of BBNJ Article 28(1). The act of authorisation that engages OST responsibility also engages BBNJ EIA obligations.

2.4.1 The OST Launching State Framework

Under the OST, States bear international responsibility for national activities in outer space, whether conducted by governmental agencies or non-governmental entities. Article VI imposes two distinct prospective obligations: a requirement of prior authorisation of non-governmental activities, and an obligation of continuing supervision.¹⁰⁴ These are distinct from the post-harm liability regime established by Article VII OST and elaborated by the Liability Convention, which distinguishes absolute liability for surface damage from fault-based liability for space damage and operates as a compensation mechanism triggered only upon the occurrence of harm.¹⁰⁵ The argument advanced in this thesis is grounded in Article VI, not Article VII: it is the preventive supervisory obligation, read in conjunction with UNCLOS Article 206 and the customary EIA duty, that requires States to assess marine environmental impacts before authorising a splashdown, irrespective of whether damage subsequently occurs and the liability regime is engaged.

A critical distinction must be drawn between State liability and State responsibility. The Liability Convention creates a secondary obligation to compensate upon the occurrence of damage; it imposes no positive obligation to prevent environ-

¹⁰⁰ Outer Space Treaty, art. VI; Cheng, "Article VI," 7; Von der Dunk, "The Origins of Authorisation," 3–28.

¹⁰¹ Liability Convention, art. I(c).

¹⁰² Cheng, "Article VI," 15; Brownlie, *System of the Law of Nations*, 44–51.

¹⁰³ Tanaka, "Reflections on the EIA in the BBNJ," 95–96;

¹⁰⁴ Stephan Hobe, Bernhard Schmidt-Tedd, and Kai-Uwe Schrogl, eds., *Cologne Commentary on Space Law*, vol. 1 (Cologne: Carl Heymanns Verlag, 2009), commentary on art. VI.

¹⁰⁵ Carl Q. Christol, *The Modern International Law of Outer Space* (New York: Pergamon Press, 1982), 195–218.

mental harm or to conduct EIAs in advance. The obligations at issue in this thesis; BBNJ Article 6, UNCLOS Articles 192, 194, and 206, and the customary due diligence duty; are primary norms whose breach generates State responsibility under the framework codified in the ILC Articles on State Responsibility.¹⁰⁶ Under that framework, a State incurs international responsibility where conduct attributable to it constitutes a breach of an international obligation.¹⁰⁷ The launch licensing decision satisfies both elements: it is attributable to the authorising State under Article VI OST, and the substantive primary norm is supplied by the BBNJ and UNCLOS.¹⁰⁸

Article VI is the functional equivalent of the due diligence standard under international environmental law: both impose a standard of conduct rather than of result; both require active oversight rather than passive licence-issuance; and both contemplate an ongoing supervisory role for the State over activities it has authorised.¹⁰⁹ The obligation of "continuing supervision" under Article VI accordingly extends across the full lifecycle of a space object, including the deorbit decision and the selection of a splashdown zone; it does not lapse at atmospheric entry.

Crucially, Article VI requires States to assure that national activities are carried out in conformity with the Treaty, while Article III OST requires that space activities be conducted in accordance with international law generally.¹¹⁰ The authorising State's responsibility under Article VI therefore encompasses compliance with applicable international environmental law, including the EIA duty under UNCLOS Article 206 and the customary due diligence obligation. A failure to conduct a marine EIA before authorising a controlled splashdown constitutes a breach of those primary obligations attributable to the authorising State, engaging State responsibility under the general framework.¹¹¹ This confirms that the authorising State exercises "jurisdiction or control" over a controlled splashdown within the meaning of BBNJ Articles 6 and 28(1).

The analysis in this section establishes three convergent propositions. First, the relevant obligations in the splashdown context are primary norms; the supervisory duty under Article VI OST, the environmental protection obligations under UNCLOS Part XII, and the EIA obligation under the BBNJ, whose breach engages State responsibility under the general international law framework; the Liability Convention's post-harm compensation regime is distinct and operates on a different legal plane.¹¹² Second, the State bearing OST supervisory responsibility for a commercial splashdown is, in virtually all foreseeable cases, the same State bearing BBNJ EIA obligations for that operation: the act of authorisation that creates the Article VI nexus simultaneously constitutes the exercise of "jurisdiction or control" within the meaning of BBNJ Article 28(1).¹¹³ Third, the structural parallel between Article VI OST's "continuing supervision" standard and the due diligence obligation under international environmental law confirms that these frameworks are mutually reinforcing rather than in tension;¹¹⁴ compliance with Article VI requires compliance with applicable environmental law, including the EIA duty,

¹⁰⁶ ILC, *Responsibility of States*, art. 4; Crawford, Peel, and Olleson, "The ILC's Articles," 975.

¹⁰⁷ *Ibid.*

¹⁰⁸ Outer Space Treaty, art. VI; BBNJ, arts. 6, 28(1).

¹⁰⁹ Handl, "State Liability for Accidental Transnational Environmental Damage by Private Persons," 525–65, at 527; Pozdnakova, "Pollution of the Marine Environment by Spaceflights," 88–90.

¹¹⁰ Outer Space Treaty, arts. III, VI;

¹¹¹ Birnie, Boyle, and Redgwell, *International Law and the Environment*, 3rd ed., 137–42.

¹¹² Brownlie, *System of the Law of Nations: State Responsibility, Part I*, 44–51; Christol, *The Modern International Law of Outer Space*, 195–218.

¹¹³ Outer Space Treaty, arts. VI, VIII; Registration Convention, art. II.

¹¹⁴ Pozdnakova, "Pollution of the Marine Environment by Spaceflights," 88–90;

and a failure to discharge that duty constitutes a breach of a primary norm attributable to the authorising State under the ILC Articles on State Responsibility.¹¹⁵

2.4.2 The BBNJ's 'Jurisdiction or Control' Framework

Article 6 of the BBNJ imposes a general obligation on each Party to ensure that activities under its jurisdiction or control are conducted in a manner that prevents, reduces and controls significant adverse impacts on marine biological diversity in ABNJ. The EIA obligation in Part IV is one specific expression of this general obligation. Furthermore, Article 28(1) requires States to conduct EIAs for planned activities under their jurisdiction or control. The phrase 'jurisdiction or control' is broader than the OST's 'launching State' category, it covers activities conducted by commercial entities or private actors licensed or authorised by the State, as well as activities conducted by the State itself.

The ITLOS Seabed Mining Advisory Opinion confirms that the obligation of due diligence, a main component of the BBNJ's EIA requirements, attaches to States by virtue of their having jurisdiction or control over an activity, regardless of whether the immediate actor is a State or a non-governmental entity.¹¹⁶ A State that licenses a commercial launch operator approves that operator's debris mitigation plan, and issues a licence authorising a controlled splashdown onto the high seas exercises 'jurisdiction or control' over that activity within the meaning of Article 6 and Article 28(1) of the BBNJ.

Article 6 therefore constitutes more than a jurisdictional allocation: it is the BBNJ's primary substantive obligation. A State that conducts a technically compliant EIA but authorises an activity predictably causing significant adverse impacts may nonetheless be in breach of Article 6, since the obligation is to "ensure that activities... do not cause" significant adverse impacts, not merely to assess whether they might.¹¹⁷ The EIA is the procedural mechanism through which the Article 6 duty is discharged, but Article 6 provides the substantive benchmark against which the authorisation decision itself is measured.

2.4.3 Reconciling the Two Frameworks

The launching State under the OST and the State exercising jurisdiction or control under the BBNJ will, in most regulated commercial launch scenarios, be the same State. The State that registers the space object is typically also the State that licenses the launch and thereby exercises jurisdiction or control over the entire mission, including the terminal splashdown phase. When these categories overlap there is no attribution conflict: the same State bears OST responsibility for the orbital phase and BBNJ EIA obligations for the oceanic phase.¹¹⁸

A mission lifecycle analysis illustrates the point. The orbital phase falls entirely within the OST framework and the space debris mitigation regime. The deorbit burn is the moment at which the BBNJ obligation crystallises: it is the act of authorising the descent, knowing the high seas is the intended endpoint, that triggers Articles 28(1) and 28(2). The atmospheric transit phase is a mixed domain in which OST jurisdiction over the registered object persists alongside aviation safety obligations. The ocean impact phase falls squarely within UNCLOS Part XII and BBNJ Part IV, since the space object has entered the marine environment

¹¹⁵ Outer Space Treaty, arts. III, VI; International Law Commission, *Responsibility of States for Internationally Wrongful Acts*, art. 12; Crawford, Peel, and Olleson,

¹¹⁶ V. Roeben and J. Guo, "The Result-Oriented Due Diligence Obligation in the ITLOS Climate Change Advisory Opinion: Developments and Implications," *Review of European, Comparative and International Environmental Law*(2026): 1–10, <https://doi.org/10.1111/reel.70041> .

¹¹⁷ Crawford, Peel, and Olleson, "The ILC's Articles," 963. *European Journal of International Law*12, no. 5 (2001): 963–91, <https://doi.org/10.1093/ejil/12.5.963> .

¹¹⁸ Outer Space Treaty, arts. VI, VIII; BBNJ, arts. 6, 28(1);

in ABNJ.¹¹⁹ This analysis does not create a hierarchy between the instruments; it demonstrates that each governs the phase to which it applies, with the BBNJ capturing both the authorisation decision and the marine impact phase that the space law regime has never addressed. Where they diverge, for example, where a space object is launched from one State's territory under another State's license, or where a multi-State joint venture is involved, the analysis must proceed by identifying which State exercises effective jurisdiction or control over the splashdown decision. The BBNJ does not require a single responsible State; it requires that the Party (or Parties) with jurisdiction or control discharge the EIA obligation. In practice, this will be determined by the licensing and authorisation structure of the relevant national space law, which in most major spacefaring nations tracks the launching State concept closely.¹²⁰

The OST responsibility framework therefore functions as a useful interpretive guide for identifying the State bearing jurisdiction or control under BBNJ Article 6 but does not exhaust that category. A State may exercise 'control' over a splashdown operation even without being the formal launching State, for example, where it has issued a landing license, coordinated with coastal States regarding the splashdown zone, or otherwise assumed operational responsibility for the terminal phase of the mission.¹²¹ The BBNJ's design ensures that no State can disclaim EIA obligations by reference to another State's formal registration of the space object.

2.4.4 Implications for Non-State Commercial Operators

The growth of private commercial spaceflight raises a specific attribution question. Under the OST, non-governmental entities may conduct space activities, but their activities are treated as 'national activities' for which the authorizing State bears international responsibility.¹²² A commercial launch operator, such as a private company holding a national launch license, is not itself a Party to the BBNJ. The BBNJ's EIA obligation falls on the Party that authorizes the activity, not on the operator directly.

The practical implication is that States with active commercial space industries must ensure that their national licensing and authorization frameworks require applicants to conduct (or demonstrate compliance with) EIA obligations for planned high-seas splashdowns before a license is issued. The EIA obligation thus functions as a domestic regulatory requirement that the State must discharge on the international plane, and which it may implement through its national space licensing regime. This creates an important role for national space law as a transmission mechanism between the BBNJ's international obligations and the commercial operators who are the immediate actors.

2.5 The BBNJ EIA Procedure Applied to Splashdown Operations

Part IV of the BBNJ establishes a multi-stage EIA process; screening, scoping, assessment, publication, decision-making, and post-activity monitoring, each of which engages the splashdown context in legally significant ways. The detailed doctrinal analysis of each stage is undertaken in Part 3 (Section 3.1). The present

¹¹⁹ UNCLOS, arts. 192, 194, 206; BBNJ, arts. 22–35.

¹²⁰ Bennett, "Orbital Debris Requires Prevention and Mitigation across the Satellite Life Cycle," 95.

¹²¹ Christian Villanueva, "State Governance for an Emerging Space Nation," SSRN Scholarly Paper No. 6217658 (Social Science Research Network, February 11, 2026), <https://doi.org/10.2139/ssrn.6217658>.

¹²² Yutaka Osada, "Governance of Space Resources Activities: In the Wake of the Artemis Accords," *Georgetown Journal of International Law* 53 (2022), <https://www.law.georgetown.edu/international-law-journal/wp-content/uploads/sites/21/2023/03/GT-GJIL230011.pdf>.

section identifies three features of the EIA procedure whose application to splashdown operations has particular legal significance for the thesis's central argument.

The first concerns scoping. Once a positive screening determination is made, the EIA must address issues that no existing space law instrument has ever required operators to examine: the chemical composition of reentry debris and the toxic substances deposited in the water column; the physical impacts of high-energy ocean impact events on benthic ecosystems; and the cumulative legacy of over 260 prior deposits in the South Pacific Oceanic Uninhabited Area.¹²³ The IADC and UNCOPUOS Guidelines address the splashdown zone exclusively in terms of its remoteness from human habitation. Their silence on marine environmental impacts is legally significant in two respects: it confirms that the space debris mitigation framework has never purported to address the marine dimension of splashdown operations, and it confirms that the Guidelines cannot constitute an applicable regulatory instrument for the purposes of BBNJ Article 29(4), the equivalency provision that would otherwise allow existing assessments to discharge BBNJ obligations.¹²⁴

The second concerns cumulative impacts. The SPOUA has functioned as a spacecraft graveyard for over five decades, creating a legacy contamination profile whose aggregate environmental burden no individual mission EIA has ever been required to account for.¹²⁵ The BBNJ's definition of cumulative impacts, encompassing past, present, and reasonably foreseeable activities, requires, for the first time, that this aggregate burden be systematically assessed before further splashdowns are authorised.¹²⁶

The third, and most consequential for the thesis's argument, concerns the relationship between the BBNJ monitoring obligation and existing space law compliance. The ITLOS Climate Change Advisory Opinion (2024) confirmed that compliance with the rules of an external regime does not carry automatic implication of compliance with the more stringent obligations of the law of the sea regarding marine environmental protection.¹²⁷ Applied to splashdown operations, this means that adherence to the IADC Space Debris Mitigation Guidelines does not discharge a State's obligations under BBNJ Article 35. The two frameworks are additive, not substitutive. The monitoring obligation thus generates a positive duty to build scientific knowledge about splashdown impacts, deep-sea ecological assessment, hydroacoustic monitoring, sediment analysis, that the IADC framework has never required and that no spacefaring State has to date systematically pursued.¹²⁸

2.5.1 OST Article IX and the Due Diligence Analogy

The OST itself contains a provision that has been interpreted as incorporating a due diligence-like obligation. Article IX requires States to conduct space activities with 'due regard to the corresponding interests of all other States Parties' and imposes a duty of consultation where a planned activity may cause potentially harmful interference with another State's activities.¹²⁹ This obligation has been read as a precursor to the environmental due diligence standard: it requires States

¹²³ Pozdnakova, "Pollution of the Marine Environment by Spaceflights," 84–85; Michael Byers and Cameron Byers, "Toxic Splash: Russian Rocket Stages Dropped in Arctic Waters Raise Health, Environmental and Legal Concerns," *Polar Record* 53, no. 6 (2017): 580–91, <https://doi.org/10.1017/S0032247417000547>.

¹²⁴ BBNJ, art. 29(4); UNCOPUOS, *Space Debris Mitigation Guidelines*; IADC, *Space Debris Mitigation Guidelines* (rev. 2021).

¹²⁵ De Lucia and Iavicoli, "From Outer Space to Ocean Depths," 366–70; García, "The Spacecraft Cemetery."

¹²⁶ BBNJ, art. 1(6); Tanaka, "Reflections on the EIA in the BBNJ," 100.

¹²⁷ ITLOS, Advisory Opinion, para. 232.

¹²⁸ BBNJ, art. 35; Lawrence et al., "The Case for Space Environmentalism," 428–35.

¹²⁹ Outer Space Treaty, art. IX

to take account of the broader consequences of their space activities for the shared space environment. Its limitation, for present purposes, is that it addresses the space environment, orbital mechanics, radio frequency spectrum, celestial body access, and does not fully extend to impacts within the marine environment.¹³⁰ Nonetheless, the “due regard” standard in Article IX is not wholly without relevance to the marine environmental context. It establishes that the OST imposes a positive obligation of consideration for consequences, not merely a negative obligation to refrain from harmful acts. Coupled with Article VI’s responsibility for national activities, this framework generates a duty of diligent oversight over the entire lifecycle of a space object, including its end-of-life disposal. What OST Article IX lacks is specificity as to the marine environment; what UNCLOS Article 206 and BBNJ Part IV supply is precisely that specificity. The two instruments are therefore complementary, not contradictory: Article IX establishes the general diligence standard, while UNCLOS and BBNJ give it marine-specific content.

The structural analogy between OST Article IX due regard and UNCLOS/BBNJ due diligence is nonetheless instructive. Both impose a duty and standard of conduct on the authorising State. Rather than explicitly requiring that no harm occur, both create a positive requirement that the State take appropriate steps to prevent significant harm. The BBNJ’s EIA obligation is the primary procedural mechanism by which that standard of conduct is demonstrated, by conducting an EIA, publishing the results, and implementing mitigation measures, the State discharges its due diligence obligation with respect to the activity’s marine environmental impacts.

2.5.2 Due Diligence and the Standard of Conduct for Splashdown Licensing

The due diligence framework has direct implications for the content of a State’s national space licensing regime. A State that authorises a commercial splashdown without requiring the operator to assess marine environmental impacts, and without itself conducting or procuring such an assessment, fails to discharge its due diligence obligation under both UNCLOS Article 206 and the BBNJ’s Part IV framework. The licensing decision is the crucial moment at which the State exercises its jurisdiction or control over the activity; it is therefore a critical inflection point for the BBNJ’s EIA obligation to be operationalized.¹³¹

States that are both parties to the OST and parties to the BBNJ face a dual compliance challenge: they must ensure that their space licensing regimes satisfy the OST’s debris mitigation requirements and the BBNJ’s EIA requirements simultaneously. This paper argues that these requirements are complementary rather than contradictory. A debris mitigation plan that satisfies UNCOPUOS guidelines addresses the orbital phase and the reentry trajectory; an EIA under the BBNJ addresses the marine environmental consequences of the terminal splashdown phase.

2.5.3 The Role of Precaution

The BBNJ incorporates the precautionary approach as one of its guiding principles. The precautionary principle operates as a risk management standard, addressing conditions of scientific uncertainty: where there are reasonable grounds to believe that an activity may cause serious or irreversible harm, the absence of full scientific certainty cannot be used as a justification for postponing

¹³⁰ Lawrence et al., “The Case for Space Environmentalism.”

¹³¹ Shani Friedman, “The Interaction of the BBNJ and the Legal Regime of the Area, and Its Influence on the Implementation of the BBNJ,” *Marine Policy* 167 (September 2024): 106235, <https://doi.org/10.1016/j.marpol.2024.106235>.

preventive measures.¹³² It is distinguished from the closely related preventive principle, which applies where the potential for harm is established, by its operation in conditions of uncertainty, shifting the burden of justification from those who oppose an activity to those who seek to authorise it.¹³³ The principle is now recognised as having crossed from political aspiration to a binding standard of conduct in both environmental treaty law and customary international law.¹³⁴

In the context of splashdown operations, where scientific knowledge of marine environmental impacts is limited and the cumulative effects of decades of operations remain poorly understood, the precautionary approach applies with particular force.¹³⁵ A State that declines to conduct an EIA on the ground that marine environmental impact is unknown or insufficiently characterised inverts the principle: it is precisely in conditions of scientific uncertainty that the precautionary approach is most demanding. This understanding is affirmed by the ITLOS Climate Change Advisory Opinion, which treats the precautionary approach as integral to the due diligence standard rather than as a separate and weaker exhortation.¹³⁶

The point is especially acute for uncontrolled reentries, where degradation of reentry precision means that impact location and debris fragmentation patterns cannot be predicted with certainty. Article 30(1) satisfies the screening threshold not only where effects are known to exceed a minor or transitory level, but expressly also where "the effects of the activity are unknown or poorly understood."¹³⁷ An operator unable to predict where reentry debris will impact, in what quantities, or in what chemical form, independently satisfies this second limb of the threshold, irrespective of any finding about actual harm. The precautionary principle thereby serves as the analytical bridge between the well-documented risks of orbital debris and the poorly understood consequences of deep-sea deposition, ensuring that scientific uncertainty about the latter reinforces rather than excuses the obligation to assess.

¹³² Nicolas de Sadeleer, *Environmental Principles: From Political Slogans to Legal Rules*, 2nd ed. (Oxford: Oxford University Press, 2020), pt. II.

¹³³ De Sadeleer, *Environmental Principles*, pt. II; Philippe Sands and Jacqueline Peel, *Principles of International Environmental Law*, 4th ed. (Cambridge: Cambridge University Press, 2018), 603–607.

¹³⁴ De Sadeleer, *Environmental Principles*, pt. II.

¹³⁵ Lawrence et al., "The Case for Space Environmentalism," 428–35.

¹³⁶ *Request for Advisory Opinion* (ITLOS, 2024).

¹³⁷ BBNJ, art. 30(1).

3 Applying the Framework: A Provision-by-Provision Analysis of the BBNJ EIA Obligation

Part 2 established that splashdown operations constitute “planned activities” within the scope of the BBNJ, that the Agreement’s “not undermine” clause does not displace the applicable EIA obligations, and that those obligations arise from both the BBNJ and the pre-existing framework of UNCLOS and customary international law. Part 3 conducts a provision-by-provision analysis of Articles 27–39 of the BBNJ as applied to splashdown operations. In its Preamble, the BBNJ calls on States Parties to act as “stewards of the ocean in areas beyond national jurisdiction on behalf of present and future generations by protecting, caring for and ensuring responsible use of the marine environment, maintaining the integrity of ocean ecosystems and conserving the inherent value of biological diversity of areas beyond national jurisdiction”.¹³⁸ But, beyond recognizing the need for States to take “all measures necessary to ensure that pollution arising from incidents or activities does not spread”¹³⁹ beyond sovereign territory, the Treaty exclusively addresses States obligations in areas outside of any national territory.

Outside the boundaries of national sovereignty, the BBNJ imposes a host of new obligations for States’ activities with respect to environmental impacts. While some of these mechanisms follow traditional assessment and reporting strategies to monitor environmental impact, the Treaty contains novel approaches such as Article 24 “Emergency Measures” mechanism, which offers a faster process to establish temporarily limited measures and minimize risks to the environment.¹⁴⁰ Article 24 provides a catch-all approach to any issues which can not be managed by other relevant legal instruments, frameworks, or governing bodies.

3.1 Analysis of the EIA Framework

3.1.1 Article 27 Analysis: Objectives

The BBNJ’s Article 27 sets out the objectives of Part IV: to establish processes, thresholds, and requirements for conducting and reporting EIAs; to ensure that relevant activities are assessed and conducted so as to prevent, mitigate, and manage significant adverse impacts; and to support the consideration of cumulative impacts. Article 27 also explicitly states that one of the objectives of the EIA section is to “provide for strategic environmental assessments” and to support the establishment and enhancement of Parties’ capacities to prepare, conduct, and evaluate EIAs.¹⁴¹ These objectives are directly applicable to splashdown operations, where hundreds of events over five decades have produced cumulative effects that remain scientifically uncertain.¹⁴²

3.1.2 Article 28 Analysis: General Obligation

Article 28 of the BBNJ establishes the general obligation for States Parties to conduct EIAs in respect of planned activities under their jurisdiction or control that take place in ABNJ.¹⁴³ Two features of the provision are of particular significance for the analysis of splashdown operations.

¹³⁸ BBNJ, Preamble.

¹³⁹ Ibid.

¹⁴⁰ Ibid., arts.24(1)-(5).

¹⁴¹ De Lucia and Iavicoli, “From Outer Space to Ocean Depths.”

¹⁴² De Lucia and Guo, “Assessing before Sinking.”

¹⁴³ BBNJ, art. 28(1); see Section 2.1.2 above on the “jurisdiction or control” allocation framework.

The first is the pre-authorisation character of the obligation. Under Article 28(1), the EIA must be conducted before the activity is authorised; a post-hoc assessment conducted after a splashdown has occurred cannot satisfy the obligation.¹⁴⁴ For future splashdown operations, including the ISS deorbit planned for no earlier than 2030, the obligation is already in force for all States Parties.¹⁴⁵

The second, and more consequential, feature is the pathway established by Article 28(2), which extends the EIA obligation to activities conducted within national jurisdiction where a Party determines that the activity "may cause substantial pollution of or significant and harmful changes" to the marine environment in ABNJ. As established in Section 2.4.3, the deorbit burn initiating a controlled reentry is carried out beyond national jurisdiction, but it is authorised through a domestic licensing framework. Launch authorisation decisions are exercises of State authority within the national legal order and therefore constitute activities "within national jurisdiction".¹⁴⁶ The legally operative question is not where the authorisation is physically executed, but whether the activity it approves may cause substantial pollution or significant and harmful changes to the marine environment in ABNJ. Where the licensed activity involves a controlled splashdown on the high seas, that causal nexus is integral to the authorisation itself: the purpose of the licence is to permit the deposition of a space object in the marine environment of ABNJ. Article 28(2) is accordingly engaged as a matter of ordinary textual interpretation.¹⁴⁷

The inadequacy of existing practice is illustrated by NASA's 1996 EIA for the International Space Station, which acknowledged open ocean areas as part of the affected environment but confined its analysis to the risk of debris physically striking marine life near the surface, without addressing marine ecosystem impacts.¹⁴⁸ The obligation under Article 28 as operationalised through Part IV demands a qualitatively different and substantially more rigorous inquiry.

That inquiry proceeds through the procedural pathway established by Part IV: screening to determine whether the licensed activity may have more than a minor or transitory effect on the marine environment in ABNJ, or whether its effects are unknown or poorly understood; scoping of the issues, impacts, and mitigation measures to be addressed; preparation of an EIA before authorisation using the best available science; public notification and publication through the Clearing-House Mechanism; a reasoned decision-making stage at which EIA findings are taken into account before the activity proceeds; and post-authorisation monitoring, reporting, and review.¹⁴⁹ A State may discharge these obligations through its own national EIA process, provided that process satisfies the BBNJ's equivalency, notification, and transparency requirements.¹⁵⁰

For splashdown and reentry operations, Article 28(2) is the strongest textual basis for BBNJ EIA obligations precisely because it captures the authorisation decision rather than requiring the physical activity to occur within ABNJ. The deorbit burn is an act of implementation; the legally operative moment is the national licensing decision that precedes it. A State that approves a debris mitigation plan designating the high seas as the intended endpoint has taken an action within national jurisdiction whose effects in ABNJ are not merely foreseeable but inten-

¹⁴⁴ *Pulp Mills*, I.C.J. Reports 2010, para. 205; Tanaka, "Reflections on the EIA in the BBNJ," 95–96.

¹⁴⁵ De Lucia and Guo, "Assessing before Sinking," 1–29.

¹⁴⁶ *Vienna Convention on the Law of Treaties*, art. 31(1); BBNJ, art. 28(2).

¹⁴⁷ BBNJ, art. 28(2); UNCLOS, art. 206.

¹⁴⁸ National Aeronautics and Space Administration, *International Space Station Final Environmental Impact Statement*, NASA Technical Report 19960053133 (1996).

¹⁴⁹ BBNJ, arts. 30–37; Tanaka, "Reflections on the EIA in the BBNJ," 99–102; see Section 3.1.4 below for analysis of each procedural stage.

¹⁵⁰ BBNJ, arts. 29(4)–(5); see Section 2.2 above on the "not undermine" clause and the equivalency framework.

tional. A domestic characterisation of the authorisation as an administrative act without extraterritorial effect cannot displace the Article 28(2) obligation: it is the extraterritorial effect, the deposition of a space object in the marine environment of ABNJ, that the authorisation is designed to bring about.¹⁵¹

3.1.3 Article 29 Analysis: Relationship with Other EIA Processes and the Exemption Question

Article 29(4) provides that it is not necessary to conduct a screening or EIA of a planned activity in ABNJ if the potential impacts of the planned activity or category of activity have been assessed in accordance with the requirements of other relevant legal instruments or frameworks or by relevant global, regional, subregional or sectoral bodies. This is the operative exemption provision, and it must be examined carefully in the splashdown context.

Applying the BBNJ's EIA framework to space object reentries is not without controversy in practice. States with significant commercial space programmes, including the United States and Russia, neither of which had ratified the BBNJ as of the date of this thesis,¹⁵² have not endorsed the view that splashdown operations require marine environmental assessment. The cost and operational flexibility implications for commercial launch operators, and the potential for EIA obligations to constrain urgent end-of-life disposal decisions, are practical objections that warrant acknowledgement. This thesis does not argue that the BBNJ framework should apply to splashdowns as the preferred application of policy; rather that it applies as a matter of existing international law.

A launching state might argue that the UNCOPUOS Space Debris Mitigation Guidelines and the IADC framework constitute an assessment under "other relevant legal instruments or frameworks," such that no BBNJ EIA is required for compliant splashdowns. This chapter argues that the exemption does not apply for two reasons. First, the UNCOPUOS guidelines contain no environmental impact assessment of the marine environment; they address orbital sustainability and focus on potential impacts to humans, not oceanic ecology. The "assessment" required for the Article 29(4) exemption must be an assessment of the potential impacts on the marine environment, the subject matter the BBNJ is designed to address. A space debris mitigation assessment focused exclusively on collision risk in low Earth orbit is categorically different in subject matter. Second, Article 29 also requires information exchange for activities already assessed under existing EIA mechanisms¹⁵³ and, to date, no such exchange has taken place in the splashdown context. This points to a gap in the space law framework, evidencing that its application not been understood, by any state, as constituting an EIA for purposes of the marine environment.

Article 29 establishes a series of mechanisms to better align the EIA provisions at the global, regional, sub-regional, and sectoral levels, and read in combination with Article 38, seek to promote the application of BBNJ EIA standards to relevant bodies. This suggests that the appropriate response for the space sector is not to invoke Article 29(4) as an exemption but rather for states and UNCOPUOS to develop sector-specific EIA guidelines that meet BBNJ standards, an important step towards aligning the existing regulatory frameworks and removing ambiguities in Treaty applications. Under Article 29(1), Parties are required to promote the BBNJ's EIA standards within the international frameworks and bodies to which

¹⁵¹ De Lucia and Guo, "Assessing before Sinking," 1–29; Pozdnakova, "Pollution of the Marine Environment by Spaceflights," 87–88.

¹⁵² BBNJ, Status of Ratification.

¹⁵³ Ross Harper, "Planetary Protection: A New Launch Pad for the Regulation of the Commercial Space Industry," *California Western International Law Journal* 50, no. 1 (2020), <https://scholarlycommons.law.cwsl.edu/cwilj/vol50/iss1/8>.

they belong, including UNCOPUOS.¹⁵⁴ Under Article 29(3), the Conference of the Parties is mandated to collaborate with relevant bodies to develop or update EIA standards and guidelines. States Parties to the BBNJ who are UNCOPUOS members are therefore under a positive obligation to promote BBNJ-compatible EIA standards in the space governance context. The coherence mechanisms in Articles 5 and 29 function not merely as a shield against regime conflict, but as an active instrument of normative convergence between space law and marine law.

3.1.4 Article 30 Analysis: Screening

The threshold for screening centers on planned activities which may have more than a minor or transitory effect on the marine environment, or the effects of the activity are unknown or poorly understood.¹⁵⁵ The factors informing that determination include the type of activity and technology used, the ecological characteristics of the location, the potential for cumulative impacts, and the extent to which effects remain unknown.¹⁵⁶ Splashdown operations independently satisfy both limbs of the threshold.

On the first limb, the limited understanding of the environmental effects of splashdown activities make it difficult to characterize them as minor or transitory. Space debris contains hazardous substances, including propellant residues acutely toxic to aquatic organisms and metallic particulates documented to accumulate in the water column, whose deposition in the marine environment constitutes more than a negligible impact.¹⁵⁷ The cumulative effect of over 260 space objects deposited in the spacecraft cemetery over five decades represents a continuous and progressive environmental stressor irreconcilable with any ordinary understanding of a transitory impact.¹⁵⁸

This conclusion is reinforced by the 2025 revision of the IADC Space Debris Mitigation Guidelines, which for the first time expressly acknowledges that ground environmental pollution "caused by radioactive substances, toxic substances or any other environmental pollutants resulting from on-board articles, should be prevented or minimized."¹⁵⁹ The significance of this development is twofold. First, it forecloses any characterisation of marine environmental impacts from splashdowns as trivial or negligible. Second, the IADC Guidelines represent the most developed expression of environmental awareness within the UNCOPUOS regulatory architecture and constitute the space law regime's closest existing analogue to an environmental risk-management framework. Their non-binding character and absence of any verification or enforcement mechanism means, however, that a general acknowledgement that pollution "should be prevented or minimized" falls far short of the procedural obligations imposed by Part IV of the BBNJ. The Guidelines' evolution in a more environmentally conscious direction is consistent with the principle, affirmed in the ITLOS Climate Change Advisory Opinion, that the due diligence standard develops as scientific understanding advances, a trajectory that reinforces rather than displaces the BBNJ EIA obligation.¹⁶⁰

On the second limb, the effects of splashdown operations on the marine environment remain unknown or poorly understood. No systematic monitoring of the spacecraft cemetery exists; the deep-sea ecosystems of the South Pacific Oceanic

¹⁵⁴ Tanaka, "Reflections on the EIA in the BBNJ," 95–96.

¹⁵⁵ BBNJ, art. 30(1).

¹⁵⁶ Ibid., art. 30(2).

¹⁵⁷ Pozdnakova, "Pollution of the Marine Environment by Spaceflights," 77, 84–85; Byers and Byers, "Toxic Splash," 580–91.

¹⁵⁸ De Lucia and Iavicoli, "From Outer Space to Ocean Depths," 368–70; Baker et al., *Natural Capital and Exploitation of the Deep Ocean*.

¹⁵⁹ IADC, *Space Debris Mitigation Guidelines* (2025 rev.), UN Doc. A/AC.105/C.1/2025/CRP.9.

¹⁶⁰ *Request for Advisory Opinion* (ITLOS, 2024); Sands and Peel, *Principles of International Environmental Law*, 605.

Uninhabited Area have been minimally studied; and the long-term consequences of progressive material accumulation on the ocean floor are not well characterised.¹⁶¹ This epistemic deficit does not extinguish the EIA obligation, the precautionary approach requires preventive action precisely in conditions of scientific uncertainty. It does, however, present a methodological challenge for any EIA conducted on the basis of existing scientific knowledge, reinforcing the necessity of baseline environmental assessment as an integral component of the scoping exercise.

Beyond individual EIA assessments, Article 39 of the BBNJ establishes a framework for strategic environmental assessments, including authority for the Conference of the Parties to initiate an SEA *motu proprio* in respect of an entire ocean area or region.¹⁶² This power could be exercised in relation to the spacecraft cemetery to collate information about deposited space objects, assess cumulative impacts, and identify data gaps and research priorities. The COP's capacity to initiate such an assessment without requiring the consent of individual States constitutes a significant institutional innovation in international environmental governance with direct application to the spacecraft cemetery, and has no parallel in the existing space law framework.¹⁶³

3.1.5 Articles 31–34 Analysis: EIA Process, Content, Publication, and Decision-Making

Where screening concludes that an EIA is required, Part IV establishes a procedural pathway through Articles 31 to 37 governing scoping, assessment, publication, decision-making, and monitoring. This section addresses the content, publication, and decision-making stages; the screening threshold is addressed in Section 3.1.4 above.

The minimum content of the EIA report is specified in Article 33(2) and includes: a description of the planned activity and the results of the scoping exercise; a baseline assessment of the affected marine environment; a description of potential impacts, including cumulative and transboundary impacts; proposed prevention, mitigation, and management measures; an account of uncertainties and gaps in knowledge; information on the public consultation process; and a non-technical summary.¹⁶⁴ Each of these requirements, if applied to the ISS deorbit, would demand forms of investigation and disclosure not previously required for splashdown operations. Most consequentially, a baseline assessment of the ecological state of the spacecraft cemetery, the condition of the South Pacific Oceanic Uninhabited Area prior to further debris deposition, does not currently exist and would need to be commissioned before any future authorisation could be granted.¹⁶⁵

The publication requirements under Article 33(3)–(5), the obligations arising from the Clearing-House Mechanism, and the institutional disparity between the BBNJ EIA architecture and the UNCOPUOS voluntary framework and its implications for the Article 5 analysis are addressed in Section 2.2 above.

Article 34 governs the decision-making stage. The BBNJ does not transfer decision-making authority to the Conference of the Parties or the Scientific and Technical Body; States retain sovereignty over their authorisation decisions.¹⁶⁶

¹⁶¹ Lawrence et al., "The Case for Space Environmentalism," 428–35;

¹⁶² BBNJ, arts. 39(1)–(2); Tanaka, "Reflections on the EIA in the BBNJ," 109–10.

¹⁶³ De Lucia and Guo, "Assessing before Sinking," 1–29; Tanaka, "Reflections on the EIA in the BBNJ," 109–10.

¹⁶⁴ BBNJ, art. 33(2); Tanaka, "Reflections on the EIA in the BBNJ," 97–98.

¹⁶⁵ Baker et al., *Natural Capital and Exploitation of the Deep Ocean*; De Lucia and Iavicoli, "From Outer Space to Ocean Depths," 368–70;

¹⁶⁶ BBNJ, art. 34(1).

However, Article 34(2) imposes a substantive constraint on the exercise of that discretion: where an EIA demonstrates that significant adverse impacts are likely, the authorising Party must ensure that measures to prevent, mitigate, and manage such impacts are identified and that the activity is conducted accordingly.¹⁶⁷ This provision imports a concrete substantive standard into what might otherwise be read as a purely procedural framework. A Party that completes an EIA identifying significant adverse marine environmental impacts cannot proceed to authorise the activity without addressing those findings. Applied to splashdown operations, a State conducting a BBNJ-compliant EIA that identifies significant marine environmental impacts would be required, as a matter of treaty obligation, to impose conditions on or decline to authorise the proposed operation.

3.1.6 Article 35 Analysis: Monitoring and Review

Article 35 requires States Parties to maintain ongoing surveillance of the impacts of activities in ABNJ that they permit or in which they engage, and to monitor the environmental impacts of authorised activities against the conditions set out in the approval decision.¹⁶⁸ The provision's particular significance in the splashdown context lies in its engagement with cumulative impact assessment. As established early in this paper, the BBNJ defines cumulative impacts as the combined effects of an activity together with those of past, present, and reasonably foreseeable activities.¹⁶⁹ The spacecraft cemetery exemplifies this; a product of the repetition of similar activities over more than fifty years. Its future trajectory, incorporating the ISS deorbit and continued commercial splashdowns, involves reasonably foreseeable activities of significant and increasing scale.

The cumulative dimensions of the problem are substantial. The spacecraft cemetery has received over 260 objects since the 1970s, ranging from small satellites to the 130-tonne Mir space station.¹⁷⁰ The ISS deorbit planned for 2030 will deorbit a further approximately 420 tonnes of material in a single event, a mass that exceeds by an order of magnitude any ordinary reading of the "minor or transitory" threshold in Article 30(1).¹⁷¹ Commercial reentry operations compound this trajectory: Starlink operations alone currently account for approximately forty per cent of all annual satellite reentries globally, each depositing aluminium alloy fragments, composite materials, and residual propellants into the same confined ocean zone.¹⁷² These figures are not isolated data points; they constitute the empirical foundation for the cumulative impact analysis that Article 35's monitoring framework is designed to support.

A monitoring framework under Article 35 would, for the first time, require systematic data collection on the environmental condition of the South Pacific Oceanic Uninhabited Area and create a mechanism through which the aggregate effects of splashdown operations become legally cognizable as a matter of treaty obligation. This transformation from the current characterisation of individual events as isolated and negligible to a regime of systematic cumulative assessment is directly engaged by Article 27's objective of supporting the consideration of cumulative impacts in EIA procedures conducted under Part IV.¹⁷³

¹⁶⁷ BBNJ, art. 34(2); *Pulp Mills on the River Uruguay*, Judgment, I.C.J. Reports 2010, para. 205.

¹⁶⁸ BBNJ, arts. 35–36;

¹⁶⁹ BBNJ, art. 1(6); see Section 2.5 above.

¹⁷⁰ De Lucia and Iavicoli, "From Outer Space to Ocean Depths," 366–68; García, "The Spacecraft Cemetery at the Loneliest Point on Earth."

¹⁷¹ NASA, *International Space Station Transition Report* (January 2022); BBNJ, art. 30(1).

¹⁷² Bennett, "Orbital Debris Requires Prevention and Mitigation across the Satellite Life Cycle," 95; Thibaut Maury et al., "Space Debris through the Prism of the Environmental Performance of Space Systems: The Case of Sentinel-3 Redesigned Mission," *Journal of Space Safety Engineering* 7 (2020): 198–205, <https://doi.org/10.1016/j.jsse.2020.07.002>.

¹⁷³ BBNJ, art. 27; De Lucia and Guo, "Assessing before Sinking," 1–29.

The relationship between Article 35 and the existing space law framework warrants direct statement. The ITLOS Climate Change Advisory confirmed that compliance with an external regulatory regime does not carry any automatic implication of compliance with the more stringent obligations of the law of the sea concerning marine environmental protection.¹⁷⁴ States cannot rely on adherence to the IADC Guidelines as discharging their Article 35 monitoring obligations. The two frameworks are additive, not substitutive: BBNJ monitoring obligations attach independently of and in addition to whatever obligations arise under the space debris mitigation framework.

3.2 How Compliance Differs From Previous Practice

The preceding analysis of Articles 27–37 reveals a structural disjunction between what the BBNJ now requires and what has historically been practised in the authorisation of splashdown operations. Where environmental assessments have been conducted under domestic law, notably FAA environmental reviews under NEPA for SpaceX Dragon splashdowns in the Pacific Ocean, they have addressed hazards to persons, property, and national airspace rather than the marine environmental impacts of ocean impact in ABNJ; none have assessed the ecological state of the spacecraft cemetery, engaged cumulative effects on the ABNJ marine environment, or satisfied the equivalency requirements of BBNJ Article 29(4).¹⁷⁵ Beyond the domestic EIA question, the record at the international level is entirely absent: no baseline assessment of the spacecraft cemetery exists; no cumulative impact assessment has been conducted across the over 260 objects deposited in the SPOUA since 1971;¹⁷⁶ no EIA report addressing marine environmental impacts of a splashdown operation has been submitted to the Clearing-House Mechanism since the BBNJ's entry into force; no post-authorisation monitoring programme exists for the ecological condition of the South Pacific Oceanic Uninhabited Area; and no alternatives analysis addressing whether new materials, active debris removal, or graveyard orbit disposal could achieve equivalent space law objectives with lesser marine environmental impact has previously been required in connection with high-seas splashdown operations.¹⁷⁷

The BBNJ establishes EIA requirements that are, in several respects, more procedurally rigorous than domestic equivalents, particularly in requiring independent scientific review, Clearing-House transparency, and post-authorisation monitoring.¹⁷⁸ For an activity that has never previously been subjected to EIA under any framework, the transition to BBNJ compliance represents a fundamental recalibration of the legal obligations attending splashdown authorisation. This compliance gap is significant but surmountable. Article 38 of the BBNJ empowers the Scientific and Technical Body to develop EIA standards and guidelines compatible with existing relevant instruments, providing the institutional mechanism through which UNCOPUOS-compatible requirements could be progressively elaborated.¹⁷⁹ The argument advanced in this thesis is that this pathway cannot be pursued unless launching States first acknowledge the BBNJ as an applicable legal frame-

¹⁷⁴ ITLOS, Advisory Opinion, para. 232; BBNJ, arts. 5, 35.

¹⁷⁵ Federal Aviation Administration, *Final Environmental Assessment and Finding of No Significant Impact/Record of Decision for SpaceX Dragon Reentry Relocation to Pacific Ocean* (2025), https://www.faa.gov/space/environmental/nepa_docs; BBNJ, art. 29(4); De Lucia and Guo, "Assessing before Sinking," 1–29.

¹⁷⁶ De Lucia and Iavicoli, "From Outer Space to Ocean Depths," 366–70.

¹⁷⁷ Aerospacelab, "Environmental Impact Assessment: Rose Mission and Rose Satellite," September 11, 2023.

¹⁷⁸ Tanaka, "Reflections on the EIA in the BBNJ," 99–103.

¹⁷⁹ BBNJ, arts. 38(1)–(2), 29(3).

work for space debris activities in ABNJ, an acknowledgement that the analysis in Parts 2 and 3 above demonstrates to be legally required.

4 Conclusion

4.1 Summary of Principal Findings

This thesis has examined a specific but increasingly consequential normative gap in international law: the absence of any established framework for the environmental impact assessment of space object reentries in areas beyond national jurisdiction. The central argument is that this gap has been substantially addressed, though not fully resolved, by the entry into force of the BBNJ in January 2026. The thesis's findings against each of its four research questions are as follows.

On the first research question, what environmental harm is caused by space object reentries and splashdowns, and to what extent is it legally recognized, the thesis finds that the harm is real, multidimensional, and legally significant, as demonstrated in Parts 1 and 2, yet systematically unrecognised under the existing regulatory frameworks.¹⁸⁰ International space law has not recognised these impacts as legally relevant; UNCLOS and the BBNJ, through their broad “any source” and “any source of pollution” language, are capable of doing so. The first contribution of this thesis is to bring this empirical reality into contact with the applicable legal frameworks and to demonstrate that the environmental harm is within the scope of existing treaty obligations.

On the second research question, what obligations launching States bear under the OST, customary international law, and UNCLOS, the thesis finds that those obligations are broader than existing practice acknowledges. The OST's launching State framework, read in conjunction with Article VI's responsibility for national activities and Article IX's due regard standard, generates a general obligation of diligent oversight over the entire lifecycle of a space object, including its end-of-life disposal. UNCLOS Articles 192, 194, and 206 impose independently binding obligations to protect the marine environment and to conduct EIAs before authorising activities likely to cause significant marine harm. Customary international law, as affirmed in *Pulp Mills* (ICJ, 2010) and confirmed in the *ITLOS Climate Change Advisory Opinion* (2024), requires EIAs as a component of the general due diligence standard for activities with the potential for significant harm to shared or transboundary environments. These obligations apply cumulatively and are not diminished by the absence of a specific space-marine interface norm; on the contrary, the very absence of such a norm within the space law framework means that the marine law framework fills the gap.

On the third research question, to what extent the BBNJ's EIA obligation applies to splashdown operations and how compliance differs from previous practice, the thesis finds that the BBNJ applies fully to controlled splashdowns as “planned activities” under Part IV, and with high probability to deliberate deorbit manoeuvres even where the final impact point is uncertain. The BBNJ's Article 5 “not undermine” clause does not exempt splashdowns from the EIA framework because: (a) the EIA obligation pre-exists the BBNJ and is grounded in UNCLOS Article 206 and customary law; (b) space law does not address marine environmental impacts and therefore does not constitute a competing framework in the relevant domain; and (c) space activities were not included among the sector-specific carve-outs, a fact that, while consistent with the BBNJ's general applicability to marine-impacting activities in ABNJ, does not by itself constitute definitive negotiating history and is best understood as a secondary argument that reinforces the primary object-and-purpose analysis. Compliance with the BBNJ framework represents a transformative departure from previous practice: pre-authorisation screening, marine baseline assessments, cumulative impact analysis, public reporting to the Scientific and Technical Body, and post-activity monitoring are

¹⁸⁰ Muñoz-Patchen, “Regulating the Space Commons,” 233–59.

all obligations that no spacefaring State has historically applied to splashdown authorisations.

On the fourth research question, whether current splashdown practice is consistent with binding international environmental law, the thesis's answer is unequivocal: it is not. No launching State has conducted a pre-authorisation EIA of a splashdown's marine environmental impacts. No State has assessed the cumulative environmental burden at the spacecraft cemetery. No post-activity monitoring programme exists for any historical splashdown site. The compliance gap is not marginal; it is structural and systemic. The BBNJ's entry into force has converted what might previously have been characterised as a soft obligation into a binding procedural requirement for all State Parties. For spacefaring States that are Parties to the BBNJ, authorising a splashdown without a prior marine EIA now constitutes a breach of their treaty obligations.

4.2 Areas for Further Research

First, the thesis has argued that the BBNJ applies to splashdowns but has not examined how States would comply in practice. A detailed study of the institutional and procedural architecture of BBNJ compliance in the space sector, including the role of national licensing regimes, the Scientific and Technical Body, the Clearing-House Mechanism, and the Conference of the Parties, would be a valuable practical contribution. In particular, the question of how UNCOPUOS and the BBNJ Conference of the Parties would coordinate on sector-specific EIA guidelines, as contemplated by Article 38 of the BBNJ, warrants close examination. The proposed EU Space Law Regulation (2025), which introduces environmental footprint declarations for space operators, may offer an early model of how national regulatory frameworks can be adapted to accommodate marine environmental requirements.¹⁸¹

Second, the thesis has focused on the obligations of State Parties to the BBNJ. A broader study of the position of non-Parties, including major spacefaring States that may not ratify the BBNJ, would be valuable. The relevant question is whether and to what extent the EIA obligation binds non-Parties as a matter of customary international law, particularly in light of the ITLOS and ICJ jurisprudence establishing EIA as a general customary rule. The progressive development of customary law in this area, and its potential to bind States that decline to ratify the BBNJ, deserves sustained scholarly attention.

Third, the thesis has noted the scientific uncertainty surrounding the environmental impacts of splashdown operations but has not undertaken a detailed scientific review. A genuinely interdisciplinary study, combining legal analysis with oceanographic, ecotoxicological, and chemical evidence, is required for further evidence-based discussions on impact of space debris in the high seas using the best available science. In particular, data on the bioaccumulation of metallic particulates from disposed of satellites in food webs, and on the long-term effects of legacy contamination in the spacecraft cemetery, would potentially ground claims of significant harm under Article 206 UNCLOS and Article 30 of the BBNJ. The observation that no systematic monitoring programme exists for the spacecraft cemetery is itself a finding that invites urgent interdisciplinary response.

Fourth, this thesis has been confined to activities in ABNJ. The question of reentries over or within territorial waters and exclusive economic zones raises distinct jurisdictional issues, including coastal State rights to require EIAs for activities in their EEZ and the applicability of UNCLOS Article 56, that could form the basis of a separate study. Similarly, the legal status of uncontrolled reentries that cannot be attributed to any deliberate planning decision raises unresolved questions of State

¹⁸¹ European Commission, *Proposal for a Regulation on the Safety, Resilience and Sustainability of Space Activities in the Union (EU Space Act)*, COM(2025) 345 final (25 June 2025), arts. 96–100.

responsibility and liability under the OST Liability Convention framework that this thesis has not addressed.

Fifth and finally, the thesis has operated at the level of the obligation to conduct an EIA. A natural extension of this research would examine the substantive content of the no-harm obligation: assuming a fully compliant EIA were conducted and demonstrated significant adverse impacts, what follows? Does the BBNJ prohibit the activity, require alternatives analysis, or merely require mitigation? The interaction between the procedural EIA obligation and the substantive no-harm rule under Article 6 of the BBNJ, and the extent to which Article 34's obligation to prevent significant adverse impacts functions as a de facto substantive veto, merits detailed doctrinal analysis that lies beyond the scope of this thesis but would be a significant contribution to the emerging law of ABNJ governance.

The governance of outer space and the high seas has long been treated as the province of two separate legal communities, operating with separate instruments, separate institutions, and separate scholarly traditions. The physical reality of space object reentry has always complicated that separation; the entry into force of the BBNJ has now given it legal consequence. The challenge for international law, and for the States that make and apply it, is to develop the institutional, procedural, and normative infrastructure to manage that consequence responsibly. This thesis has sought to contribute to that project by clarifying the legal foundations and identifying the normative obligations that already exist. The work of building compliance frameworks to discharge those obligations remains to be done.

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