

CORAL REEF DAMAGE IN RAJA AMPAT: INTERNATIONAL LEGAL PROTECTION OF REEFS
CORAL

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Abstrack

Coral reefs are one of the biological resources originating from the sea which play a very important role in maintaining the balance of coastal ecosystems and supporting the economic sustainability of the community. beach. Indonesia is country archipelago with line beach The second longest in the world, which has a major responsibility to protect this ecosystem. In the context of international law, the 1982 United Nations Convention on the Law of the Sea (UNCLOS) provides a legal basis for coastal states to regulate, conserve, and restore the marine environment, including coral reefs, as stipulated in Articles 192-194. This study aims to analyze the form of coral reef protection according to the provisions of the 1982 UNCLOS, assess its implementation in Indonesian national law, and examine the government's responsibility in the case of coral reef damage in Raja Ampat. The research methods used are normative and empirical juridical, with a legislative, conceptual, and case study approach. The results of the study indicate that the obligation to protect the marine environment is erga omnes, binding on all countries without exception. Indonesia has ratified UNCLOS through Law Number 17 of 1985, and supplemented it with national regulations such as Law Number 32 of 2009 concerning Environmental Protection and Management, as well as PP Number 60 Year 2007 about Conservation Source Power Fish. Although Normatively, the legal instruments are strong, but their implementation still faces challenges. matter coordination inter-agency, limitations source Power man, as well as Weak field supervision. The case of coral reef damage by the cruise ship MV Caledonian Sky in King Ampat year 2017 become reflection weakness system law enforcement

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environment sea Indonesia. Effort settlement change make a loss Which No optimal The study reveals gaps in cross-jurisdictional legal liability mechanisms. The study's recommendations include strengthening maritime law enforcement through strict liability mechanisms, expanding marine conservation areas, and utilizing drone-based monitoring technology and underwater photogrammetry to support scientific evidence in law enforcement.

Keywords: *UNCLOS 1982, legal protection, coral reefs, Raja Ampat, international maritime law.*

INTRODUCTION

reef coral is foundation main life sea tropical. More from 25% of marine species live and thrive in it, making this ecosystem one of the most One Which most rich And complex in world [4]. Indonesia own more Of the 17,000 islands and coral reefs covering approximately 2.5 million hectares, Indonesia occupies a strategic position in global conservation [7]. However, the condition of coral reefs in Indonesia shows a worrying downward trend. Data from the Al-Zayn Journal notes that approximately 33% of Indonesia's coral reefs have experienced severe damage due to human activities and climate change [4].

This damage is generally caused by fishing practices that damage nature, namely the use of fish bombs and cyanide poison, sedimentation due to land clearing, and marine pollution [5]. In addition, unsustainable tourism activities like dive mass without arrangement And cruise boat Cruises in conservation areas also worsen the condition of the ecosystem. This phenomenon causes ecological, social and economic losses, considering that coral reefs are the main source of livelihood for fishermen and marine tourism operators [3], [6].

In the context of international law, the United Nations Convention on the Law of the Sea (UNCLOS) 1982 set obligation for country beach For protect and preserve environment sea. Chapter 192 UNCLOS in a way firm mention that "States have the obligation to protect and preserve the marine environment", while Article 194 requires states to mitigate and control marine pollution from all sources, whether originating from land, ships, or marine resource exploration activities [1]. This provision is universal. and binding all country, including Indonesia, as form collective responsibility for the sustainability of the world's marine ecosystems.

Indonesia has internalized the principles of UNCLOS through Law Number 17 of 1985. In addition, several national regulations also support marine conservation efforts, including Law Number 27 of 2007 concerning Management of Coastal Areas and Small Islands, Law Number 32 of 2009 concerning Environmental Protection and Management, and the Regulation of the Minister of Maritime Affairs And Fishery Number 31 Year 2020 about Area Conservation Waters [8]. However, in practice, the implementation of these regulations still faces various obstacles, such as weak supervision, overlapping authority between agencies, and low legal awareness among the public [3], [6].

The case of coral reef damage by the cruise ship MV Caledonian Sky in the waters King Ampat year 2017 become example real weakness system protection and enforcement law sea in Indonesia. Boat flagged English the It hit a coral area on Mios Mansuar Island and caused damage to an area of approximately 1,600 square meters [3]. The Raja Ampat Regency Government is demanding compensation of up to IDR 6 trillion, but the settlement process has not been completed due to diplomatic obstacles and cross-border jurisdiction.

According to research by Arya et al. [6], law enforcement in Raja Ampat has been carried out through routine patrols and outreach to the community, but has not been effective in preventing new damage. Weak coordination between central and regional officials has resulted in legal action against perpetrators of environmental damage not being carried out. walk optimal. In context This, principle not quite enough answer country based on UNCLOS 1982 need enforced in a way consistent so that protection environment The sea is not only declarative but also operational.

In addition, modern technological advances such as drone monitoring and underwater photogrammetry can be important supporting tools in monitoring ecosystem conditions. coral in a way real time [9], [10]. Method This allows documentation visual three dimensions And collection data spatial Which accurate, Which can used as scientific evidence in legal processes and conservation planning.

Thus, coral reef protection is not only the responsibility of moral or ecological, but Also is obligation law international This research is expected to contribute to academic development in strengthening the legal perspective of Indonesian marine environments and serve as a reference for formulating legal and technology-based policies to protect coral reefs sustainably.

RESEARCH METHOD

Study This use approach law normative Which combined with empirical law to obtain a holistic picture of the application of the principles of the 1982 United Nations Convention on the Law of the Sea (UNCLOS) to coral reef protection in Indonesia, particularly in the Raja Ampat region. A normative approach was used because this research is based on a study of applicable international and national legal norms. According to Kumala et al. [2], study normative very important in study law sea Because international law is abstract and requires systematic interpretation to be implemented within the national legal system, researchers examine the relationship between the international legal obligations in UNCLOS 1982 and Indonesia's national legal instruments that follow up on them, such as:

- 1) Constitution Number 17 Year 1985 about Confirmation UNCLOS 1982
- 2) Law Number 32 of 2009 concerning Environmental Protection and Management
- 3) Constitution Number 27 Year 2007 about Management Region Coast and Small Islands
- 4) Fish Resources
- 5) Regulation Minister Marine And Fishery Number 31 Year 2020 about Marine Conservation Area.

In addition to examining regulations, normative research also analyzes legal principles such as erga omnes obligation, state responsibility, and strict liability, which form the basis for protecting the global marine environment. These principles are outlined in academic literature and international jurisprudence, as reviewed by Rebay [1] and Pramudianto [7]. The legal analysis is conducted deductively, namely by deriving conclusions from general norms (UNCLOS

1982) to specific norms (national law and practice in Indonesia). This approach aims to assess the suitability implementation law national to commitment international Which has been ratified.

Approach empirical used For see as far as where norm law applied in the field. Previous empirical research conducted by Dewi et al. [5] in Buton Regency showed that the main obstacle in law enforcement environment sea No located on absence norm, but on limited human resources, lack of monitoring facilities, and minimal coordination between law enforcement agencies. In the context of Raja Ampat, an empirical approach is used. with referring to on results study Muharuddin & Hidayat [3] And Arya et al. [6], who explained the law enforcement steps in the case of coral reef damage by the ship MV Caledonian Sky. Through an empirical approach, study This evaluate effectiveness apparatus in demand change make a loss, examine cross-border diplomatic barriers, and assess local community involvement in ecosystem restoration.

This method also takes into account the concept of environmental legal sociology, namely how legal norms are understood, accepted, and implemented by the community. According to Arya et al. [6], the legal awareness of coastal communities greatly influences the success of marine environmental law enforcement. Without active community participation in monitoring and conservation, the application of legal sanctions will be ineffective.

Study This use data secondary as source main, Which includes:

- 1) Material law primary: international agreements (UNCLOS 1982), national laws, and relevant derivative regulations.
- 2) Secondary legal materials: academic literature, books, and scientific journals that discuss issues of maritime law, marine conservation, and state responsibility.

Tertiary legal materials: legal dictionaries, international legal encyclopedias, and publications official institution government like Ministry Marine And Fisheries (KKP).

In addition to secondary data, empirical data from interviews and field observations documented in previous research was also used, such as report Government Regency King Ampat And results study Justitia Journal of Law [6]. The analysis was conducted using descriptive-analytical and comparative methods. Descriptive analysis was used to explain the legal facts that occurred, such as the compensation process in the Caledonian Sky case, while comparative analysis was used to compare the practice of enforcing Indonesian maritime law with the principles of UNCLOS 1982. In addition, the content analysis method was also used for legal texts, namely interpreting the substantive meaning of the articles in UNCLOS, especially Articles 192, 194, and 195. 235 relating to the state's responsibility in protecting the marine environment.

To strengthen the validity of the analysis, this study applies triangulation of data sources, namely comparing the results of legal studies with the results of empirical research. And data technology monitoring reefs coral like drone And underwater photogrammetry [9], [10]. In an effort to strengthen the accuracy of legal evidence, this study utilizes the integrative theory of law and technology integration. Contini et.al. [9] and Gospodinova & Kirov [10] proved that underwater image technology based on deep learning and photogrammetry can help law enforcement in measuring coral damage accurately. scientific. Approach This open opportunity for environmental forensics—that is, proving damage to the marine environment based on digital data—which can be used as evidence in environmental litigation. Thus, the research

method This is not only nature textual, but also adaptive to development of marine conservation technology. This is important for research into Indonesian marine environmental law. No left behind from practice international which now start integrating eco-legal framework with marine technology innovation.

THEORY

1.1 Principles Base UNCLOS 1982 in Protection Environment Sea

UNCLOS 1982 considered as milestone law sea international modern which combines aspect sovereignty, security, economy, and environment [1]. As a “*Constitution for the Oceans*”, this convention provides a legal basis for coastal states to regulate activities at sea while maintaining the sustainability of their ecosystems.

Obligation protect environment sea in Chapter 192 UNCLOS nature absolute obligation and cannot be suspended under any circumstances. This article is even categorized as a *ius cogens* norm, namely a rule of international law that has the highest standing and must be obeyed by all countries [1].

Furthermore, Article 193 grants states the right to utilize marine natural resources in accordance with their national policies, provided that such utilization does not cause environmental damage. This means that a state's sovereign rights are always balanced with ecological responsibilities.

There is no international agreement that specifically regulates protection of reefs coral. However various instrument law like The Convention on Biological Diversity (CBD) and Agenda 21 strengthen the global commitment to marine conservation [7]. UNCLOS 1982 serves as an umbrella framework that requires countries to adopt national policies in line with these principles.

1.2 Sovereignty And Sovereign Rights Country Coast

According to international maritime law, the concept of sovereignty is not absolute but is limited by the common interests of mankind. Kumala *et.al.* [2] explains that coastal states have sovereign rights over the Exclusive Economic Zone (EEZ) to the extent that 200 miles sea for development and utilization source power. However on moment the same is obliged to protect the marine environment from damage.

The implementation of these sovereign rights must take into account the principles of good ocean governance, that is order manage sea which transparent, participatory, and sustainable [5]. In context this, work the same between countries become key. Chapter 197 UNCLOS obliges states to cooperate to protect the marine environment, through the exchange of scientific information and conservation technology.

Indonesia translating these principles through Blue Economy policies and the development of national marine conservation areas. By 2024, the government is targeting 30 million hectares of marine areas to become Marine Protected Areas (MPAs), including parts of Raja Ampat, which UNESCO has recognized as a World Heritage Site for its biodiversity [4].

1.3 Principle Not quite enough Answer Country (State Responsibility) And Strict Liability

The principle of state responsibility in marine environmental law is regulated in Article 235 of UNCLOS which states that states are responsible for fulfilling their international obligations to protect the marine environment. If a state fails to prevent activities that cause transboundary environmental damage, it may be held liable under international law.

The concept of state responsibility has evolved towards a stricter form of liability, particularly for high-risk activities such as large ship voyages and the exploitation of underwater resources [1]. In the context of the King Ampat, the flag state of the ship that caused the coral damage has a moral and legal obligation to provide compensation.

Torano [8] also highlights the importance of implementing administrative, civil, and criminal sanctions against parties who cause damage to marine ecosystems. This includes obligations to carry out environmental restoration and compensation payments based on the economic valuation of the ecosystem.

1.4 Mark Economy, Social, And Ecological reef Coral

As the largest maritime and archipelagic country in the world, Indonesia has large and diverse marine economic potential [11]. The economic value of Indonesia's coral reefs is estimated to reach billions of dollars per year. year from sector fishery, tourist, And protection line beach. Damage to coral reefs causes a decrease in fish productivity, coastal abrasion, and loss of marine tourism potential [4]. Apart from economic value, coral reefs also have great social value for coastal indigenous communities who depend on the sea as a source of life and identity. culture. By Because That, policy conservation must involving local communities through a community-based marine management approach.

From an ecological perspective, damage to coral reefs has an impact on the marine food chain, balance carbon, And change climate global. Loss ecological This often not immediately visible, but have long-term effects that harm future generations.

Damage to the marine environment, including coral reefs, will affect the availability of fishery resources in the area. The quality and quantity of fishery resources and other marine resources will decline. The impact of damage to coral reefs and the marine environment will be felt by coastal communities, especially fishermen [12].

1.5 Utilization Technology in Supervision And Enforcement Law

Developments in information technology and remote sensing have opened up new opportunities in coral reef protection. Contini et al. [9] introduced a drone-based monitoring and multi-scale knowledge distillation approach to map coral reef conditions on a large scale with high precision. This technology allows for routine monitoring of marine conservation areas without significant costs.

Meanwhile, Gospodinova & Kirov [10] describe an underwater photogrammetry method that uses three-dimensional imagery to monitor changes in coral structure in detail. This technique is important in legal evidence because it can scientifically show the actual level of damage.

The application of this technology needs to be integrated into Indonesia's marine environmental law policy. Digital evidence from monitoring results can be used as electronic evidence, as stipulated in Law Number 11 of 2008 concerning Electronic Information and Transactions, thereby strengthening the legal standing in marine environmental compensation claims.

DISCUSSION & RESULT

1.6 Implementation UNCLOS Principles 1982 in System Law National

Indonesia is Wrong One country archipelago the biggest in world Which have a direct

interest in the sustainability of the marine environment. Ratification of the United Nations Convention on the Law of the Sea (UNCLOS) 1982 through Law No. 17 of 1985 made the provisions of the convention part of the national legal system. Thus, the obligation to protect the marine environment, as stipulated in Articles 192-194 of UNCLOS, becomes Indonesia's legal responsibility.

Chapter 192 confirm that every country own obligation For maintain and safeguard the sustainability of the marine environment, while Article 194 stipulates the obligation of the state to take steps to address pollution and damage to marine ecosystems from various sources, including exploration, shipping, and development activities in coastal areas [1]. This provision is not only moral, but also legally binding, meaning that the state cannot ignore its responsibilities for economic or technical reasons.

The application of this principle in Indonesia is reflected in a number of national regulations, such as Law Number 32 of 2009 concerning Environmental Protection and Management, Law Number 27 of 2007 concerning Management of Coastal Areas and Small Islands, and Government Regulation Number 60 2007 concerning the Conservation of Fish Resources [8]. These three legal instruments demonstrate Indonesia's commitment to maintaining harmony between the use of marine resources and ecosystem sustainability.

However, in practice, the implementation of UNCLOS principles in Indonesia still faces serious challenges. One major obstacle is overlapping authority between agencies, which leads to weak coordination and policy effectiveness. For example, supervision area conservation sea often done by more than One institution, like Ministry Marine And Fishery (KKP), The Ministry of Environment and Forestry (KLHK) and local governments have been under scrutiny. As a result, exploitation and tourism activities in conservation areas are often poorly monitored.

Besides That, part big regulation conservation Still nature sectoral And has not adopted an integrated ocean management approach. In fact, UNCLOS emphasizes importance management cross sector And cross region For guard the marine ecosystem as a whole. Without good coordination between institutions, coral reef protection becomes merely an administrative formality without significant ecological impact [2].

Another obstacle arises in the aspect of law enforcement. Although administrative and criminal sanctions exist for perpetrators of environmental damage, their implementation is often sluggish. No consistent. Lots case violation environment sea Which end without strict law enforcement, especially if it involves foreign parties or large corporations. The principle of environmental responsibility as stipulated in Article 235 of UNCLOS has not been fully implemented in national practice [3].

Furthermore, the polluter pays principle—which requires the perpetrator of damage to bear the costs of remediation—is still rarely used in marine environmental cases. Yet, this principle is a crucial element of international environmental law because it reflects ecological justice. If Indonesia wants to strengthen its legal standing in the eyes of the world, then the application of this principle must be integrated into all marine resource management policies [4].

Thus, although Indonesia has normatively implemented the provisions of UNCLOS through ratification and the formation of national regulations, its implementation still requires improvement at the institutional, coordination and enforcement law so that can ensure

protection effective to coral reef ecosystem [5].

1.7 Studies Case Damage reef Coral King Four: Analysis Law and Diplomacy

Case damage reefs coral by boat cruise MV Caledonian Sky in the year of 2017 become Wrong One example most clear weakness enforcement Indonesian marine environmental law. The British-flagged ship hit a reef in the waters off Mios Mansuar Island, Raja Ampat. Ampat, and caused damage to an area of 1,600 meters rectangle. Based on calculation Government Regency Raja Ampat, mark loss ecological, social, And economy reach around Rp 6 trillion [3].

From perspective law sea international, incident This including violation to Chapter 194 paragraph (2) UNCLOS Which confirm that country must ensure that activities under its jurisdiction or control do not cause damage to the marine environment of other countries or international maritime areas [1]. Because the ship the flagged English, so based on principle flag state responsibility, the United Kingdom is legally responsible for the actions of the ship.

However, in practice, cross-border accountability mechanisms have not been effective. The Indonesian government has submitted a diplomatic note to the British government, but no clear agreement on compensation has been reached. This indicates that existing international legal mechanisms remain weak in terms of enforcement of cross-jurisdictional environmental cases [8].

The main obstacles in this case include three things. First, the limited diplomatic mechanisms for holding foreign countries accountable. Second, the absence of standard international in valuation economy ecosystem sea, so that The proposed loss assessment is considered non-objective. Third, there is no specific international arbitration body to handle disputes over marine environmental damage caused by non-state activities.

Apart from legal obstacles, there are also technical aspects that contribute to the occurrence of damage the. Supervision area conservation in King Ampat is still carried out conventionally, without a satellite-based digital monitoring system or drone monitoring. In a report by a conservation agency, it was stated that tourist ship shipping routes often cross conservation areas without adequate navigation guidance, so the risk of collision with coral is very high [9].

If viewed from the aspect of legal responsibility, the Raja Ampat regional government actually has make an effort do enforcement law with demand change losses to the ship. However, the process did not reach the settlement stage due to the complexity of international jurisdiction and the absence of a bilateral agreement between Indonesia and English regarding compensation environmental damage sea. This situation show that not quite enough answer environment nature shared responsibility, where the resolution requires cooperation between countries and the application of firmer international legal mechanisms [3].

The Caledonian Sky case reflects that the mere existence of international legal instruments is not enough. A strong national system is needed for implementation. diplomacy environment Which proactive, as well as utilization technology modern in monitoring conservation areas so that similar incidents do not happen again [10].

1.8 Obstacle Structural And Institutional in Enforcement Law Marine Environment

Enforcing marine environmental law in Indonesia faces not only substantive legal challenges but also structural and institutional obstacles. Although numerous regulations exist, their implementation remains far from effective.

First, there is overlapping authority between agencies, which leads to weak oversight and enforcement of marine environmental violations. Management of marine conservation areas, for example, involves multiple agencies, such as the Ministry of Marine Affairs and Fisheries, Ministry of Environment and Forestry, government area, until apparatus enforcer law. Disharmony between institution cause violation like arrest fish illegal, coral damage, or waste disposal is often not handled quickly [5].

Second, there are still limitations in human resources and technology for marine environmental monitoring. In eastern Indonesia, including Raja Ampat, the number of field officers overseeing marine conservation areas is too small compared to the vast waters that need to be protected. Yet, these areas are centers of global biodiversity (the coral triangle) and play a vital role in the global ecosystem [4].

Third, there are social and cultural legal barriers at the community level. Coastal communities' awareness of the importance of protecting the marine environment remains low. Lots Which Still use method arrest fish destructive like bomb and cyanide. Low literacy law causes People often do not know that these actions are criminal acts that can damage their own livelihoods [6].

Furthermore, cross-jurisdictional law enforcement is also a major obstacle. When the perpetrator of the damage is a foreign party, national law enforcement often struggles to enforce sanctions due to limitations in international diplomacy. matter This, principle not quite enough answer country (state responsibility) Which arranged in UNCLOS Article 235 has not been fully translated operationally at the national level [1].

With thus, effort strengthen protection reefs coral in Indonesia must start with reforming maritime law institutions, improving human resources, and establishing an effective cross-institutional coordination system.

1.9 Integration Technology And Proof Digital in Enforcement Law Sea

Current technological advances provide significant opportunities for increasing the effectiveness of marine environmental monitoring and law enforcement. Technologies such as drones, satellite imagery, and underwater photogrammetry enable real-time and accurate monitoring of ecosystem conditions [9].

Implementation technology This can done through two approach main:

- 1) A preventative approach involves using technology to continuously monitor conservation areas. For example, drone surveillance can be used to detect tourist or fishing vessel activity that could potentially damage coral reefs.
- 2) Repressive approach, namely the use of digital data as legal evidence (scientific evidence) in the law enforcement process.

Underwater photogrammetry technology allows for 3D visual documentation of damaged coral areas, so that evidence of damage can be presented scientifically in litigation processes [10]. In addition, the system Automatic Identification System (AIS) can also be developed to automatically identify vessel movements in marine conservation areas.

In the context of national law, this type of digital evidence has legal force under Law Number 11 of 2008 concerning Electronic Information and Transactions. Therefore, the results of technology-based monitoring can be used to hold accountable those responsible for marine ecosystem damage.

The application of technology also opens up opportunities for public participation through community-based monitoring. Coastal communities, diving groups, and institutions... conservation can involved in a way active in system monitoring digital, so that control social to marine areas increase. Draft This in line with the principle of bottom-up governance in environmental law, where environmental protection is not only the obligation of the state, but also the collective responsibility of citizens [4].

1.10 Relevance UNCLOS 1982 to Challenge Global And Policy National

Global climate change has had a significant impact on marine ecosystems, including coral reefs. Rising sea temperatures have caused the phenomenon of coral bleaching, which threatens the sustainability of ecosystems worldwide. In this context, UNCLOS 1982 remains relevant because it contains the obligation of states to take steps to protect fragile and rare ecosystems as stated in Article 194 paragraph (5) [1].

For Indonesia, the biggest challenge is balancing marine economic activities and environmental conservation. The marine tourism sector in Raja Ampat, for example, give contribution economy Which big, However Also has the potential to cause ecological pressure if not strictly regulated. Therefore, a national policy is needed that regulates the carrying capacity of marine tourism, a permit system sustainable, as well as education to perpetrator tour so that No damage coral ecosystem [7].

Furthermore, international cooperation is a crucial aspect in strengthening marine protection. UNCLOS encourages countries to collaborate through data exchange, joint research, and capacity building in the marine sector. Indonesia can leverage regional forums such as the Coral Triangle Initiative (CTI) and the ASEAN Working Group on Coastal and Marine Environment to expand its network of collaboration in coral reef conservation [5].

Thus, the implementation of the principles of UNCLOS 1982 is not only an international legal obligation, but also a long-term strategy to maintain the economic, social and ecological sustainability of Indonesia's seas.

CONCLUSION

Protection reefs coral is not quite enough answer law And moral For every country, especially Indonesia, as an archipelagic nation rich in extraordinary marine resources. Under the provisions of UNCLOS 1982, every country is obliged to protect and preserve the marine environment, including coral reef ecosystems, which play a vital role in supporting the balance of the global ecosystem.

Indonesia has adopt principles UNCLOS to in system The law is enforced through various national regulations, such as the Law on Environmental Management and Coastal Area Management. Normatively, these legal instruments are sufficient to provide a basis for protecting coral reefs. However, in practice, various obstacles remain, such as overlapping authority between agencies and lax law enforcement. dis coordination cross institution, as well as lack of awareness public awareness of the importance of marine conservation.

The case of coral reef damage in Raja Ampat is a clear reflection of the significant challenges Indonesia faces in effectively implementing maritime law, particularly when dealing with foreign actors or entities. Transnational accountability mechanisms are not yet functioning optimally, while environmental diplomacy systems still need to be strengthened to negotiate fair ecological compensation.

In addition to legal aspects, marine ecosystem protection also relies heavily on the use of modern technology. Surveillance technologies such as drone monitoring, image satellite, And photogrammetry lower water give opportunity big to improve the effectiveness of legal oversight and enforcement. Integrating law and technology is a strategic step that must be taken to ensure marine protection systems can meet the challenges of the digital era and climate change.

Thus, it can be concluded that coral reef protection requires not only strong regulations but also consistent implementation, inter-agency synergy, active community participation, and innovative technological support. Marine protection is not merely a national issue, but rather part of a global responsibility to ensure the sustainability of life on Earth.

REFERENCE

- [1] Von Rebay, *The Designation of Marine Protected Areas: A Legal Obligation* , 1st ed. Cham: Springer Nature Switzerland AG, 2023.
- [2] MT Kumala, D. Sunyowati, E. Narwati, and RT Vinata, "The Philosophical Basis of the Authority of Coastal States to Manage Natural Resources in Their Exclusive Economic Zone (EEZ)," *Transactions on Maritime Science* , vol. 12, no. 1, 2023.
- [3] M. Muharuddin and W. A. Hidayat, "Responsibility Government Area against Damage reef Coral in Regency King "Ampat," *Justice* , vol. 6, no. 2, pp. 64-76, 2020.
- [4] DOD Putra, "Utilization and Legal Protection of Marine Reef Resources Coral in Indonesia," *Al-Zayn: Journal Knowledge Social & Law* , vol. 3, no. 4, pp. 3960-3970, 2025.
- [5] R. T. Vinata and M. T. Kumala, "Joint Security Efforts to Combat IUU Fishing in the Waters of Indonesia," *Lex Portus* , vol. 9, pp. 36-50, 2023.
- [6] S. W. Arya, D. P. Mark, and M. Ali, "Law Enforcement on Coral Reef Protection in Raja Ampat Regency," *Justitia Jurnal Hukum* , vol. 8, no. 1, 2024.
- [7] A. Pramudianto, "International and National Environmental Law Regulations in Effort Protect Ecosystem reef Coral," *Journal Education Basic and Social Humanities* , vol. 1, no. 3, pp. 453-464, 2022.
- [8] B. E. Torano, "Review Juridical Protection And Management reef Coral in Indonesia According to Law Sea International," *Lex Administration* , vol. 9, No. 7, 2021.
- [9] M. Contini, V. Illien, J. Barde, S. Poulain, S. Bernard, A. Joly, and S. Bonhommeau, "From Underwater to Drone: A Novel Multi-Scale Knowledge Distillation Approach for Coral Reef Monitoring," *Ecological Informatics* , art. 103149, 2025.
- [10] V. Gospodinova and A. Kirov, "Underwater Photogrammetry," *IOP Conference Series: Earth and Environmental Science* , vol. 1427, no. 1, p. 012006, 2024.
- [11] Vinata, Ria Tri, Masitha Tismananda Kumala, Peni Jati Setyowati. (2020). " Marine Biodiversity Joint Exploitation Agreement in the Border Area of the Continental Shelf between Coastal States ", in Proceedings of the 2nd International Conference on Science, Technology, and Environment (ICoSTE 2020) - Green Technology and Science to Face a New Century, pages 153-156
- [12] Kumala, Masitha Tismananda. (2023). " Fishermen's Human Rights Protection and Sustainable Development in the Indonesian Marine Sector ". Lex Portus, Vol. 9. Issue 4. P.16-27. DOI 10.26886/2524-101X.9.4.2023.2

