

Titanic Challenge: Ethical Dilemmas in Deep Sea Exploration

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Abstract: Deep sea tourism, which offers unparalleled access to the ocean's abyss, presents a complex ethical and environmental challenge. Certainly, the allure of exploring the unknown is undeniable, but the potential consequences for marine ecosystems are profound. Commercialization, driven by profit motives, can overshadow the delicate balance required for responsible exploration. Submersible operations, while essential for exploration, introduce risks of habitat disturbance, pollution, and various contamination. The potential for human error, equipment malfunction, and accidents, as tragically illustrated by the Titan submersible disaster, highlights the need for rigorous safety protocols and emergency preparedness. Moreover, the psychological impact of operating in extreme environments on both tourists and crew members is a critical yet often overlooked concern. Ethical considerations extend beyond environmental protection and human safety. The distribution of benefits from deep sea tourism must be equitable, with local communities and conservation efforts receiving their fair share. Questions arise regarding the rights of future generations to experience and benefit from pristine marine environments. Additionally, the commercialization of such unique experiences may raise concerns about accessibility and affordability.

Keywords: Extreme tourism, Deep sea tourism, Ethics, Deep sea exploration, Environmental science

1. Introduction

Deep-sea diving, while sharing the inherent risks of high costs and danger common to other extreme tourism activities, carries additional unique concerns. These include a heightened risk of habitat disturbance, pollution, and other forms of contamination, as well as the potential to damage or destroy valuable scientific and historical sites.

All of this was made clearer by the tragic implosion of Oceangate's Titan submersible in June 2023, which serves as a stark reminder of the potential for catastrophic consequences when safety is compromised. The Titan's catastrophic failure was largely attributed to CEO Stockton Rush's disregard for safety concerns, allegedly calling them "pure waste" (Smith-Schoenwalder, 2023). This disregard for safety ultimately led to the tragic loss of five individuals, including Rush himself. While Oceangate is only just starting to face legal repercussions, the intense public scrutiny has ignited crucial conversations about safety regulations and ethical considerations within the deep-sea diving sector.

Deep-sea diving falls under the umbrella of "adventure tourism," a rapidly growing niche sector encompassing a range of activities with varying levels of risk. "Soft adventure" activities, such as snorkelling and hiking, pose relatively low risks, while "hard adventure" activities, including rock climbing and polar exploration, demand higher skill levels and carry greater inherent dangers (Janowski et al., 2021, Zaid et al., 2023). Deep-sea diving, with its immense pressures and the potential for equipment malfunctions, undeniably resides within the "hard adventure" category even if one is in a craft such as a submersible.

Despite the burgeoning popularity of adventure tourism, the ethical and legal frameworks surrounding its riskier aspects remain largely underdeveloped. Deep-sea diving, with its inherent dangers and the potential for catastrophic outcomes, warrants significant academic attention, yet it remains largely understudied. While some research has explored the ethical dilemmas of space tourism (Marsh, 2006, Marsh, 2010) and general extreme tourism in general (Marsh, 2024), a comprehensive examination of the ethical and legal considerations specific to deep-sea diving is urgently needed.

2. Ethical Considerations

2.1 Human Safety

While the risks of self-contained underwater breathing apparatus (SCUBA) diving are well known, and include decompression sickness, nitrogen narcosis, equipment malfunctions, barotrauma, and cold water exposure (Germonpré, 2006), fewer individuals may consider the challenges of deep sea diving in a submersible.

Deep-sea submersible operations present a unique set of risks. Similar to SCUBA, equipment failures, such as malfunctions in life support systems, propulsion, or communication systems, pose a significant threat. The extreme pressure and unforgiving environment of the deep sea can exacerbate these risks, making even minor

malfunctions potentially catastrophic. Accidents, including collisions with underwater objects, entanglement in debris, or unforeseen environmental factors, can have devastating consequences. The remote nature of deep-sea operations often complicates rescue efforts, increasing the potential for loss of life. The psychological impact on both tourists and crew members must not be underestimated. The confined space, the isolation, and the constant awareness of the immense pressure surrounding the submersible can induce anxiety, claustrophobia, and even panic attacks (Marsh, 2024). However, unlike SCUBA divers who must go through training and classes to be aware of these risks, passengers on a submersible are simply that... passengers which may or may not have experience in high stress environments.

2.2 Environmental Impacts

Deep-sea tourism also raises concerns about its potential impact on the environment in general and in scientific and archaeological research in particular. Submersible operations, while offering unparalleled access to the deep sea, also carry a heightened risk of environmental impact.

Deep-sea tourism activities, such as submersible dives and recreational scuba diving, can inadvertently disturb habitats which also serve as delicate research sites (Milazzo et al., 2002). These sites may contain valuable scientific data, including information on biodiversity, geological processes, and climate change. The presence of tourist vessels, the deployment of equipment, and even the subtle effects of light and noise pollution may disrupt ongoing research and compromise the integrity of scientific findings. The very act of human presence, whether it's recreational divers stirring up sediment (Milazzo et al., 2002) or deep sea mining (Willaert, 2021) can disrupt delicate deep-sea communities. These ecosystems, often characterized by slow growth and long lifespans, are particularly vulnerable to disturbance.

Deep-sea ecosystems harbour a remarkable diversity of life, many of which are yet to be discovered. The presence of tourists, even with the best intentions, can inadvertently disturb or even harm these unique organisms. The risk of accidental contact, entanglement in equipment, or the introduction of diseases are all potential threats to deep-sea biodiversity. The sheer size of submersibles and the potential for mechanical failures increase the risk of physical damage to fragile habitats like deep-sea coral reefs or hydrothermal vents. Additionally, the noise generated by submersibles can disrupt the communication and behaviour of marine animals, potentially impacting their feeding, mating, and navigation patterns.

Pollution which could spread further than the original location can pose another significant threat. Small submersibles, despite technological advancements, can still release minute amounts of particles or fluids into the water when conducting science or during a catastrophic event such as an implosion (Schmaltz et al., 2020). Implosions, of course will also contribute to a buildup of debris, further impacting the delicate balance of these ecosystems. Larger vehicles like nuclear submarines, may further leak radiation into the ocean (Diniz Costa, 2017).

Deep-sea tourism can compete with scientific research for access to limited resources, such as research vessels, specialized equipment, and skilled personnel. This competition can hinder scientific progress and limit our understanding of the deep sea. The deep sea also harbours numerous archaeological sites, including shipwrecks and ancient human settlements. OceanGate's Titan was going to explore the wreck of the Titanic before it imploded. Deep-sea tourism activities can inadvertently damage these sites, destroying valuable historical and cultural artifacts.

2.3 Equity and Accessibility

Another ethical consideration of deep-sea tourism includes the equitable distribution of benefits and the preservation of these unique environments for future generations. It is important to assure that the economic benefits of deep-sea tourism are fairly distributed among local communities and ensure that local businesses and residents receive a fair share of the economic gains. This can be achieved through initiatives like employing local guides, sourcing local supplies, and reinvesting tourism revenue into community development projects.

Additionally, it may also be important to consider accessibility and affordability. Deep-sea tourism, particularly submersible expeditions, can be expensive, effectively excluding most people. Efforts should be made to explore innovative models for making these experiences more accessible, such as developing more affordable options, offering scholarships and subsidies, and promoting community-based tourism initiatives.

Finally, the ethical imperative to protect the rights of future generations to experience and benefit from pristine marine environments cannot be overstated. Deep-sea tourism must be conducted in a sustainable

manner that minimizes environmental impact and preserves the integrity of these unique ecosystems for future generations. This requires a commitment to responsible tourism practices, including minimizing disturbance to marine life, preventing pollution, and supporting marine conservation efforts.

3. Regulatory Framework

3.1 Environmental Regulations - BBNJ Agreement

Until recently, there were no environmental regulations which regulated the environmental impact of high Seas (200 miles or more from the coast) and the international deep seabed. Monitoring and mitigating environmental damage in the deep sea can present significant challenges.

In June 2023, the international community came together to pass 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” (Lothian, 2023). The BBNJ Agreement, as it is known more commonly, is aimed at protecting the biodiversity of the high seas, the vast areas of the ocean beyond national jurisdiction. By providing a legal framework for the conservation and sustainable use of marine biodiversity in the high seas, it offers hope for the long-term health of our oceans and the many benefits they provide to humanity and tackles legally some of the ethical concerns mentioned above.

The following are the four key elements in the BBNJ Agreement

- **Marine Genetic Resources Including the Fair and Equitable Sharing of Benefits:** The Agreement establishes a mechanism for sharing both monetary and non-monetary benefits, including access to research and technology, capacity building, and support for sustainable development in developing countries.
- **Establishing Marine Protected Areas (MPAs):** The agreement enables the creation of MPAs in the high seas to conserve and protect vulnerable marine ecosystems.
- **Environmental Impact Assessments:** It requires countries to conduct Environmental Impact Assessments for activities that may have significant adverse impacts on marine biodiversity. This includes deep sea diving, submersible operations, and deep sea mining
- **Capacity Building and Technology Transfer:** The agreement emphasizes the importance of supporting developing countries in implementing the treaty through capacity building and technology transfer.

The BBNJ Agreement represents a significant step towards a more sustainable and equitable use of the high seas, ensuring their conservation for present and future generations.

3.2 Safety Standards

Deep-sea submersible operations demand the highest safety standards to mitigate the inherent risks associated with operating in the extreme and unforgiving deep-sea environment, however, there are few requirements in this often self-regulating industry. These standards should encompass a multifaceted approach encompassing equipment maintenance, comprehensive crew training, and well-defined emergency procedures. Some of these protocols should include but not limited to the following:

- **Meticulous Equipment Inspections:** Regular and thorough inspections of all critical components, including the pressure hull, life support systems, propulsion systems, and communication systems, are paramount. This includes non-destructive testing, material analysis, and functional checks to ensure the integrity and reliability of all equipment. Due to their usual presence in the high seas and being oftentimes designated as an “experimental” craft, can allow submersibles to forgo recommended, but not required, certifications. Manned submersibles, particularly carrying passengers, should be certified to the intended depth or should not be permitted to continue.
- **Preventative Maintenance:** A proactive maintenance schedule is important to identify and address potential issues before they can escalate. This may involve regular servicing, component replacements, and system upgrades to incorporate the latest safety technologies.
- **Extensive Training Programs:** Pilots, crew members, and even passengers should undergo rigorous and comprehensive training programs in the event of an emergency. This training should cover:
- **Submersible Systems:** *In-depth knowledge of the submersible's systems, including navigation, communication, life support, and emergency procedures.*
- **Emergency Response:** *Comprehensive training on emergency procedures, including fire, flooding, loss of power, and medical emergencies. Included in this is medical preparedness, which means ensuring*

adequate medical supplies and trained personnel on board is crucial. The remote nature of deep-sea environments necessitates a high degree of self-reliance in medical emergencies. This is important even if the trip is only expected to be a few hours in length.

- **Psychological Preparedness:** Addressing the psychological challenges of operating in a confined and potentially stressful environment, such as claustrophobia and anxiety.
- **Contingency Plans:** Developing and regularly reviewing comprehensive contingency plans for various emergency scenarios, including loss of communication, equipment malfunctions, and medical emergencies.
- **Emergency Communication Systems:** Ensuring reliable and redundant communication systems to facilitate timely emergency response. Establishing clear and concise communication protocols between the dive team, surface support personnel, and emergency response agencies includes the use of redundant communication systems, designated emergency frequencies, and pre-arranged contact procedures
- **Rescue and Recovery Protocols:** Establishing clear and well-rehearsed rescue and recovery protocols in collaboration with relevant authorities and other stakeholders. This should include access to trained and equipped emergency response teams, including skilled divers, medical personnel, and specialized rescue vessels, is critical. These teams should be readily available and capable of responding swiftly to incidents.
- **Technological Advancements:** Continuous research and development of advanced safety technologies, such as real-time monitoring systems, improved communication systems, and more robust hull designs, are crucial for mitigating risks before they become problematic. Further, utilizing advanced technologies such as underwater acoustic positioning systems, remotely operated vehicles (ROVs), and underwater communication systems can significantly enhance search and rescue efforts.
- **Collaboration and Coordination:** Effective coordination among various stakeholders, including government agencies, maritime authorities, and private operators, is essential for successful rescue operations. This requires clear lines of communication, shared information, and a unified command structure.

4. Conclusion

Deep-sea diving, while sharing the inherent risks of high costs and danger common to other extreme tourism activities, carries additional unique concerns. These include a heightened risk of habitat disturbance, pollution, and other forms of contamination, as well as the potential to damage or destroy valuable scientific and historical sites. All of this was tragically underscored by the implosion of Oceangate's Titan submersible in June 2023, highlighting the potential for catastrophic consequences when safety is compromised. This event ignited crucial conversations about safety regulations and ethical considerations within the deep-sea diving sector.

Deep-sea submersible operations present a unique set of risks. Equipment failures, accidents, and the psychological impact on both tourists and crew members, including anxiety, claustrophobia, and potential for panic attacks, pose significant threats. While the risks of SCUBA diving are well-known, the unique pressures and confined space of a submersible create a distinct set of psychological challenges for passengers who may not be used to confined environments. Addressing these challenges requires a multifaceted approach. Robust safety regulations are crucial, encompassing rigorous equipment maintenance, comprehensive crew training, and well-defined emergency procedures. Continuous research and development of advanced safety technologies, such as real-time monitoring systems and improved communication systems, are essential.

Deep-sea tourism activities can also have significant environmental impacts. Submersible operations can disturb delicate ecosystems, damage research sites, and contribute to pollution. The presence of tourists can disrupt marine life and potentially damage archaeological sites. The BBNJ Agreement, while primarily focused on the conservation and sustainable use of marine biodiversity in the high seas, provides a valuable framework for responsible ocean stewardship. Its provisions for environmental impact assessments and the equitable sharing of benefits from marine genetic resources can inform the development of regulations for deep-sea tourism. Furthermore, conducting thorough and independent Environmental Impact Assessments is crucial to assess potential impacts and implement appropriate mitigation measures. Prioritizing scientific research and conservation efforts is essential to ensure the long-term sustainability of deep-sea ecosystems.

Raising public awareness about the unique and fragile nature of the deep sea and the importance of responsible tourism is crucial. Engaging the public through educational programs, media outreach, and citizen

science initiatives can foster a deeper understanding and appreciation for the ocean and empower individuals to become active participants in ocean conservation efforts.

Finally, fostering ongoing dialogue and collaboration among governments, researchers, industry stakeholders, and conservation organizations is vital for effective regulation, research, and the development of best practices for sustainable deep-sea tourism assuming it is permitted to continue. By addressing these challenges and implementing a comprehensive framework for responsible and sustainable deep-sea tourism, we can strive to ensure that these unique and awe-inspiring experiences are enjoyed responsibly while safeguarding the health of our oceans for future generations.

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