POLICY BRIEF

TRANSLATING RESEARCH OUTPUTS INTO POLICY MAKING PROCESS FOR MARINE PLASTIC WASTE MANAGEMENT: AN EXAMPLE OF VIET NAM

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INTRODUCTION

In 2014 Viet Nam generated approximately 1.8 million tons of plastic waste annually and increased to 2.93 million tons in 2021, with an annual growth rate of 5%. Viet Nam has taken significant steps to address plastic waste through active participation in both national and international initiatives. A prime example is its involvement in the ASEAN Bangkok Declaration, which focuses on the collective fight against marine plastic pollution across Southeast Asia. The government's proactive stance is also reflected in various legal frameworks and collaborations aimed at tackling plastic waste, particularly in marine environments. However, Vietnam's efforts to reduce plastic waste are hindered by gaps in policy formulation and implementation. While regulations targeting single-use plastics and non-biodegradable packaging have been introduced, enforcement remains inconsistent. Policies such as the environmental tax on plastic bags and the Extended Producer Responsibility (EPR) system lack clarity and effective implementation, limiting their impact[1] Additionally, there is a lack of comprehensive regulations addressing microplastic pollution, and the infrastructure for waste sorting and recycling remains underdeveloped. Without immediate action, particularly the contribution from academia and practitioners Vietnam's plastic waste crisis will continue threatening the nation's ecosystems, public health, and economic well-being. Under the project named "Sources, Sinks, and Solutions for the Impact of Plastics on Coastal Communities in Viet Nam" - 3SIP2C, a number of key findings across 05 work packages (WPs) on sources and sinks of both macro and micro plastic wastes, impacts of plastic waste on ecosystems and socio-economic, gaps in policy implementation and awareness on plastic waste reductions in Viet Nam can be use as important inputs for sustainable development and environmental policy makers at central and local level.

KEY FINDINGS FROM THE 3SIP2C PROJECT

SOURCES AND SINKS OF PLASTIC WASTES

Understanding the sources and sinks of plastic wastes, particularly in both fresh water bodies and marine is critically important to identify best strategies to reduce plastic wastes at sources

[1] Nguyen Sy Linh (2024). Informal workers play important role in EPR and global plastics treaty implementation in Viet Nam. Vietnam Law and Legal. May 2024

and on-site. Under 3-D hydrodynamic model and a Lagrangian-particle tracking model of the 3SIP2C project we identified that around 90 tons of macroplastic wastes enters the sea through Ba Lat river mouth of Red River Delta in the dry season (Dec 2021 - Feb, 2022) and ~134 tons in the wet season (Jun - Aug 2022). Macroplastics are mainly transported south along the shoreline in dry season (70%) and offshore. Plastic hotspots mainly occur at the shoreline adjacent to the river mouth and are skewed towards the downwind side relative to the seasonal prevailing wind direction. In addition, through 2 sampling campaigns in Feb. - March 2023 (dry season) and July - Aug. 2023 (wet season) with 1923 water and sediment samples plus 53 natural fishes collected from the water and sediments for analysis. The finding indicates that microplastic (MiP) concentrations were higher during the dry season compared to the rainy season in both the Red River and Cat Ba Island. The highest MiP concentration was found in the surface water layer and MiP concentration in Cat Ba Island (open sea) is higher than in Cat Ba Bay, upstream Red River, downstream then estuarine areas. Dominant plastic types observed in samples included polyethylene terephthalate (PET), rayon, and nylon and most of MiPs were found in a fibre shape.

IMPACTS OF PLASTIC WASTES ON ECOSYSTEM AND SOCIO-ECONOMICS OF PLASTIC WASTES

Results from the survey of 200 fishers across three coastal communities in Vietnam from the Red River Delta to the Mekong River Delta and key informant interviews, focus group discussions indicated with all fishers encounter plastic wastes in the marine environment and these plastics interferes with their fishing activities, particularly additional time sorting catch with increased associated costs due to lost time. In addition, plastic wastes in the sea snags propellers and causes vessel breakdown, leading to lost fishing time and associated costs being towed to the coast. In some cases, fishers have been injured when attempting to deal with plastic waste that is interfering with the functioning of their fishing vessel leading to serious injuries. Notably, nearshore fishing communities reported the economic loss of around 15% of their annual revenue as a result of plastic waste, but the severity of this economic loss varies from one community to another. Furthermore, under 3SIP2C we also carried out a survey of 330 coastal aquaculture businesses, including floating fish farms, clam farms, and extensive and intensive shrimp farms from the Red River Delta to the Mekong River Delta to better understanding the impacts of plastics on their business. The findings indicate that aquaculture farmers often express less concerns about plastic wastes than fishers in the same area. Overall, the cost of plastic waste ranges from 0.1% to 3% of the farm's annual revenue. The cost of plastic waste varies from locations, for example, farms located in open coastal water (such as floating cages and clam farms) experience higher impacts from plastic waste than farms situated inland like intensive shrimp farms and open burning of plastic waste remains the common practice in many aquaculture farms that may cause onsite air and water pollution. Additionally, all interviewed farmers reported incidences of mass deaths of their farmed animals over the last five years and they have great concerns

about water pollution and diseases that affect their aquaculture business which may associate with plastic wastes. However, farmers in our interviews have limited information and awareness about microplastics and their potential to carry pollutants and pathogens.

Plastic waste not only impact on aquaculture production but also impact on tourism sector, particularly in the coastal areas. The findings from interviews with 6 tourism management officers, 16 tourism providers, 60 domestic and international tourists in Cat Ba Island (Hai Phong City) indicate that beautiful sceneries and a clean environment are key factors that attract tourists to Cat Ba. Reduction in attractiveness caused by plastic pollution could result in 8% loss in tourism revenue annually, particularly water-based tourism services such as boat tours and beachfront hotels being directly impacted. The study also reveals that both tourism businesses and tourists want to see changes that help them to reduce single-use plastic consumption, better communication programmes, strong punishment for littering, and increase waste collection infrastructure.

Beside impact of large plastic waste, aquaculture is also influenced by microplastics. Under 3SIP2C project we conducted in-situ experiments for up to 1 year at various locations (within and outside of fish and clam farms, a mangrove area, and a reference site) to monitor biofilm formation, detect for pathogens, and quantify for antibiotic- and metal-resistance genes on the surface of microplastics (polystyrene, high-density polyethylene) and glass beads (as reference). The findings reveal that biofilms formed on microplastics within 2 days and progressively increased over several months. Particularly, biofilms formed more rapidly on polystyrene within fish farms. Additionally, various metal and antibiotic resistance genes were detected and their concentrations increased over several months. Notably, pathogenic organisms were detected within microplastic biofilms and ingestion of microplastics with associated pathogens, toxic metals and resistance genes could be linked to observed defects/diseases in farmed animals.

SOLUTIONS TO REDUCE PLASTIC WASTES

Under 3SIP2C project we also explored the current national and local policies r to understanding measures to address the challenges of plastic wastes, particularly on coastal communities. Content analysis of the national action plan on marine plastic litter management by 2030 (Decision No.1746/QD-TTg) and 22 action plans of provincial authorities to implement the national action plan indicate that not all 28 provinces along the coastal line in Vietnam have developed and approved the action plan to execute the national action plan. Only 22 provinces formulated and approved their action plans, and 15/22 action plans of province indicated clear regulations/arrangement on implementation and 5/22 action plans of provinces have specific budget for implementation budgets, other show no indication of budget allocation.

Notably, most of the activities at both national and local level are related to formulate plans and programme on awareness raising and communication than the concrete actions to

directly reduce plastic waste generation, collection and treatments. There is no monitoring and evaluation framework to track down the progress of achieving national targets on plastic waste reduction in Viet Nam. Through 04 roundtable discussions with 200 participants come from management agencies (national, provincial and commune level), research institutions and universities, business sectors, NGOs and media, we noted that previously formulation of plastic waste reduction policies was normally lack of study-based evidences and active participation of wide-range stakeholders but limited to the management agencies. There is still lack of close collaboration between policy-makers, researchers and practitioners in both policy formulation and implementation.

Beach clean-up activities have been promoted by various projects and campaigns, within 3SIP2C project, beach clean-up and waste audit event validates AI-based geoinformatics models were organized in Giao Hai commune, Giao Thuy district, Nam Dinh province in March and October 2023. The findings show that domestic plastic waste dominates with 60-70%, with 6-8% of waste identified from fishing activities. Repeated drone surveys with AI models enable high resolution automatic detection and monitoring of coastal plastic debris to identify seasonal changes in plastic deposition reveals total waste coverage rose to 12% during the rainy season in September 2023 compared to 0.9% after beach cleaning event in March 2023 and ~ 6% during the dry season in March 2024. Beach clean-up combined with waste compositional analyses, therefore can deliver direct information on the scale and nature of waste pollution at Giao Hai beach and can deepen awareness and understanding of the plastic challenge and encourages local action to solve the problem.

In addition, using local community knowledge was also applied to identify plastic hotspots on Cat Ba Island, Hai Phong city. The results indicate that hotspots of plastic pollution on Cat Ba were not revealed on previous maps. Visualising plastic waste sinks on the 3D model identified by communities from different regions on Cat Ba helps raising awareness of the dynamic and interconnected nature of plastics in the region. High school students, therefore gained hands-on and practical experiences in facilitating community discussions and social engagement. Integrating the new community information with the 3D model resulted in a novel GIS-based plastic hotspot map of Cat Ba, co-designed by local communities can be an innovative solution to identify plastic waste hotspots and to raise awareness of local communities on sources and sinks of plastic wastes.

GAPS AND CHALLENGES

Even knowledge on sources, sinks and impacts of plastic wastes on coastal communities of Viet Nam has dramatically increased, and solutions to tackle challenges of plastic waste have also amplified in recent year, there are still gaps that need addressing.

- Sources and sinks of large plastic wastes from land to sea have not been mapped or identified nationwide by seasons, and sources from domestic and cross-national borders have not yet quantified.
- Micro-plastics discovered in environmental samples but works need to carry out with aquatics creatures, particular fish, mussels, shrimps… associated with specific aquatic environment or sites.
- Sources, sinks and impacts of micro-plastic have not intensively studied and more work need to be carried both with environmental and living organism samples.
- Impacts of large plastic wastes on aquaculture and tourism sectors have been studied for some areas but wider direct and indirect assessments on impacts of plastic wastes to other locations and sectors is necessary.
- Current regulations do not comprehensively cover microplastic pollution or set clear standards for the disposal and recycling of various types of plastic. At national level, the policy framework related to plastic waste management in Viet Nam is quite comprehensive but there is no budget mobilization and allocation mechanism in place to provide financial resources to implement measures indicated.
- Awareness about the impact of plastic wastes have increased recently, particularly among the youth but not the whole society due to the lack of sound messages for communication and education purposes.

RECOMMENDATIONS

CONDUCT MORE STUDIES TO FURTHER LOCATING MAIN SOURCES OF PLASTIC WASTE ON RIVERS, LAKES AND SEAS

- Studies on upstream waste management efforts, especially in urban areas along the Red River and Mekong river delta to estimate amount of plastic wastes originated from upstream and urban setting into sea;
- Conduct ongoing research to refine forecasting models and adapt strategies to evolving environmental conditions;
- Promote modeling and forecasting of particulate transport and accumulation using computer simulations, contributing to an early warning system that determines the time and location of plastic pollution hotspots;
- The application of AI modeling technology and new drone-based sensors for mapping and quantifying the distribution of beach waste by season and other variables.

- Optimize cleanup operations using seasonal, area-first dispersion models in order to better understand sources and types of plastic wastes.

- Develop and implement a periodic plastic pollution survey program, combining the use of drones and beach solid waste audit activities carried out by local communities.

FURTHER EXPLOIT THE IMPACT OF LARGE PLASTIC WASTES ON SOCIO-ECONOMY DEVELOPMENT AND IMPACT OF MICROPLASTIC ON ECOSYSTEM AND HUMAN HEALTH

- Expanding studies on direct and indirect impacts of large plastic waste on economic development by geographical and chronological arrangement in order to better understand impact of plastics on economy.

- Setting up experimental studies on impacts of MiP on aquatic ecosystems and living organisms, particularly the concentration and threshold of MiP pollution.

- More studies to identify standards and thresholds for MiP and emerging pollutants in the environment as well as the antibiotic risks associated with MiP contamination;

- Study and develop faster screening tools to identify the presence of MiPs in the environment in order to provide early warning messages to aquaculture farms and public health agencies.

- Supporting people and businesses to access knowledge on impact of MiPs and measures to prevent MiPs into environment and food chain.

PROMOTE INNOVATIVE AND COLLECTIVE EFFORTS IN REDUCING PLASTIC WASTE FROM SOURCES TO SINKS

- Develop a comprehensive plastic waste management framework based on study-based data and information providing by academia and practitioners. The policy framework should include sound regulations and standards for the management of MiPs and other pollutants in fresh and salty water bodies.

- Strengthen waste collection and treatment infrastructure at source, especially in urban and rural areas, to reduce the leakage of plastic waste to waterways.

- Set up a monitoring framework to monitor progress towards the national target of reducing plastic waste in the oceans and seas by 75% in 2030.

- Develop a supply chain for coastal plastic waste treatment, creating conditions for fishermen to participate in environmental cleanup events.

- Establish a funding scheme that can support stakeholders to implement tasks and measures that lead to the achievement of the national plastic reduction targets, particularly the targets set in the National Action Plan on Marine Plastic Litter Management to 2030.

- Support local communities and businesses in reducing ocean plastic waste through dynamic mechanism that involve domestic and international funding scheme.

- Encourage tourism businesses to change their operation policies and financial instruments to make alternatives to single-use plastics more affordable.

BUIDING DATABASE ON PLASTIC VALUE CHAINS

- Establish a database of plastic generation, collection and treatment (e.g. sources, types and quantity of plastic wastes) and operate a monitoring system to monitor the implementation of plastic waste reduction policies.

- Promoting beach cleanup and inspection activities that can provide real-world data on the amount and types of plastic wastes.

- Promoting local community involvement, especially schools in plastic waste auditing event to create data that can be used to validate large-scale ocean modelling results, while connecting local communities to the natural sciences.

- Develop a monitoring system using biological indicators and biological tests in critical environments;

- Regularly monitor water quality and enforce/penalize non-compliance

COMMUNICATION, EDUCATION AND COLLABORATION

- Developing and delivering more comprehensive communication strategies to better inform the whole society about the benefits of reducing plastic waste in the oceans and seas, and the importance of collective efforts in achieving national goals related to plastic waste reduction in Viet Nam;

- Promote outreach activities, raise awareness of the flow of plastic waste by ocean currents and winds along the coast.

- Educational programs should be incorporated into school curricula and community outreach initiatives, along with distributing flyers in tourism agencies to encourage people not to litter and to reduce plastic use;

- Enhancing evidence-based communication on the impact of microplastics on animal and human health on aquaculture, particularly the one-health approach.

- Strengthening international cooperation, expand scope and facilitate the exchange of knowledge on new strategies and examples of effective policy application;

- Connecting domestic and foreign universities, ensuring flexible information exchange and inter-national action planning;

- Coordinating, investing and training local leaders, local communities and businesses, and empowering illegal waste disposal are essential components to improve the current situation.

Reducing plastic wastes requires the involvement of multiple stakeholders, including government agencies, private businesses, local communities, NGOs and academia. In Vietnam, local authorities play a crucial role in waste collection and enforcement of plastic reduction measures. However, there is a growing recognition of the need for greater participation from industries, especially those producing and utilizing plastics, to take responsibility for managing their waste. Additionally, local communities have been increasingly engaged through initiatives such as beach clean-ups, yet their formal integration into the decision-making process remains limited. Therefore, setting targets for each phase is necessary, and first step is to identify resources and appropriate implementation methods according to the scale and characteristics of each locality, region, and community.

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