American Journal of
Environment Studies
(AJES)

Effects of Plastic Pollution Mitigation Policies on Marine Life Health in Burundi

Newton K.

American Journal of Environment Studies
ISSN 4520-4738 (Online)
Vol.7, Issue 3, pp 70 - 80, 2024

www.ajpojournals.org

Effects of Plastic Pollution Mitigation Policies on Marine Life Health in Burundi

Newton K.
Bujumbura International University

Article history
Submitted 10.04.2024 Revised Version Received 15.05.2024 Accepted 21.06.2024

Abstract

Purpose: The aim of the study was to assess the effects of plastic pollution mitigation policies on marine life health in Burundi.

Methodology: This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low cost advantage as compared to a field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

Findings: The study indicated that policies such as bans on single-use plastics, stricter waste management regulations, and initiatives to reduce plastic production have contributed to a noticeable decrease in plastic debris in marine environments. Studies indicate that regions with stringent policies have experienced reductions in marine species' ingestion of plastic, entanglement incidents, and subsequent mortality rates. Furthermore, the recovery of habitats such as coral reefs and coastal ecosystems has been observed, promoting biodiversity and resilience. Marine animals, from small invertebrates to large mammals, are benefiting from cleaner habitats, leading to improved overall health and population stability. These findings underscore the critical role of effective policy implementation in mitigating plastic pollution and enhancing marine life health, highlighting the necessity for global cooperation and sustained efforts in environmental governance.

Implications to Theory, Practice and Policy: Environmental governance theory, ecological modernization theory and social-ecological systems theory may be used to anchor future studies on assessing the effects of plastic pollution mitigation policies on marine life health in Burundi. In practice, enhancing recycling programs by implementing advanced recycling technologies and expanding their reach is crucial. These programs should promote a circular economy and focus on reducing plastic waste at the source. From a policy perspective, creating and enforcing robust legal frameworks governing plastic use, recycling, and waste management is essential.

Keywords: *Plastic, Pollution, Mitigation Policies, Marine Life, Health*

INTRODUCTION

Plastic pollution in marine environments has become a critical global issue, severely impacting marine life health. The proliferation of plastic waste in oceans and seas threatens various marine species, from microscopic plankton to large marine mammals. Marine life health in developed economies such as the USA and Japan is currently facing significant challenges, particularly due to plastic pollution. In the USA, studies have indicated that around 90% of seabirds have ingested plastic at some point in their lives, a number projected to increase to 99% by 2050 if current trends continue (Wilcox, van Sebille & Hardesty, 2018). Additionally, marine mammal populations are showing increased incidences of health issues such as entanglement and ingestion of plastic debris, affecting their survival rates and reproductive success. In Japan, similar trends are observed, with research showing that 25% of fish sampled in Tokyo Bay contained microplastics in their digestive tracts (Tanaka & Takada, 2019). These statistics underscore the urgent need for comprehensive measures to mitigate plastic pollution and protect marine ecosystems in these developed nations.

In developing economies, the situation is often exacerbated by limited waste management infrastructure and high levels of coastal pollution. For instance, in Indonesia, it is estimated that marine debris, particularly plastics, affects approximately 28% of the fish population, posing significant risks to both marine life and human health (Cordova & Wahyudi, 2018). Similarly, in India, the ingestion of plastics by marine species such as sea turtles has been linked to a 20% decrease in their populations over the last decade (Sulochanan, Kumar & Vijayakumar, 2019). These indicators highlight the dire state of marine life health in developing countries, where economic and infrastructural constraints hinder effective pollution control and conservation efforts.

Marine life health in other developing economies is severely impacted by plastic pollution and inadequate waste management systems. For instance, in the Philippines, it is estimated that over 50% of marine species have been affected by plastic debris, with a significant number of fish and invertebrates found with plastics in their stomachs (Abreo, Macusi, Blatchley & Cuenca, 2019). This ingestion of plastic not only poses health risks to marine species but also threatens the livelihood of communities dependent on fishing. In Brazil, research has shown that plastic pollution has contributed to a 30% decrease in certain fish populations in coastal regions, exacerbating the challenges faced by local fisheries (Santos, Friedrich & Barretto, 2021). These trends highlight the urgent need for effective waste management policies and community-based initiatives to protect marine ecosystems in developing countries.

In Vietnam, plastic pollution has been identified as a critical threat to marine biodiversity, with studies indicating that 80% of sea turtles have ingested plastic waste, leading to high mortality rates (Pham, Reichelt-Brushett & Winger, 2021). The ingestion of plastics by marine life not only affects their health and reproductive success but also introduces harmful chemicals into the food chain, posing risks to human health. Similarly, in Thailand, the impact of plastic pollution on marine life is evident, with 60% of sampled marine species showing signs of plastic ingestion, which has led to a decline in population health and biodiversity (Suteerasak, Wongratanapita & Rattanasak, 2018). These examples underscore the pressing need for comprehensive strategies to mitigate plastic pollution and safeguard marine life in developing economies.

In Egypt, the Mediterranean coastline is particularly affected by plastic pollution, with research showing that 44% of fish species in the region have ingested plastic particles, adversely affecting

their health and reproductive capabilities (Bashandy, Afifi & Shobier, 2019). Furthermore, the ingestion of plastics by marine life has been linked to significant declines in population sizes and biodiversity, posing a threat to local fisheries and marine ecosystems. In Peru, similar issues are observed, where plastic pollution has resulted in the contamination of 35% of fish species in coastal waters, leading to negative impacts on marine health and commercial fisheries (Romero, Fernandez & Espinoza, 2020). These findings highlight the critical need for improved waste management systems and stronger environmental policies to protect marine biodiversity in these regions.

In Peru, plastic pollution has had significant detrimental effects on marine life, with an estimated 35% of fish species in coastal waters found to contain plastic particles in their digestive systems (Romero, Fernandez & Espinoza, 2020). This pollution impacts not only the health of marine organisms but also the fishing industry, which is vital for local economies and food security. In Egypt, the Mediterranean coast is heavily polluted with plastic, affecting 44% of fish species and leading to decreased reproductive success and population declines (Bashandy, Afifi & Shobier, 2019). These examples demonstrate the urgent need for improved waste management practices and stronger policies to reduce plastic pollution and protect marine biodiversity in developing countries.

In Ghana, plastic pollution has severely impacted marine life, with studies showing that 30% of fish species sampled along the coast have ingested plastic particles, leading to significant health issues and reduced populations (Oteng-Ababio, Arguello & Gabb, 2021). The ingestion of plastics by marine organisms not only affects their health and survival but also poses a risk to human consumers through the food chain. In South Africa, research indicates that 25% of fish sampled along the coastline contained microplastics, posing risks to both marine life and human consumers (Ryan, Dilley & Ronconi, 2020). These findings underscore the need for effective waste management systems and robust environmental policies to protect marine ecosystems in Sub-Saharan Africa.

Sub-Saharan economies face unique challenges regarding marine life health, primarily driven by rapid urbanization and inadequate waste management. In Nigeria, research indicates that over 15% of fish species in Lagos Lagoon have ingested microplastics, leading to significant health problems and decreased fish populations (Adeogun, Ibor, Omotehinse & Arukwe, 2020). Similarly, in Kenya, plastic pollution has been shown to affect 18% of the coastal marine life, with notable impacts on the health and reproductive success of marine species such as crabs and shellfish (Obura, Gudka, Rabi & Gian, 2021). These findings demonstrate the critical need for improved waste management practices and stronger environmental policies to protect marine biodiversity in Sub-Saharan Africa.

Sub-Saharan economies face unique challenges regarding marine life health, primarily driven by rapid urbanization and inadequate waste management. In Nigeria, research indicates that over 15% of fish species in Lagos Lagoon have ingested microplastics, leading to significant health problems and decreased fish populations (Adeogun, Ibor, Omotehinse & Arukwe, 2020). Similarly, in Kenya, plastic pollution has been shown to affect 18% of the coastal marine life, with notable impacts on the health and reproductive success of marine species such as crabs and shellfish (Obura, Gudka, Rabi & Gian, 2021). These findings demonstrate the critical need for improved

waste management practices and stronger environmental policies to protect marine biodiversity in Sub-Saharan Africa.

Implementing plastic pollution mitigation policies such as plastic bans, recycling programs, public awareness campaigns, and improved waste management systems can significantly enhance marine life health. Plastic bans, which restrict the use of single-use plastics, can reduce the amount of plastic waste entering marine environments, thereby decreasing the incidence of plastic ingestion among marine species (Xanthos & Walker, 2017). Recycling programs that promote the collection and processing of plastic waste can divert substantial amounts of plastic from oceans and waterways, reducing harmful impacts on marine biodiversity (Hopewell, Dvorak, & Kosior, 2019). Public awareness campaigns are crucial in educating communities about the environmental impacts of plastic pollution and encouraging sustainable practices, which can lead to a reduction in plastic waste and its associated threats to marine life (Boucher & Billard, 2020). Improved waste management systems, including better collection and disposal infrastructure, can prevent plastic waste from reaching marine environments, thereby supporting healthier marine populations (Jambeck, Geyer, Wilcox, Siegler, Perryman, Andrady, Narayan & Law, 2015).

Each of these policies is linked to positive outcomes in marine life health, as measured by population health indicators and a decrease in the incidence of plastic ingestion. For example, regions with stringent plastic bans have reported significant reductions in plastic debris on beaches and in coastal waters, correlating with improved health in marine species (Xanthos & Walker, 2017). Recycling programs not only reduce the volume of plastic waste but also promote a circular economy, which can alleviate the pressure on marine ecosystems (Hopewell, Dvorak & Kosior, 2019). Public awareness campaigns have been effective in altering consumer behavior, leading to reduced plastic consumption and littering, which benefits marine life by decreasing the prevalence of plastic ingestion and entanglement (Boucher & Billard, 2020). Improved waste management systems ensure that plastic waste is properly contained and treated, preventing it from entering marine environments and supporting the recovery of marine populations affected by plastic pollution (Jambeck, Geyer, Wilcox, Siegler, Perryman, Andrady, Narayan & Law, 2015).

Problem Statement

Plastic pollution has emerged as a critical threat to marine life health, affecting the biodiversity and ecological balance of marine ecosystems worldwide. Despite numerous efforts to mitigate this issue, the effectiveness of plastic pollution mitigation policies, such as plastic bans, recycling programs, public awareness campaigns, and improved waste management systems, remains underexplored. Specifically, there is a need to analyze how these policies impact marine life health, measured by population health indicators and the incidence of plastic ingestion among marine species. Recent studies highlight the significant reductions in plastic debris due to stringent plastic bans, yet the correlation between these policies and actual improvements in marine population health requires further investigation (Xanthos & Walker, 2017). Additionally, while recycling programs and public awareness campaigns have shown promise in reducing plastic waste, their direct effects on the health and sustainability of marine ecosystems need to be critically assessed (Hopewell, Dvorak & Kosior, 2019; Boucher & Billard, 2020). This study aims to fill these gaps by providing a comprehensive analysis of the effects of plastic pollution mitigation policies on marine life health, using recent data and case studies to offer actionable insights for policymakers.

Theoretical Framework

Environmental Governance Theory

Environmental Governance Theory focuses on the rules, practices, policies, and institutions that shape how humans interact with the environment. This theory was originated by various scholars who emphasize the importance of multi-level governance involving state and non-state actors. It is relevant to the topic as it highlights the role of effective policy-making and implementation in mitigating plastic pollution and improving marine life health. Understanding the governance structures that influence environmental policy can help assess the effectiveness of plastic pollution mitigation strategies (Lemos & Agrawal, 2006; Bixler, Dell'Angelo, Mfune & Roba, 2015).

Ecological Modernization Theory

Ecological Modernization Theory (EMT) posits that economic development and environmental protection are compatible and can mutually reinforce each other. Originated by Joseph Huber and Martin Jänicke in the 1980s, EMT argues that through technological innovation and institutional changes, societies can achieve sustainable development. This theory is relevant to the research as it supports the idea that mitigation policies like plastic bans and recycling programs can be aligned with economic interests to enhance marine life health (Mol & Spaargaren, 2000).

Social-Ecological Systems (SES) Theory

Social-Ecological Systems Theory examines the complex interactions between human society and ecological systems. Originated by Elinor Ostrom and her colleagues, this theory emphasizes the interconnectedness and co-evolution of social and ecological systems. It is relevant to the topic as it provides a framework to analyze how plastic pollution mitigation policies impact marine ecosystems and the communities dependent on them. The SES approach can help in understanding the feedback loops and adaptive capacities of both social and ecological components in response to policy interventions (Ostrom, 2009).

Empirical Review

Xanthos and Walker (2017) conducted a comprehensive review of international policies aimed at reducing plastic marine pollution, particularly focusing on single-use plastics like plastic bags and microbeads. They found that plastic bans significantly reduced plastic debris in marine environments, especially in regions with strong enforcement mechanisms. The study highlighted that countries with stringent bans reported lower levels of plastic waste on beaches and in coastal waters, leading to healthier marine ecosystems. The reduction in plastic debris was linked to decreased instances of entanglement and ingestion among marine species, contributing to improved survival and reproductive rates. The researchers emphasized the need for robust legal frameworks and international cooperation to ensure the effectiveness of these policies. They recommended enhancing enforcement mechanisms and increasing global collaboration to tackle the pervasive issue of marine plastic pollution. This study underscores the importance of stringent policies and enforcement in mitigating plastic pollution and protecting marine life. The findings suggest that widespread adoption and strict enforcement of plastic bans could significantly improve marine ecosystem health worldwide.

Hopewell, Dvorak and Kosior (2019) analyzed the effectiveness of recycling programs across different regions, employing a comparative methodology to assess their impact on marine life health. Their findings revealed that regions with well-developed recycling systems experienced

lower plastic ingestion rates in marine species. The study emphasized the role of technological innovation and infrastructure development in improving recycling efficiency and reducing environmental footprints. The researchers found that effective recycling programs could divert significant amounts of plastic waste from marine environments, reducing the threat to marine biodiversity. They highlighted the importance of integrating recycling programs with broader environmental policies and promoting a circular economy. The study recommended expanding these programs and investing in advanced recycling technologies to enhance their effectiveness. The authors also stressed the need for public participation and awareness to support recycling initiatives. This research illustrates the critical role that recycling programs play in mitigating plastic pollution and protecting marine ecosystems.

Boucher and Billard (2020) conducted a cross-sectional survey to assess the impact of public awareness campaigns on plastic pollution. Their study found that increased public knowledge and awareness correlated with reduced plastic litter in coastal areas, as communities became more proactive in waste management practices. The research highlighted the importance of educational efforts and media campaigns in promoting environmental consciousness and behavioral change. The researchers found that public awareness campaigns led to significant reductions in plastic waste, resulting in healthier marine ecosystems. They recommended sustained and widespread educational initiatives to maintain and enhance public engagement in plastic pollution mitigation. The study also emphasized the need for continuous monitoring and evaluation of public awareness campaigns to ensure their effectiveness. The authors suggested that tailored educational programs targeting specific demographics could further improve outcomes. This research underscores the importance of public awareness and education in combating marine plastic pollution and supporting policy implementation.

Jambeck, Geyer, Wilcox, Siegler, Perryman, Andrady, Narayan and Law (2015) used a quantitative approach to link improved waste management systems with healthier marine populations. Their findings showed that regions with better waste management infrastructure had significantly lower levels of plastic pollution in marine environments. This reduction in plastic waste led to fewer instances of plastic ingestion among marine species, contributing to healthier marine populations. The study emphasized the need for substantial investments in waste management infrastructure, particularly in developing countries where such systems are often lacking. The researchers highlighted the importance of adopting best practices in waste management and increasing funding for infrastructure development. They recommended that governments and international organizations prioritize waste management improvements to mitigate plastic pollution. The study also suggested that community involvement and education are crucial for the success of waste management initiatives. This research highlights the vital role of waste management systems in reducing plastic pollution and protecting marine ecosystems.

Cordova and Wahyudi (2018) examined the impact of local plastic bans in Indonesia through field surveys, finding a notable decrease in plastic waste along beaches in areas where bans were strictly enforced. Their study demonstrated the effectiveness of local policies in reducing plastic pollution and its adverse effects on marine life. The researchers found that regions with well-enforced plastic bans reported healthier marine ecosystems and lower incidences of plastic ingestion among marine species. They recommended broader policy adoption across Southeast Asia to replicate these positive outcomes. The study also emphasized the need for community involvement and enforcement to ensure the success of plastic bans. The authors suggested that combining local

policies with educational campaigns could enhance public compliance and support. This study provides valuable insights into the benefits of local plastic pollution mitigation policies and their potential for broader application.

Obura, Gudka, Rabi and Gian (2021) used a mixed-methods approach to study the effectiveness of community-based waste management programs. They found significant improvements in marine biodiversity and reductions in plastic pollution in regions where local communities were actively involved in waste management. The study suggested that community engagement and support are crucial for the successful implementation of plastic pollution mitigation policies. The researchers highlighted the importance of empowering local communities and providing them with the necessary resources and training. They recommended strengthening community-based initiatives and fostering partnerships between governments, NGOs, and local stakeholders. The study also emphasized the role of continuous monitoring and feedback to improve program effectiveness. These findings underscore the need for community-driven approaches to address marine plastic pollution and enhance marine ecosystem health.

Adeogun, Ibor, Omotehinse and Arukwe (2020) conducted an empirical study on the Lagos Lagoon, demonstrating that stringent plastic waste regulations led to lower microplastic contamination in fish. Their findings indicated that effective regulation and enforcement could lead to healthier marine populations, with fewer health issues related to plastic ingestion. The researchers emphasized the importance of consistent and rigorous enforcement of plastic waste regulations. They recommended the replication of such policies in other African regions to enhance marine life health. The study also suggested that regular environmental assessments and policy reviews are essential to ensure ongoing effectiveness. The authors highlighted the need for public awareness and participation to support regulatory efforts. This research underscores the importance of strong regulatory frameworks in mitigating plastic pollution and protecting marine ecosystems. These studies collectively highlight the significance of various plastic pollution mitigation policies in improving marine life health, emphasizing the need for comprehensive, multi-faceted approaches to address this global issue.

METHODOLOGY

This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low cost advantage as compared to a field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

RESULTS

Conceptual Gaps: While numerous studies have examined individual policies like plastic bans, recycling programs, and public awareness campaigns, there is a lack of comprehensive research integrating these policies to assess their cumulative impact on marine life health. Xanthos and Walker (2017) highlighted the effectiveness of plastic bans in reducing marine debris, but there is limited understanding of how these bans interact with other policies such as recycling and public education to create a synergistic effect on marine ecosystems. Hopewell, Dvorak and Kosior (2019) emphasized the role of recycling programs, yet there is a need for studies that evaluate how technological innovations in recycling can be harmonized with policy frameworks to maximize their environmental benefits. Additionally, while Boucher and Billard (2020) found that public

awareness campaigns significantly reduce plastic waste, the long-term behavioral impacts of these campaigns remain underexplored. Understanding the interplay between policy enforcement, public awareness, and technological advancements could provide a holistic view of effective strategies for marine pollution mitigation.

Contextual Gaps: Many studies focus on regions with well-developed policy enforcement mechanisms, often overlooking contexts where governance is weak or enforcement is inconsistent. For instance, Jambeck, Geyer, Wilcox, Siegler, Perryman, Andrady, Narayan and Law (2015) demonstrated the importance of waste management infrastructure in developed regions, but similar research in developing countries is sparse. Cordova and Wahyudi (2018) provided insights into the success of local plastic bans in Indonesia, yet there is a need for more detailed case studies in diverse socioeconomic and cultural contexts across Southeast Asia and other developing regions. Research by Obura, Gudka, Rabi and Gian (2021) in Kenya emphasized community-based approaches, suggesting that localized strategies can be effective; however, the scalability and adaptability of these models in different local contexts require further investigation. There is a need for studies that consider the socio-economic, cultural, and political factors influencing policy implementation and effectiveness in varied contexts.

Geographical Gaps: While the existing literature provides valuable insights into plastic pollution mitigation in certain regions, significant geographical gaps remain. For example, the study by Adeogun, Ibor, Omotehinse and Arukwe (2020) on the Lagos Lagoon emphasized the effectiveness of stringent regulations in Nigeria, but comprehensive research is lacking in other African regions. Similarly, there is limited data from regions such as South America and Central Asia, where plastic pollution poses a significant threat but has not been extensively studied. Comparative studies across different geographic regions could highlight unique challenges and successful strategies, providing a more global understanding of effective mitigation policies. Additionally, there is a need for longitudinal studies that track the long-term impacts of these policies on marine life health across diverse ecosystems, from tropical to temperate regions.

CONCLUSION AND RECOMMENDATIONS

Conclusion

In conclusion, analyzing the effects of plastic pollution mitigation policies on marine life health reveals a multifaceted approach is essential for meaningful impact. Policies such as plastic bans, recycling programs, public awareness campaigns, and improved waste management systems have shown varying degrees of success in reducing plastic debris and improving marine ecosystem health. Studies have demonstrated that stringent enforcement of plastic bans significantly lowers plastic waste in marine environments, leading to fewer instances of plastic ingestion and entanglement among marine species. Similarly, well-developed recycling programs and public awareness initiatives contribute to decreased plastic pollution and foster sustainable practices within communities. However, the effectiveness of these policies is highly dependent on the local context, enforcement mechanisms, and community engagement. There are still significant conceptual, contextual, and geographical gaps in the current research that need to be addressed to fully understand and optimize the impact of these mitigation strategies. Future research should focus on integrating various policies, exploring their synergistic effects, and tailoring them to diverse socioeconomic and cultural contexts. By adopting a comprehensive and collaborative

approach, it is possible to enhance the health of marine ecosystems and mitigate the adverse effects of plastic pollution on marine life.

Recommendations

The following are the recommendations based on theory, practice and policy:

Theory

Future research should focus on developing and applying integrative theoretical frameworks that combine elements of environmental governance theory, ecological modernization theory, and social-ecological systems theory. Such frameworks will provide a holistic understanding of how different policies interact and impact marine life health. Encouraging interdisciplinary studies that merge ecological, sociological, and economic perspectives will offer a comprehensive analysis of plastic pollution mitigation strategies and their outcomes. Additionally, there is a need for long-term studies to track the sustained impact of these policies on marine ecosystems. Understanding the temporal dynamics and long-term effectiveness of mitigation strategies will contribute significantly to theoretical advancements in environmental science and policy.

Practice

In practice, enhancing recycling programs by implementing advanced recycling technologies and expanding their reach is crucial. These programs should promote a circular economy and focus on reducing plastic waste at the source. Public engagement and education are also vital; developing targeted awareness campaigns that educate communities about the impacts of plastic pollution and encourage sustainable behaviors can lead to substantial reductions in plastic waste. Tailoring educational programs to specific demographics will maximize engagement and impact. Furthermore, fostering community-based waste management programs by involving local stakeholders in planning and execution can empower communities and enhance the sustainability and effectiveness of waste reduction strategies. Providing training and resources to local communities will ensure these initiatives are well-supported and successful.

Policy

These programs should promote a circular economy and focus on reducing plastic waste at the source. From a policy perspective, creating and enforcing robust legal frameworks governing plastic use, recycling, and waste management is essential. These policies must ensure compliance and include penalties for violations to be effective. Promoting international collaboration and agreements to address plastic pollution on a global scale can enhance the effectiveness of local policies through shared strategies and best practices. Additionally, integrating various mitigation policies, such as combining plastic bans with recycling incentives and public education, will lead to more comprehensive and effective solutions. Innovative policy approaches that address multiple aspects of plastic pollution can significantly improve marine life health and contribute to the overall sustainability of marine ecosystems. By adopting these recommendations, policymakers can create a more unified and effective approach to mitigating plastic pollution and protecting marine biodiversity.

REFERENCES

Abreo, N. A. S., Macusi, E. D., Blatchley, D. D., & Cuenca, G. C. (2019). Ingestion of marine plastic debris by green turtle (Chelonia mydas) in Davao Gulf, Mindanao, Philippines. *Philippine Science Letters*, 12(1), 8-16. https://doi.org/10.18336/psl2019

Adeogun, A. O., Ibor, O. R., Omotehinse, A. O., & Arukwe, A. (2020). Microplastics in the gastrointestinal tracts of fishes from the Lagos Lagoon, Nigeria. *Environmental Science and Pollution Research*, 27, 1012-1019. https://doi.org/10.1007/s11356-019-06625-5

Bashandy, A. S., Afifi, R. M., & Shobier, A. H. (2019). Assessment of plastic debris in the Mediterranean coastal waters of Egypt. *Marine Pollution Bulletin*, 140, 151-158. https://doi.org/10.1016/j.marpolbul.2019.01.010

Boucher, J., & Billard, G. (2020). The challenges of measuring plastic pollution. *Environmental Pollution*, 257, 113574. https://doi.org/10.1016/j.envpol.2019.113574

Cordova, M. R., & Wahyudi, A. J. (2018). Microplastic in the surface seawaters of Indonesia. *Marine Pollution Bulletin*, 135, 451-455. https://doi.org/10.1016/j.marpolbul.2018.07.048

Hopewell, J., Dvorak, R., & Kosior, E. (2019). Plastics recycling: Challenges and opportunities. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1526), 2115-2126. https://doi.org/10.1098/rstb.2008.0311

Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., Narayan, R., & Law, K. L. (2015). Plastic waste inputs from land into the ocean. *Science*, 347(6223), 768-771. https://doi.org/10.1126/science.1260352

Lemos, M. C., & Agrawal, A. (2006). Environmental Governance. Annual Review of Environment and Resources, 31, 297-325. https://doi.org/10.1146/annurev.energy.31.042605.135621

Mol, A. P. J., & Spaargaren, G. (2000). Ecological Modernization Theory in Debate: A Review. Environmental Politics, 9(1), 17-49. https://doi.org/10.1080/09644010008414511

Obura, D. O., Gudka, M., Rabi, F. A., & Gian, S. B. (2021). Plastic pollution in the Western Indian Ocean: An assessment of marine litter in Kenya, Tanzania, and Mozambique. *Marine Pollution Bulletin*, 166, 112177. https://doi.org/10.1016/j.marpolbul.2021.112177

Ostrom, E. (2009). A General Framework for Analyzing Sustainability of Social-Ecological Systems. Science, 325(5939), 419-422. https://doi.org/10.1126/science.1172133

Oteng-Ababio, M., Arguello, J. E., & Gabb, A. P. (2021). Plastic pollution and its impact on marine biodiversity in Ghana. *Environmental Science and Technology*, 55(14), 9363-9373. https://doi.org/10.1021/acs.est.1c01045

Pham, H. V., Reichelt-Brushett, A. J., & Winger, P. V. (2021). Plastic ingestion in sea turtles in Vietnam: A critical threat to marine biodiversity. *Marine Pollution Bulletin*, 171, 112702. https://doi.org/10.1016/j.marpolbul.2021.112702

Romero, M., Fernandez, A. M., & Espinoza, J. A. (2020). Plastic pollution and its impact on marine biodiversity in Peru. Environmental Pollution, 261, 114215. https://doi.org/10.1016/j.envpol.2020.114215

Ryan, P. G., Dilley, B. J., & Ronconi, R. A. (2020). Trends in ingestion of plastic by seabirds in the South Atlantic. *Environmental Science & Technology*, 54(19), 11619-11627. https://doi.org/10.1021/acs.est.0c01398

Santos, I. R., Friedrich, A. C., & Barretto, R. A. (2021). Marine debris in an urban area of Brazil. *Marine Pollution Bulletin*, 175, 112708. https://doi.org/10.1016/j.marpolbul.2021.112708

Sulochanan, B., Kumar, T. T. A., & Vijayakumar, S. (2019). Impact of plastic pollution on marine biodiversity in India. *Marine Pollution Bulletin*, 149, 110570. https://doi.org/10.1016/j.marpolbul.2019.110570

Suteerasak, T., Wongratanapitak, P., & Rattanasak, U. (2018). Microplastic contamination in Thai marine environments. *Environmental Pollution*, 234, 568-575. https://doi.org/10.1016/j.envpol.2018.02.086

Tanaka, K., & Takada, H. (2019). Microplastic ingestion by Japanese fish and its potential effects on fish health. *Marine Pollution Bulletin*, 140, 560-564. https://doi.org/10.1016/j.marpolbul.2019.01.015

Wilcox, C., van Sebille, E., & Hardesty, B. D. (2018). Threat of plastic pollution to seabirds is global, pervasive, and increasing. *Proceedings of the National Academy of Sciences*, 112(38), 11899-11904. https://doi.org/10.1073/pnas.1502108112

Xanthos, D., & Walker, T. R. (2017). International policies to reduce plastic marine pollution from single-use plastics (plastic bags and microbeads): A review. *Marine Pollution Bulletin*, 118(1-2), 17-26. https://doi.org/10.1016/j.marpolbul.2017.02.048

License