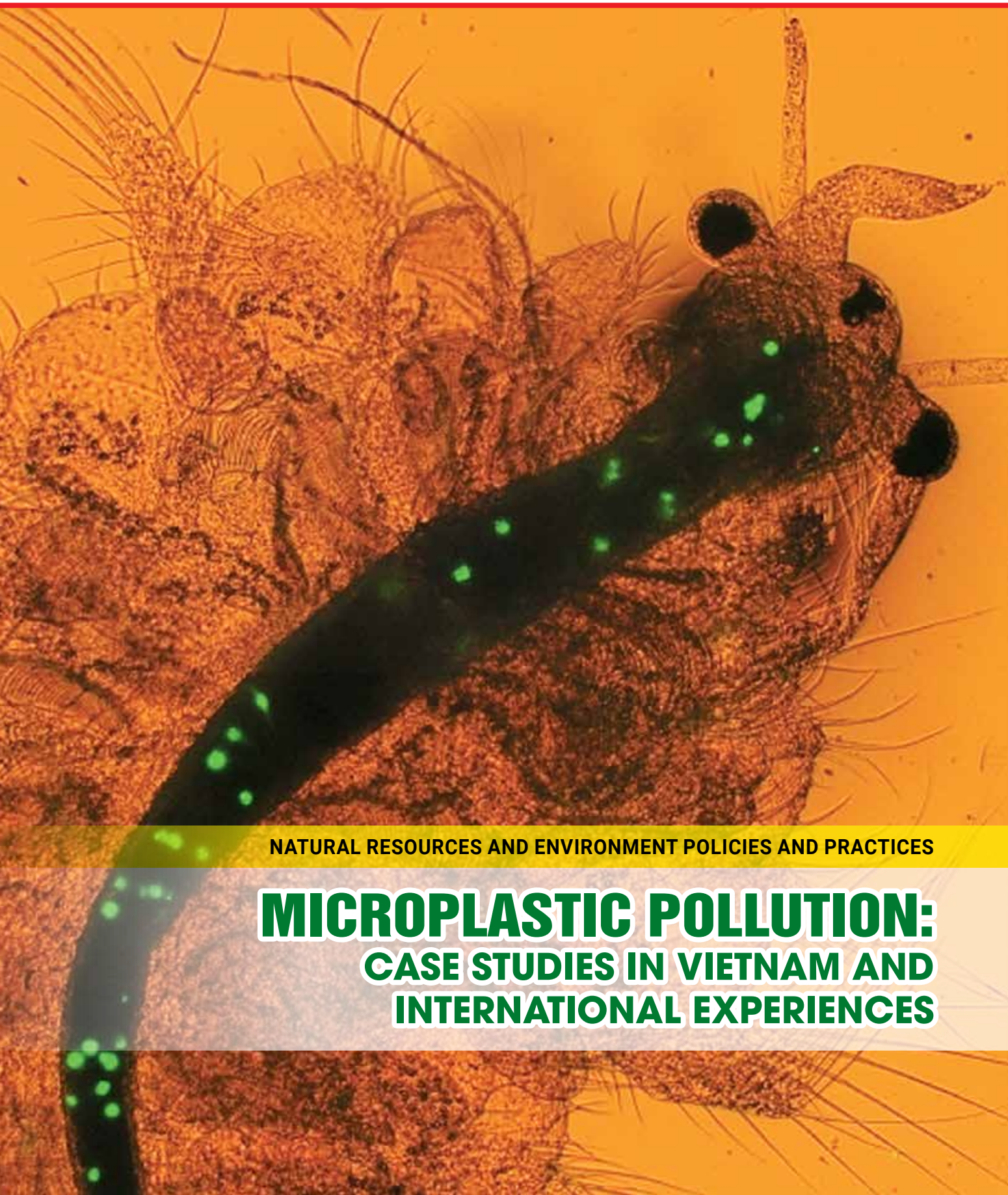

NATURAL RESOURCES AND ENVIRONMENT POLICIES AND PRACTICES

MICROPLASTIC POLLUTION:
CASE STUDIES IN VIETNAM AND INTERNATIONAL EXPERIENCES

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Cover photo:
Microplastics founded in a seawater shrimp.
Photo: IAEA

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Hanoi, March 2021

Contents

The meeting "National guidance for plastic pollution hotspotting and shaping action - Report on researching in Vietnam"

On November 18, 2020, IUCN coordinated with partners to hold a meeting **"National guidance for plastic pollution hotspotting and shaping action - Report on researching in Vietnam"** to share research results on plastic pollution hotspoting in Vietnam; Collect ideas from stakeholders about the results, revise and complete the study and share it with participants.

Through the MARPLASTICs initiative funded by the Sida, IUCN and UNEP have developed "National Guidelines for Plastic Pollution Hotspotting and Shaping Action". The three main elements of the methodological framework were: identifying hotspotting, prioritizing intervention solutions and focusing on the development of tools to implement them. Quantis and EA are advisory partners to help develop and apply this methodology.

In practice, applying many measures are needed to contribute to reducing plastic pollution, but the aim of this approach is to assist Vietnam in identifying priority actions and selecting the ones with the most impact appropriate to domestic context.

Plastic bags discharged after use at Tho Quang dock, Da Nang | Photo: IUCN

Training course: Microplastics: Environmental pollution and potential impacts on human health

Vietnam Journalists Association | Photo: Hội NBVN

In Ho Chi Minh City, the Center for Training of Journalism (Vietnam Journalists Association) in collaboration with the French Media Development Agency (French Embassy) organized the training course "Microplastics: Environmental pollution and potential impacts on human health".

The participation of the course were reporters working in press agencies in Ho Chi Minh City and neighboring provinces such as Tuoi Tre (Youth) Newspaper, Law Newspaper of Ho Chi Minh City, Voice of Vietnam Radio in Ho Chi Minh City, Ho Chi Minh City Television, Dong Nai Radio - Television, Dong Nai Newspaper, Lao Dong Newspaper...

During the 3-day training course, the trainees were absorbed, exchanged and discussed with the experts and lecturers about the knowledge and harms of microplastics, the effective way to communicate about this issue to the public.

The participants were organized a visit to and exchanged with experts at the Center for Asian Water Research (CARE) - Ho Chi Minh City University of Technology; representative of Ho Chi Minh City Urban Environment Limited Company on the situation and plastic waste treatment in Ho Chi Minh City. In the laboratory, the trainees were able to learn about the work of a scientific researcher and access the data of the COMPOSE project.

Conducting a beach debris monitoring programme in the coastal areas of Viet Nam

In order to develop a standardized methodology for plastic waste monitoring in coastal areas in Viet Nam, in February-December 2019, IUCN in partnership with GreenHub prepared a manual entitled "Methodology on monitoring and assessment of beach debris" and conducted beach monitoring activities in 11 MPAs and NPs, including Bai Tu Long, Cat Ba, Bach Long Vi, Con Co, Cu Lao Cham, Ly Son, Hon Cau, Nui Chua, Nha Trang, Phu Quoc and Con Dao.

This methodology was based on NOAA and UNEP guidelines on marine plastic debris monitoring with adjustments for the local context. In March 2019, the method was tested in Hai Phong in collaboration with IMER and Viet Nam University of Science.

Monitoring will take place twice a year over three years with the participation of MPA and NP staff and volunteers. The results of the first phase (May-July 2019) showed that plastic waste makes up to 97% of seven categories of waste collected (plastics, metals, glass, rubber, cloth, wood and miscellaneous). The most common plastic waste was styrofoam, rope/net, container foam and plastic bags.

These initial results were shared at a national workshop on "Ocean Plastic Pollution: Action Plan of Fishery Sector" organised by IUCN and Directorate of Fishery of the Ministry of Agriculture and Rural Development in October 2019. They will serve as valuable input to an Action Plan on Plastic Waste Management of Fishery for 2020-2025.

Running such a program requires sustained effort and technical and financial assistance from government agencies, CSOs, and other stakeholders. Plastic waste monitoring, together with other measures and, critically, government leadership will hopefully remove Viet Nam from the top five countries for marine plastic pollution.

Types of waste collected on a beach
Photo: IUCN Viet nam

Volunteers in a coastline waste monitoring program
Photo: IUCN Viet Nam

Hybrid seminar on "Microplastics pollution in Viet Nam: scientific researches support policy interventions in Viet Nam"

For the past few years, some researchers conducted by NGOs, scientists and universities about microplatics have raised concern about its impacts on environment, food chains, human health, wildlife, etc. The scale of studies has been extended not only ocean but also freshwater areas. One Recently one publication was released in November 2020 about "Baseline assessment of microplastic concentrations in marine and freshwater environments of a developing Southeast Asian country, Viet Nam". This study was conducted by a group of scientists and led by Dr. Emilie Strady through COMPOSE project (Creating an observatory for measuring plastic occurrences in society and environment).

Scientists adopted a methodology to implement a microplastic monitoring in sediments and surface waters of 21 environments (rivers, lakes, bays, beaches) of eight cities or provinces in Viet Nam. The results have shown that microplastic concentrations in surface waters varied from 0.35 to 2522 items m-3, with the lowest concentrations recorded in the bays and the highest in the rivers .

Whilst the researches and information about microplastics are limited in Viet Nam, sharing results from these researches with relevant government agencies and other stakeholders will help policy makers to have better understanding and accordingly take measures to dwindle microplastics pollution and better management the use of plastics. As such, IUCN in collaboration with French National Institute of Sustainable Development (IRD) will organize a hybrid seminar on "Microplastics pollution in Viet Nam: scientific researches support policy interventions in Viet Nam" on 5 March 2021 in Ha Noi and online.

This activity will be organized as a part of COMPOSE project with the financial support of French Ministry of Europe and Foreign Affairs and Sida-funded-MARPLASTICCS (Marine plastic and coastal community) projects. Participants from government agencies, research institutes, NGOs, National Plastic Action Network, NGOs and others will be invited to join the seminar for discussion.

The workshop objectives are to: (i) To update information and knowledge about current situation and distribution of microplastics pollution in Viet Nam with relevant stakeholders including Government and CSOs; and (ii) To propose policy recommendations on microplastics management based on the existing researches and case studies.

Specialists investigating microplastics samples in a river Photo: IRD/COMPOSE

Specialists taking microplastic samples on a river | Photo: IRD/COMPOSE

Current conditions of plastic and microplastics waste in Vietnam

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In recent years, along with socio-economic development, urbanization and population growth, the situation of plastic waste generation and disposal of persistent plastic bags have tended to increase through years and are putting pressure on the Vietnamese environment. Most plastic waste has a very small rate of biodegradation, which breaks down into smaller particles and then becomes microplastics - plastic particles that are less than 5 mm in diameter (UNEP, 2016).

1. Sources of plastic waste generation

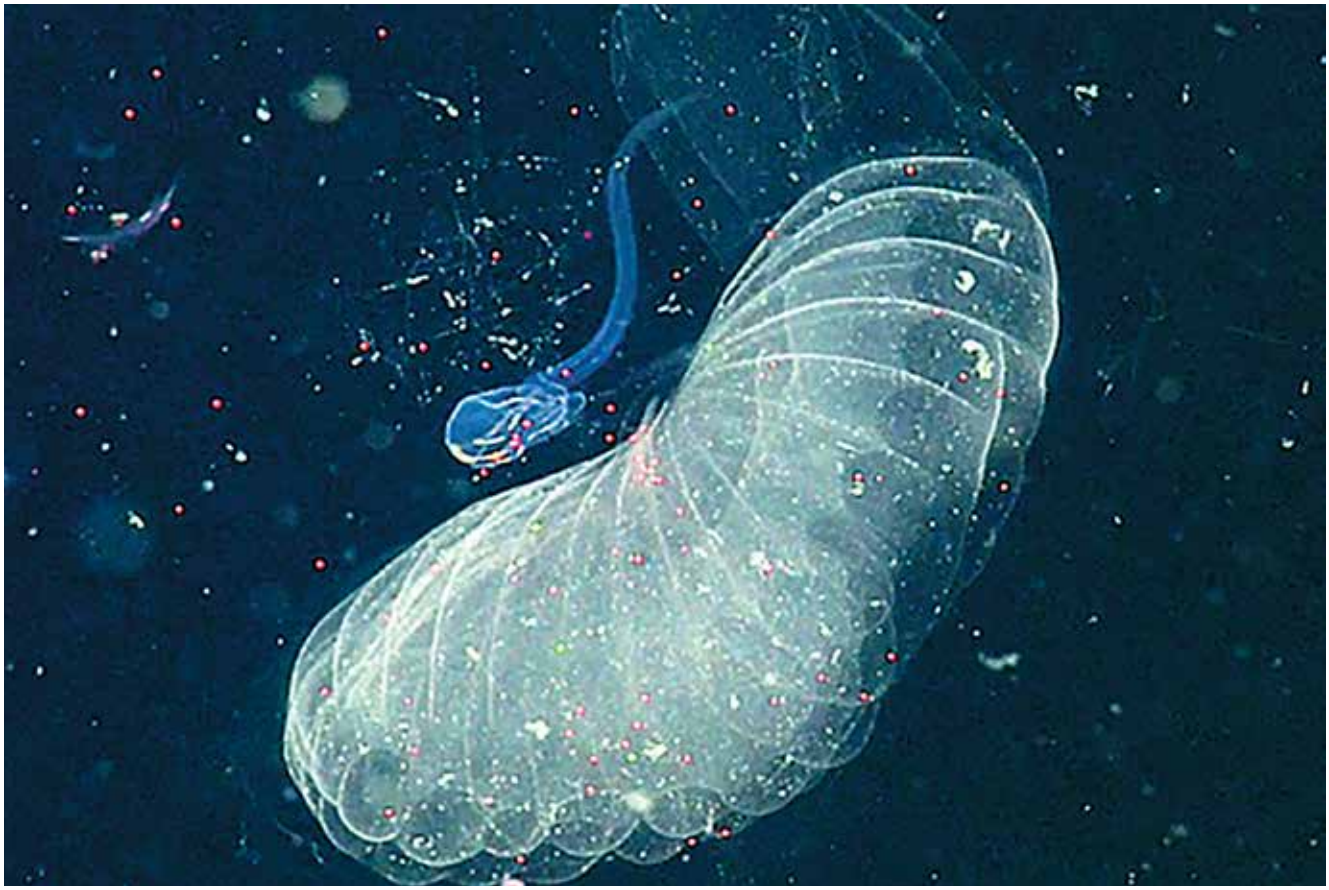
In Vietnam, the main types of plastic waste are plastic bags, plastic bottles, disposable plastic products, hard-to-recover and difficult to recycle plastic products,... arising from (i) Daily activities and consumption; (ii) Socio-economic activities include: Packaging (40% of plastic produced for food packaging, household appliances, industrial products) (Bai, 2018); Agriculture (plastic waste can be generated from cultivation such as plastic used for covering the soil, plastic to wrap fruit such as guava, mango, fertilizer packaging, pesticides (pesticide packages exist in the form of plastic bottles, zinc-coated plastic bags that are difficult to decompose and classified as hazardous waste); Construction (plastic is used extensively as door frames, plastic doors, gates, tables, chairs, cabinets, plastic blankets for covering buildings); Tourism (discharging plastic waste from activities of tourists, boats, tourist establishments); Plastic recycling (plastic loss from the recycling process, eliminating non-recyclable plastic products mixed with recycled plastics) (MONRE, 2020).

According to Bai (2018), industries on the mainland that generate microplastics in Vietnam include: cosmetics and personal care products (4,600-94,500 microplastics are released each time using skin care products); Textile (releasing a large amount of fabric fibers (microplastics)); Land traffic: Microplastics (mainly <80μm) from worn tires; Plastic production and manufacturing (loss due to plastic transportation); Maintenance and demolition of ships (hull and storage cleaning); Wastewater treatment (conventional wastewater treatment facilities cannot retain or dispose microplastics). Meanwhile, the source of microplastics at sea is the accidental loss of goods, the use of personal care products and cosmetics of passengers on cruise ships, etc.

Macroplastics and microplastics generated on land are not collected and properly treated seriously threaten the soil, water and air environment, and enter the flows to cause marine and ocean pollution; along with other types of plastic waste generated from marine activities such as fishing, aquaculture, shipping, industrial activities on the seas, marine tourism, recreational activities at sea. These plastic waste sources not only pollute the marine environment but also seriously affect aquatic flora and fauna, marine animals and human health.

2. The current situation of plastic and microplastic waste

In 2015, Vietnam produced and consumed about 5 million tons of plastic; the majority is imported (about 80%), which includes imported plastic scrap (Vietnam Environment Administration, 2019 (cited from the report of the Plastic Association). In 2017, Vietnam plastic industry consumed about 5.9 million tons of virgin plastic materials (FPTS, 2019). Currently there are about 2,000 plastic enterprises, of which 450 are manufacturing packaging, generating a large amount of daily plastic waste including hard-to-decompose plastic bags (MONRE, 2019a). With the high number of businesses and product types, Vietnam's plastic output in 2008 reached 2.3 million tons, the average growth rate of 15%/year. In 2018, the production output of the plastic industry increased by 7%, reaching 8.3 million tons, of which the production of packaging plastic accounted for the largest proportion in the industry's value structure, reaching about 36%; plastic construction materials, household appliances and other industries such as electronics, electricity, and transportation account for about 16%, 36% and 12% respectively (MONRE, 2019a). The consumption of plastic per capita in Vietnam increased rapidly from 1990-2018 to 3.8 - 41.3 kg/person (MONRE, 2020); this is consistent with the plastic composition of domestic solid waste in Vietnam increasing from 5.5% in 2009 to 13.9% in 2017 (MONRE, 2019b). Although the import of plastic scrap has been gradually controlled, from 2016 to 2018, the amount of imported plastic scrap still increased,



Microplastics founded in sea organisms | Photo: MBARI

in 2016 it was 18,548 tons, in 2017 it was 90,839 tons and in the first nine months of 2018, it was 175,000 tons (MONRE, 2020).

In Vietnam, similar to other countries, nearly 50% of plastic products are designed, manufactured for one-time use and then disposed of. Of the total amount of plastic waste disposed of, only a small proportion is recovered or recycled, the rest is treated by incineration or landfilling (MONRE, 2019a).

Photo: vpas.vn

The amount of plastic waste and plastic bags of the whole country accounts for about 10-12% of domestic solid waste, estimated at 2.6-2.8 million tons of plastic waste generated in 2019, a large amount floating on rivers, lakes, estuarine and coastal wetlands (Government, 2019). A statistic shows that, on average, each Vietnamese household uses about 10 plastic bags every day, on average, each household uses about 1 kg of plastic bag per month (MONRE, 2020). The increasing number of plastic packaging and plastic bags used has become a burden on the environment, seriously threatening the soil, water, air and ocean environment, even leading to the white pollution catastrophe. In urban areas of Vietnam, the total volume of used plastic bags is 10.48-52.4 tons/day; only about 17% of these bags are reused (MONRE, 2020). Between 2,000 and 13,000 tons of floating plastic debris are collected annually on the main urban canals (Kieu-Le et al., 2016).

The sorting and collection of plastic waste and recyclable plastic bags are often spontaneous at the household scale, garbage collectors and free scavengers; plastic waste which has no value or has low recyclable value (eg. foam boxes, plastic straws and especially thin plastic bags) is discharged directly into the environment or disposed of in landfills and incinerators. Landfill plastic waste accounts for a large proportion, as the average proportion of packaging waste and plastic bags at domestic solid waste landfills accounts for 6-8% (MONRE, 2019a). In landfills in some major cities (Hanoi, Hue, Ho Chi Minh City and Bac Ninh), the proportion of plastic waste ranges from 12% to 16%, ranking second after organic waste (MONRE Newspaper, 2020). As for plastic waste and plastic bags from industrial activities, most of them are classified and recovered by production establishments for production rotation or sold to other units for recycling.

According to estimates by Jambeck et al. (2015), based on the amount of unmanaged plastic waste generated from residential areas of 50km along the coast, Vietnam is the 4th out of 192 countries studied for marine plastic waste, which unmanaged plastic waste amounts to 1.83 million tons per year, corresponding to 0.28-0.73 million tons of plastic discharged into the seas and 6% of the total amount of plastic discharged into the seas worldwide. In Vietnam, 80% of plastic waste come from the mainland, that is, from production and human activities, the remaining 20% come from fishing, aquaculture, and ships, etc. This type of waste accounts for 50-80% of the amount of marine waste and will increase in the near future (MONRE, 2020).

Regarding the situation of microplastics pollution, Vietnam has no official statistics, however, recently there have been some studies to determine the distribution and content of microplastics in sediment samples and water environment. On the Saigon River, the density of filamentous microplastics at each point ranged from 172,000 MPs/m3 to 519,000 MPs/m3 and the density of microplastics at each point varied from 10 MPs/m3 to 223 MPs/m3 (Lisa Lahens et al., 2018). Microplastics were also found in all three waters of Tien Giang, Can Gio and Ba Ria - Vung Tau with densities ranging from 0.04 to 0.82

particles/m3 of seawater, the lowest in Can Gio and the highest in Tien Giang. The common feature of microplastics in these three seas is thin and fibrous, with sizes concentrated in the range 0.25-0.5mm and 1-2.8mm, and with a variety of colors (Nguyen Thao Nguyen, 2019).

Up to now, there is no overall assessment of the source of arising (from cleaning products, cosmetics, laundry activities, textiles, transportation ...) and the situation of microplastics in the environment (soil, water, air) in Vietnam. Microplastics can penetrate and destroy cells in the body of organisms in fresh water and in the marine environment; they can act as intermediaries for the accumulation of dangerous chemicals, when ingested by animals, they will be poisoned, and this toxin is transferred to humans when humans eat these animals (MONRE, 2020).

Thus, at present, the risk of environmental pollution caused by plastic waste in Vietnam tends to increase. If not properly controlled, plastic waste will threaten the lives of aquatic plants and animals, marine animals, pollute the environment, greatly impact socio-economic development such as tourism and transportation, agriculture,... Therefore, Vietnam needs to come up with effective solutions to better manage this type of waste.

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Innitital finding on distribution and characteristics of microplastics on the surface sediment in the Ba Lat River Mouth, Northern Vietnam

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Microplastics (MPs) are newly identified form of pollutant in the environment. These types of pollutant are receiving a lot of attention from researchers all around the world. Knowledge on MPs pollution in Vietnam is still almost unknown. In this study, suspended MPs were characterized quantitatively and qualitatively in the surface sediment in the Balat River Mouth (Red River Mouth), Northern Vietnam. MPs were extracted by a floatation method then they were counted and categorized according to shape and size under a stereomicroscope. MPs' components were determined using Fourier Transform Infrared Spectroscopy (FT-IR). Plastic abundances varied significantly in the Mouth, with densities from 70 items to 2830 items per kilograms of dry sediment surface. Plastic particles (300 - 5000 µm) constituted more than 88% by number of items. Fibers being the dominant shape in all samples, followed by films and granules. The MPs were mainly in transparent, red and blue colors. Polyethylene (PE), polyamide (PA) and polypropylene (PP) were the three main polymer types found in the Balat River Mouth sediments. This study provides initial clues in understanding the characteristics and potential sources of MPs in the environment.

Key words: Microplastics (MPs), sediment, Balat River Mouth, Northern Vietnam.

1. Introduction

In the last few decade, microplastics (MPs) became a ubiquitous pollutant in the soils and waters, result in a serious potential threat to ecology. The first recordings of MPs in surface water date back to the 1970s in North America as spherules in plankton tows along the coast of New England (Carpenter et al., 1972). However, evaluations of MPs in environments weren't reported until the beginning of this century (Thompson et al., 2004). Since then, MPs have been found in most large bodies of water (oceans, seas, lakes, and rivers) and sediments (Thompson et al., 2004; Arthur et al., 2009; Lusher et al., 2013; Mohamed Nor and Obbard 2014; Zhao et al., 2014; Tender et al., 2015; Baldwin et al., 2016; Gewert et al.,

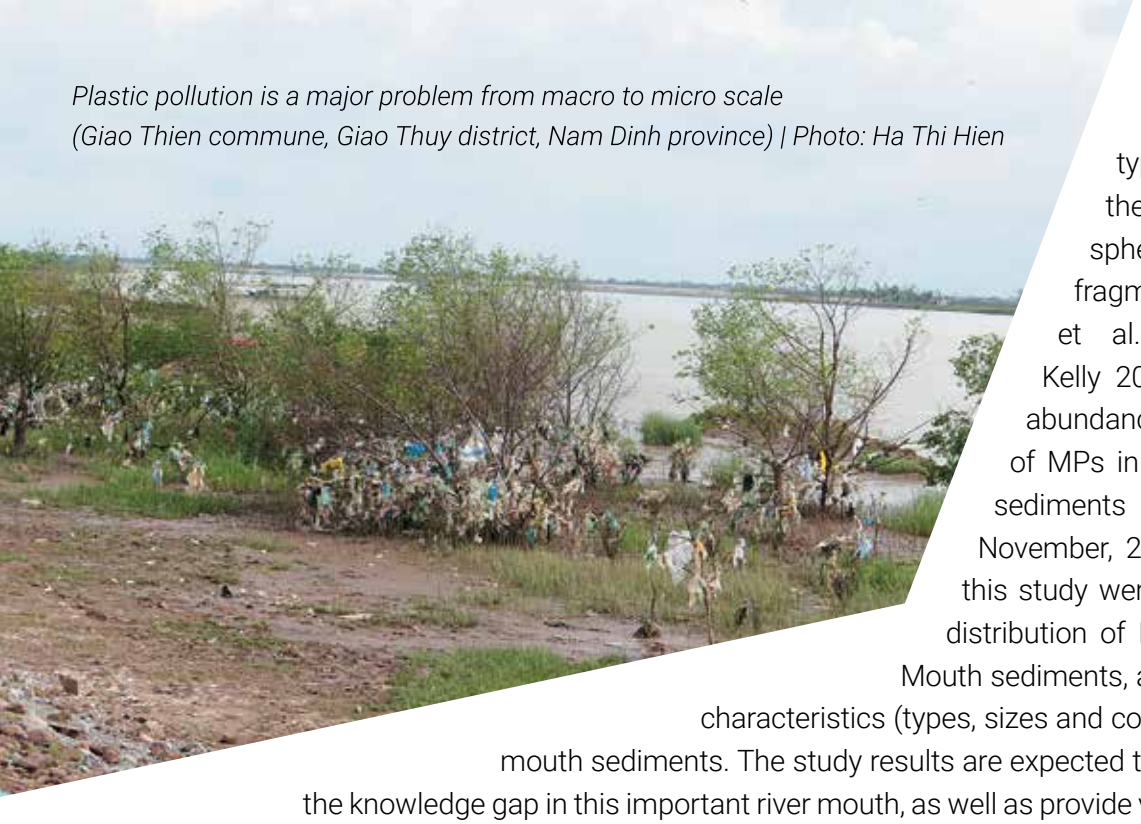
Cửa Ba Lạt, nơi sông Hồng hòa vào biển | Ảnh: An ninh thủ đô

2017; Dobaradaran et al., 2018; Karkanorachaki et al., 2018; Acosta-coley et al., 2019; Galafassi et al., 2019; He et al., 2020). In recent years, the global production of plastic is approximate 300 MMT (million metric tons) per year. And the use of plastic products will certainly continue to increase in the future. Most of the common plastics resin production ends up routinely in litter as well as in municipal solid waste. The other parts of plastic litters are the more likely locations near coastal and river mouth.

Microplastics are plastic particles which are smaller than 5.0 mm in size (Arthur et al., 2009). MPs are very common, man-made particles distributed in the environment. There are two main ways microplastics formed and enter environment: primary and secondary microplastics (Arthur et al., 2009). Primary MPs are intentionally produced at a microscopic scale through the process of extrusion or grinding, either as precursors to other products or ingredient of products which enter the environment directly through any of different channels-for example, using product (e.g., personal care products being washed into domestic wastewater systems), unintentional loss from transport, or spills during manufacturing, or abrasion during washing (e.g., laundering of clothing made with synthetic textiles) (Arthur et al., 2009). Secondary microplastic introductions occur when larger plastic items breaking down undergo weathering, wave action, wind abrasion, photo or biological degradation (Thompson et al., 2004). Through degradation process, the larger pieces be broken into smaller plastic fragments which eventually become undetectable by eyes. Plastics with a low-density particles tend to float on the sea surface (PP, PE with d = 0.91 to 0.97 g/cm3) while those with a density that exceeds that of seawater (1.02 g/cm3) will sink and accumulate in the sediments (polystyrene - PS, polyacrylic - PA, polyvinylchloride - PVC with d = 1.05, 1.17 and 1.40 g/cm3, respectively) (Arthur et al., 2009). However, through density modification, even low-density plastics can travel throughout soils, airs to rivers then to the seas. As a result, coastal zones and river mouths are one of the most impacted areas. They are subjected to tourism, harbors, desalination plants, marine traffic, fish farms, and especially population pressure.

The presence of large amounts of MPs in freshwater and marine ecosystems have negative impacts on aquatic health. Microplastics can be digested by low trophic fauna due to their very small size, with uncertain consequences for the health of the organism. For example, the ingestion of polystyrene beads (~100 nm) by suspension-feeding bivalve mollusks significantly increased when they were incorporated aggregates in natural seawater. The forming of aggregates is an important process for energy transfer between pelagic and benthic habitats, once they were sinking on the sediment layers (Ward and Kach, 2009). Sediment-dwelling organisms, such as the lugworm, are capable of bioturbation. Thus, MPs which have settled on the benthos could be drawn into the sediment, where they would be available to in fauna.

In ecosystems, MPs can enter the soil environment either directly from biosolids application, irrigation water, atmospheric deposition, or indirectly through the in situ degradation of large pieces of plastic. In recent decades, many types of soils were contaminated with large amounts of plastic residue. The most prominent



Plastic pollution is a major problem from macro to micro scale (Giao Thien commune, Giao Thuy district, Nam Dinh province) | Photo: Ha Thi Hien

types of MPs identified in the environment include spheres, pellets, irregular fragments and fibers (Wright et al., 2013; Wright and Kelly 2017). In this study, the abundance and characteristics of MPs in the Balat River Mouth sediments were investigated in November, 2018. The objectives of this study were to: (1) determine the distribution of MPs in the Balat River Mouth sediments, and (2) characterize the characteristics (types, sizes and colors) of MPs in the river mouth sediments. The study results are expected to contribute to bridging the knowledge gap in this important river mouth, as well as provide valuable information for estimating and monitoring microplastics presence in a tidal river system.

2. Results

The MPs were determined by floatation method. Due to difficulties in separating and quantifying MP particles from sediment, our research focus on their abundances, types and components of MPs in sediment surface. The initial information is critical for evaluating the risk of soil borne microplastic pollution in the Balat River Mouth, Northern Vietnam.

2.1. Microplastic abundances

Microplastics were found in every replicate sediment samples at two locations: bare sediment (nearby the mangroves) and in mangroves. At each location, three samples were collected and analyzed to determine the MPs' concentration. The research found the number of MPs in bare sediments range from 70 to 2830 items kg-1 dry weight, while in mangrove it ranges from 120 to 1240 items kg-1 dry weight (Table 1). In summary, the MPs in bare sediments were higher than in mangroves, with the mean values were 856.9 ± 682.0 and 646.2 ± 348.4 items kg-1 dry weight, respectively. The significant differences ($P < 0.05$) were found between the two locations.

Table 1. The average number of MPs (items kg-1 dry weight) in the two locations.

Location		Fibers	Films	Granules	Total
Bare sediments	Average	786.9	26.3	43.8	856.9
	Stdev	796.5	39.9	96.3	
Mangroves	Average	582.9	43.8	19.5	646.2
		415.2	62.7	53.4	

2.2. Microplastic types, colors and sizes

The result showed the most frequent geometries of MPs were fibers, followed by films and granules (Figure 1). The proportion of fibers measured in this study (91%) was in line with those published in Saigon River (92%; Lahens et al. 2018). This ratio also confirmed that the synthetic fibers production was dominated as the possible sources of anthropogenic fibers come from the textile and apparel industry in the Red River Delta.

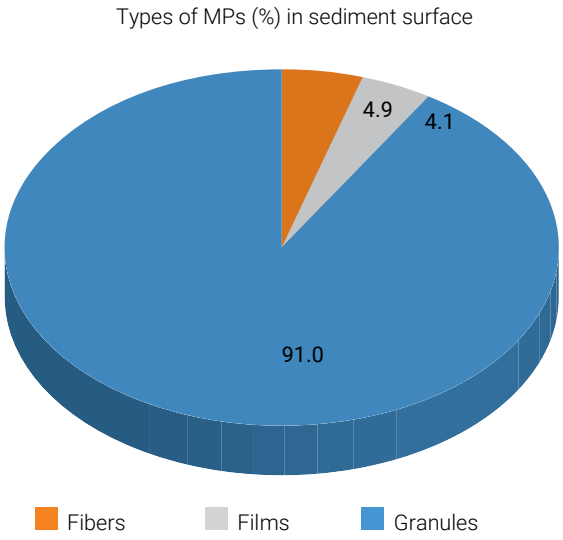


Figure 1. Types of microplastics (in percentage) in sediment surface in the Balat River Mouth.

The larger plastic particles (300 - 5000 µm) constituted more than 88% by number of items. The MPs were mainly in transparent, red and blue colors with fiber being the dominant shape in all samples. Transparent and dark blue colored plastics comprised the majority of the particles. The variation of sizes (~ 300 to 5000 µm) and shapes mean that MPs were degraded by UV and mechanical erosion on the surface of sediments after floating on water, and then being transported by waves and currents, until they settle in the sediment surface (Figure 2). However, due to the variable of environmental factors, the shape, color and size can be widely different from case to case as reported in research literatures (Horton et al., 2017; Sathish et al., 2019; He et al., 2020).

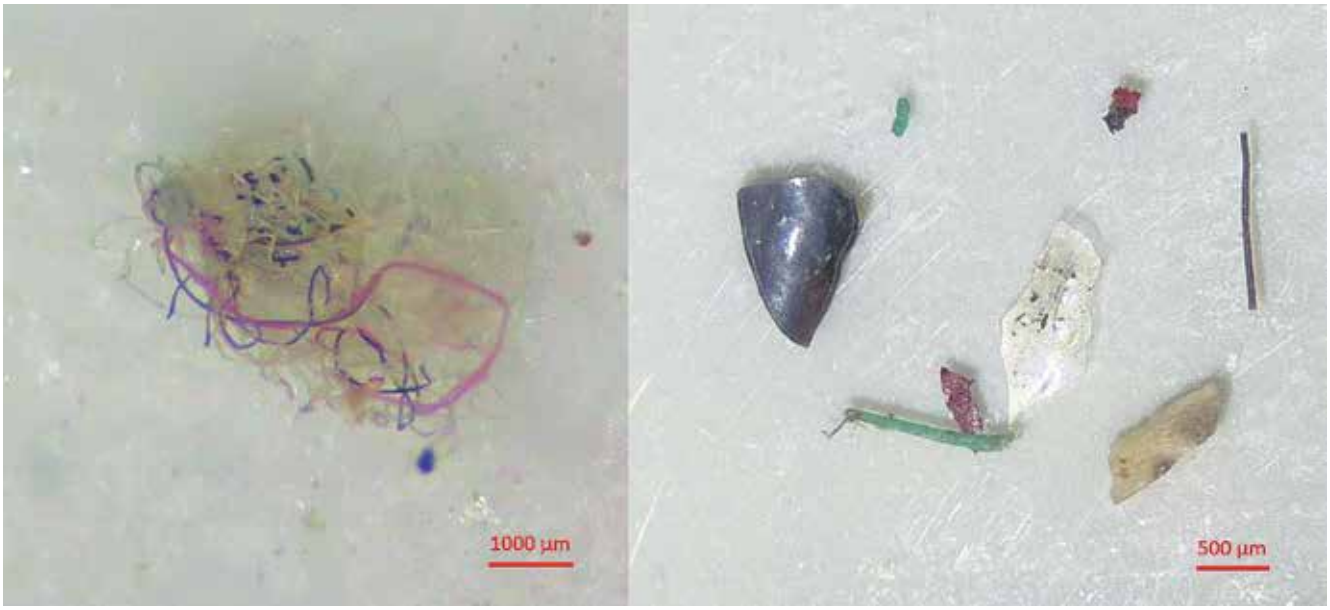


Figure 2. The types (fibers, films and granules), colors (transparent, red and blue/dark blue), sizes and abundance of microplastics (detected particles from 53 µm sieve) in the sediment samples of the Balat River Mouth.

Oceans are polluted by microplastics | Photo: Kinh te Moi truong

Photo: Dantri

2.3. Microplatic components

The FTIR analysis confirmed most items are PE (polyethylene) and some PP (polypropylene), polyamide (PA) and polystyrene (PS). This is in accordance with its global production, being the most common and cheaper plastic polymers produced. PE and PP have been reported in many literatures as the two most common polymer types with widespread distribution in freshwater, estuarine and marine environments, based on their quantities (Cole et al., 2011; Nor and Obbard 2014; Andrady 2017; Horton et al., 2017; Sathish et al., 2019; He et al., 2020). With low density, PE, PS and PP (from 0.91 to 0.97 g/cm3) can float on the water surface of the rivers and oceans, then those particles deposited on sediments and beaches. The finding in this study is coinciding with Nor and Obbard (2014) and Lahens et al. (2018). This study initial reveals the abundance, component distribution and characteristics of microplastic pollutants in the Balat River Mouth sediments, and provides basic data for further research on microplastics in estuarine environments worldwide.

Conclusions

The study results provide the initial clues in understanding the abundances, types and characteristics of MPs in the sediment surface at the Balat River Mouth, Northern Vietnam. The further study and analysis in MPs are needed with a special focus on particle components in living creatures at nanoscale.

Acknowledgments

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Aquaculture in Xuan Thuy National Park | Photo: VQG Xuan Thuy

Micro-plastics leading to macro-problems (tiny seedling is threaten by several plastics)
Photo: Nguyen Thi Kim Cuc, Nam Phu Commune, Tien Hai District, Thai Binh Province

Those tiny little plastic pieces in coastal area are more harmful than you can imagine
Photo: Nguyen Thi Kim Cuc, Bach Long Commune, Giao Thuy District, Nam Dinh Province.

Plastic pollution is a major problem from the macro to micro scale | Photo: Ha Thi Hien - Giao Thien Commune, Giao Thuy District, Nam Dinh Province.

The ubiquitous presence of microplastic in Vietnamese aquatic environments

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Plastic pollution of aquatic environments is a major scientific and societal issue. The diversity of plastic polymers and sizes used in the market and found in the environment makes this issue complex to study and to remediate. While the enhanced use of single-use degradable material associated to plastic use reduction campaigns can limit the emission of plastic towards the waterways, how to tackle the less visible pollution, the one referring to the microplastics?

Microplastics are ranging from 1 to 5,000 µm long. They are polluting the terrestrial and aquatic environments worldwide and are becoming a threat to the health of ecosystems, biota and humans (Rochman et al., 2013). Their exposure may occur by ingestion, inhalation and dermal contact due to the presence of microplastics in products, foodstuff and air, and may cause particle toxicity, with oxidative stress and inflammatory lesions (Prata et al., 2020).

Microplastics originate from manufactured pellets and microbeads and from fragmentation processes of plastic litter, enhanced by UV radiation and turbulence, and from degradation of textile and garment, enhanced by wear and tear and washing. Microplastics are thus released to the aquatic environment through different sources: from wastewater effluents of domestic or of industrial origins, from tyre particles, from agricultural plastic and from leakage during plastic waste management. Wastewater treatment plants play a role in the removal of microplastics in wastewaters but the efficiency of the removal depends strongly on the technologies used (Bui et al., 2020).

The assessment of microplastics in the aquatic environment is quite recent, especially in freshwaters and estuaries, and is increasing worldwide, but some areas remain under-evaluated, especially the environments from or crossing the developing countries. Viet Nam is now an exception. Recently, a network of Vietnamese researchers conducted a baseline assessment of microplastic concentrations in marine and freshwater environments of Viet Nam (Strady et al., 2020a). This national assessment was performed under the COMPOSE project, funded by the French Ministry of Europe and Foreign Affairs and implemented by the French Embassy in Viet Nam and the French Research Institute for Sustainable Development. The project aimed to conduct the assessment using a common and adapted

methodology, from sampling to laboratory analysis. Current research and worldwide group of experts have indeed evidenced the influence of the equipment and protocols used on the measured concentrations, and have recommended to homogenize the methodology. Therefore, a common methodology adapted to local facilities, human resources and technical challenges for assessing microplastics in the aquatic environments have been developed based on our past experience in the Saigon River (Lahens et al., 2018; Strady et al., 2020b). The methodology was implemented by training local researchers and technicians from various institutions of our research network, by providing the basic tool and equipment, and was recently published (Strady et al., 2020a).

Under this COMPOSE framework, 21 specific aquatic environments were studied in nine cities and provinces of Viet Nam, representing 19 surface waters and 2 beach sediments (Figure 1). In Northern Viet Nam, we focused on the Red River Delta system, from Ha Noi, to the coastal zone of Quang Ninh province. Three riverine sites and three urban lakes were selected in Ha Noi: the Red River close to Ha Noi, the To Lich River, the Nhue River, the Ho Tay lake, the Yen So Lake and the Bay Mau Lake. In Hai Phong and Quang Ninh, three coastal sites were selected: the Do Son Bay; Cua Luc Bay and the Ha Long Bay. In Central Viet Nam, two urban lakes and one river were selected in Da Nang City: the Cong Vien Lake, the Hoa Phu Lake, the Han River. In the South Central coastal region, of Binh Dinh province two sites in the Thi Nai lagoon and one in Quy Nhon Bay were selected. In Southern Viet Nam, six sites were selected: the Tri An Reservoir, the Dong Nai River, the Dau Tieng Reservoir and the Dinh River estuary and two sandy beaches, the Sau Beach and the Dau Beach in Ba Ria – Vung Tau province.

Microplastic concentrations in surface waters varied from 0.35 to 2,522 items m- 3 showing a wide range of variation up to four orders of magnitude among the different environments (Figure 2). Microplastic concentrations in sediments were in the same range, 1,542 items m-3 in Sau Beach and 2,024 items m-3 in Dau Beach. Globally, lower range of microplastic

Researchers are investigating microplastics on a river | Photo: IRD/COMPOSE

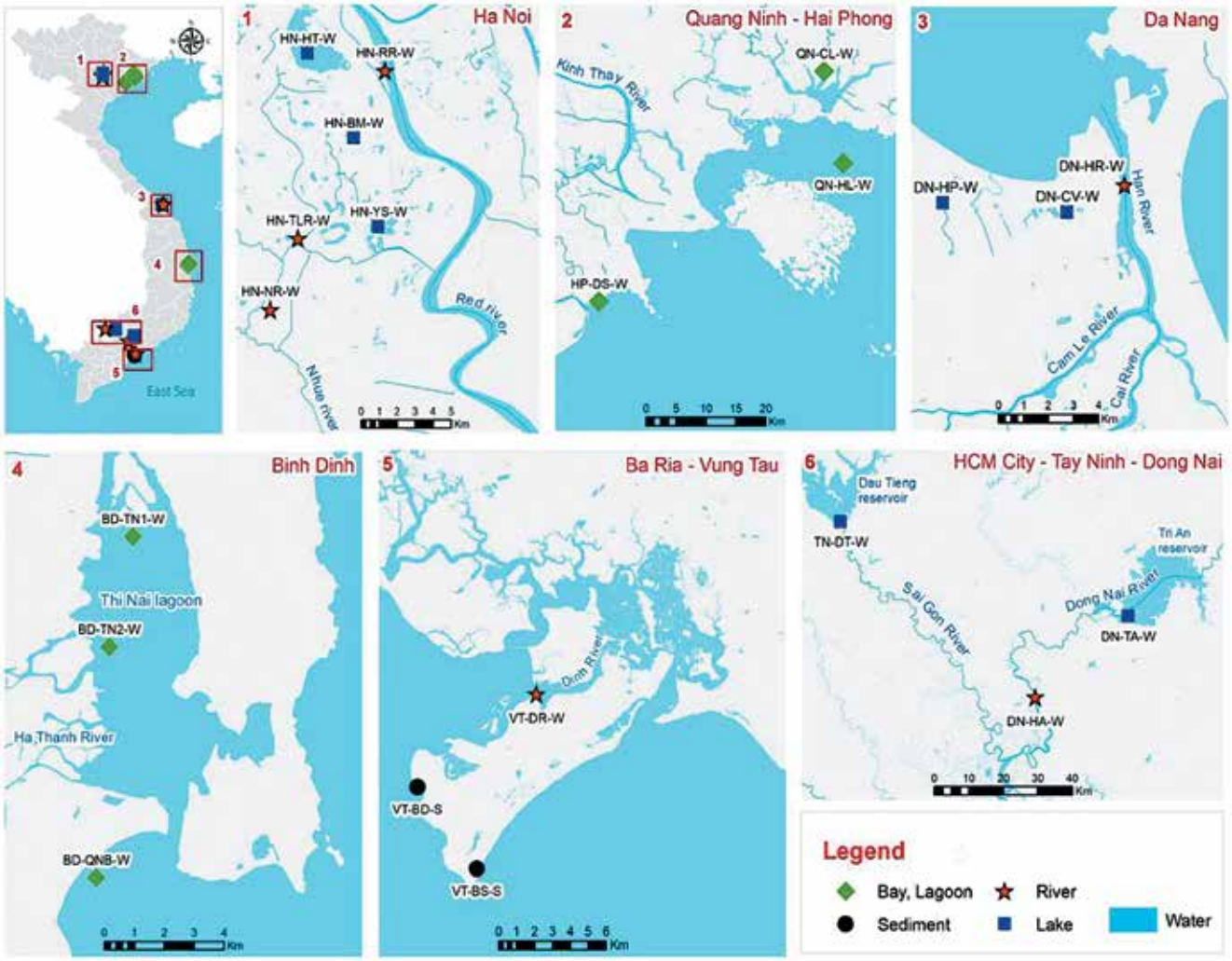

Figure 1: sampling sites undertaken under the COMPOSE monitoring network (adapted from Strady et al., 2020a)

concentrations was observed in bays while higher range of concentrations was recorded in rivers showing that those surface freshwater environments tend to be more polluted by microplastic than the surface marine environments. More specifically, in rivers, microplastics exhibited a wide variation of concentrations from 2.3 items m-3 in the Red River to 2,522 items m-3 in the To Lich River with lower concentrations in main rivers and higher ones in smaller and urban rivers, specifically receiving untreated wastewaters. The microplastic concentrations measured were all lower than the ones previously measured in the Sai Gon River and its urban canals, rising up to 251,000 anthropogenic fibers m-3 for a limit of observation of 40-5,000µm (Strady et al., 2020b). The Sai Gon River is largely impacted by textile and garment industry, the plastic fragments representing less than 1% of the plastic particles identified (Lahens et al., 2018). In lake and reservoir environments, the microplastic concentrations varied from 1.5 items m-3 in Tri An Reservoir to 611 items m-3 in Ho Tay Lake. The lowest concentrations were observed in the two sampled reservoirs and the highest ones in urbans lakes, without any size effect of lakes observed. In bays, microplastic concentrations varied from 0.4 items m-3 in Cua Luc bay to 28.4 items m-3 in the Dinh River estuary mouth. We note that compared to environments from countries listed as emitting the most plastic to the ocean (Jambeck et al., 2015), the level of microplastic concentrations measured in Viet Nam are in the low range of the ones measured in China, Philippines and Indonesia (Cordova et al., 2019; Esquinas et al., 2020; Zhang et al., 2018).

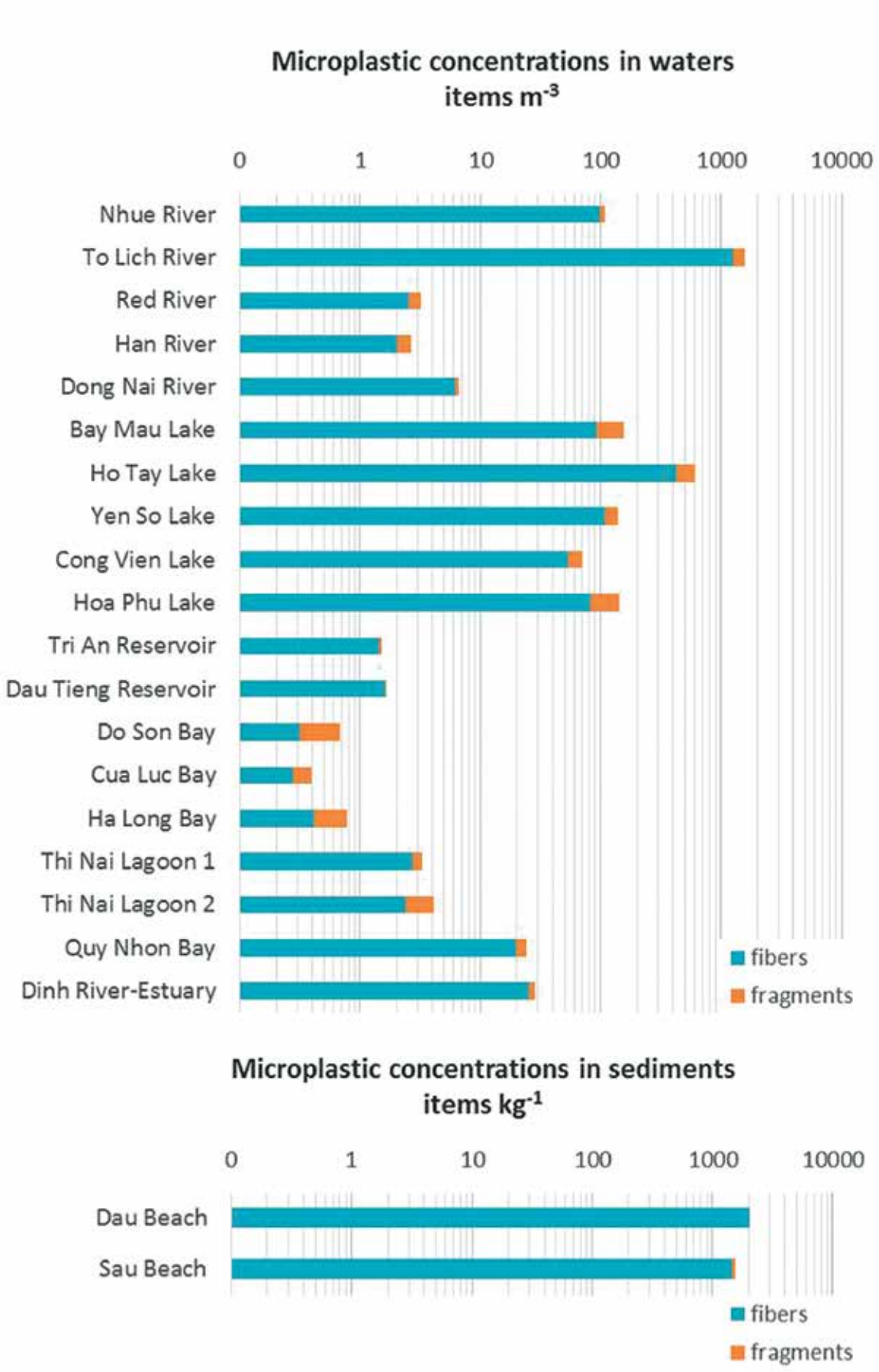

Figure 2: Concentrations of microplastics, fibers and fragments in surface waters and sediments (adapted from Strady et al., 2020a)

This first baseline study evidenced thus that the levels of microplastic concentrations fluctuated spatially and within a type of environment. Therefore, a long term approach with pluri-annual measurements under a monitoring program is needed to address the temporal variability of the microplastic concentrations in each environment. The COMPOSE project is funding a quarterly sampling until beginning of 2021, and as tackling microplastic pollution is an environmental priority, as long as marine debris pollution, the monitoring assessment need to be continued and extended in the future. In a policy context, especially under the decision 1746/QĐ-TTg (2019) promulgating the national action plan for marine plastic waste management to 2030, the baseline study presented provides an adapted methodology to assess microplastic pollution and particularly to monitor the effectiveness of actions of remediation that will be set up in the future by local authorities to reduce microplastic pollution from sources to sea. The extend of microplastic pollution is related to the sources of microplastic to the environment, including the surrounding anthropogenic activities using plastic (fisheries, aquaculture, households, landfills) and the direct release of wastewaters, treated or untreated. Therefore we recommend to identify specifically the sources of microplastic to each environment. Measuring directly the microplastic concentrations in the wastewater effluents, treated or untreated, can be an example of the first step to implement remediation processes at those sources, to limit the microplastic emissions to rivers and lakes, and then towards the sea.

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Microplastic pollution in aquatic organisms in Vietnam

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Since the first commercial production in the 1950s, plastic production has been exponentially increased with the global production in 2018 reaching 359 million tonnes (Plastic Europe, 2019). Due to mass production and utilization of plastics coupled with solid waste mismanagement, plastic debris was found ubiquitous in the aquatic environments and has become a world wide's emerging environmental issue (Barnes et al., 2009). Microplastics, the so-called "invisible plastics" – plastic items in the size range of 1 µm – 5 mm, are threats to the global environment (Sussarellu et al., 2016).

Microplastics are recorded in surface water of world's oceans, rivers, lakes, reservoirs and in sediments. They can be microbeads added in personal care products or pellets used as input materials in plastic industry. They can also originate from the fragmentation of bigger plastics due to weathering agents such as ultra violet radiation, mechanical abrasion and biological degradation and from wear and tear of textile's forming then plastic microfibers. Wastewaters, especially untreated ones, were identified as an important carrier of microplastics to the aquatic environment (Bui et al., 2020).

Aquatic organisms such as shrimps, fish, clams, mussels and oysters may mistake microplastics for foods and ingest them. Microplastics were found in different organisms' different organs in which digestive tract and gills contained most of the microplastics (Su et al., 2018). The accumulation of microplastics may pose serious threats to the animals due to the microplastics themselves such as reduced food intake, oxidative stress or damage of gastrointestinal tract and due to the additives added during the plastic production or the toxic substances such as persistent organic pollutants and heavy metals absorbed on microplastics' surface (Sequeira et al., 2020). This may lead to the transfer of microplastics and other pollutants in the upper trophic levels and even humans' body through the food web.

Due to plastic waste mismanagement and few public awareness regarding plastic pollution, Vietnam was ranked 4th in the top countries emitting the most plastic waste to the world's oceans (Jambeck et al., 2015). Microplastic abundance in aquatic

environments of Viet Nam are getting monitored (Strady et al., 2021) but so far microplastic contamination in aquatic organisms is partly understood in Viet Nam. Thus, this paper aims to synthesize the data on microplastic concentration in aquatic organisms of Viet Nam and to provide recommendations on future scientific research and policy making relating to microplastic contamination issue.

In Viet Nam, studies of microplastic contamination were conducted in Asian green mussels from a brackish water zone in Thanh Hoa province and wild species of fishes and shrimps from the Long Tau river – downstream zone of the Saigon – Dong Nai River (Phuong et al., 2019; Kieu Le et al., 2021). Microplastics abundance in Asian green mussels (*Perna viridis,* **Figure 1a**) was of 0.29 (±0.14) items per gram of wet weight in soft tissues and 2.60 (±1.14) items per individual (**Figure 2**). The predominant type of microplastics were Polypropylene (PP) originating from household materials with short lifetime such as packaging bags and Polyester originating from synthetic textile (Phuong et al., 2019). In wild shrimps and fish *(Metapenaeus ensis, Metapenaeus brevicornis, Cynoglossus puncticeps, Scianidae, Polynemus melanochir, Pseudapocryptes elongatus, Clupeoides borneensis* and *Glossogobius sp.,* Figures 1b – i), microplastics were found in all tested species with 99% of the microplastic being in the shape of fibers. In more detail, the average microplastic fiber concentration varied from 0.33 to 1.41 fibers per gram wet weight of organisms with the lowest and highest concentrations found in *Pseudapocryptes elongatus* and *Metapenaeus brevicornis,* respectively (**Figure 2**). Concentrations of fibers varied from 1.33 to 9.33 fibers per individual with the lowest and highest concentrations found in ***Polynemus melanochir*** and ***Clupeoides borneensis,*** respectively (Kieu Le et al., 2021).

a) Perna viridis | *b) Metapenaeus Ensis* | *c) Metapenaeus Brevicornis*

d) Cynoglossus Punchticeps | *e) Scianidae* | *f) Polynemus Melanochir*

g) Pseudapocryptes Elongatus | *h) Clupeoides Borneensis* | *i) Glossogobius Sp.*

Figure 1. Aquatic organisms collected for assessment of microplastic pollution in Vietnam (adapted from Phuong et al., 2019 and Kieu Le et al., 2021)

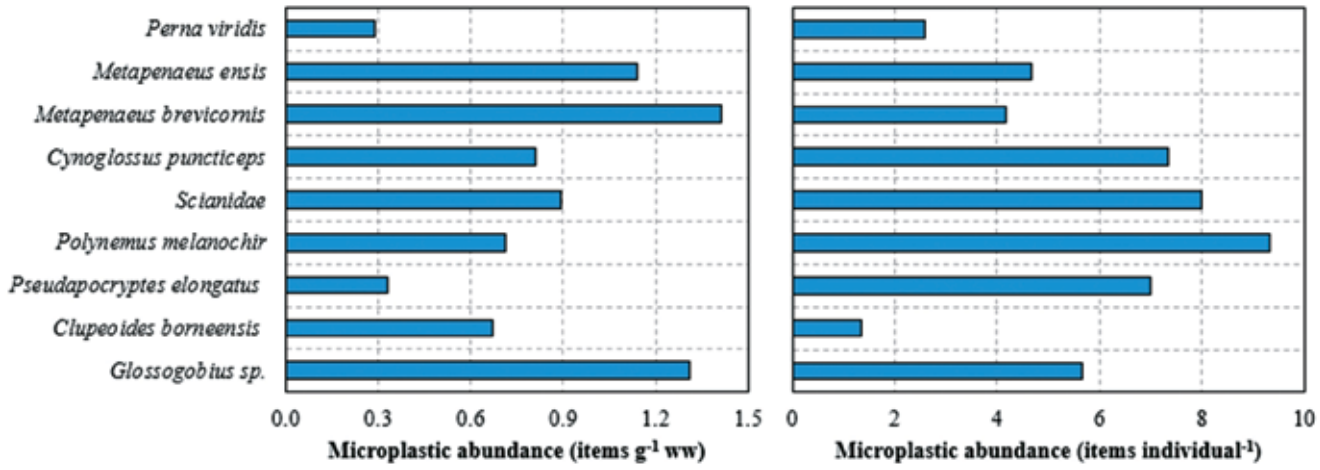
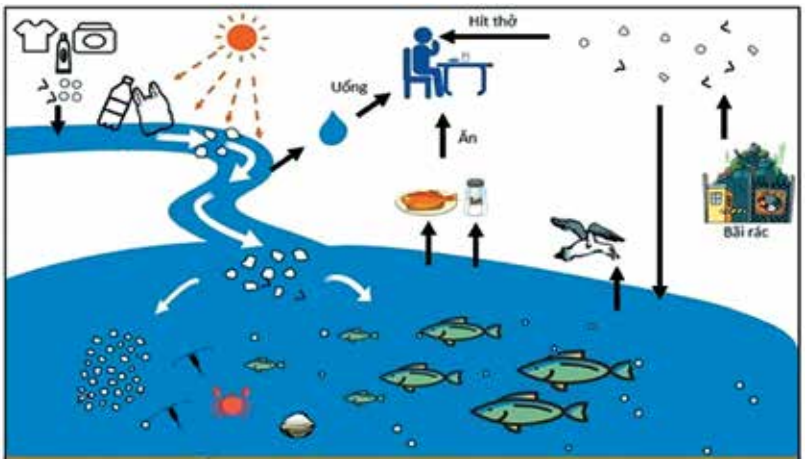


Figure 2. Average microplastic concentration expressed in items g-1 wet weight and items individual-1 for the aquatic organisms in Vietnam. For Perna viridis, "items" included both fragments and fibers while for other shrimps and fish, "items" implied fibers only (adapted from Phuong et al., 2019 and Kieu Le et al., 2021)

Those results in Vietnam showed high level of microplastic contamination compared to microplastic levels measured in bivalves in Europe (Phuong et al., 2018), fishes from Mediterranean Sea (Tsangaris et al., 2020) or wild fishes from the Pearl River Estuary, China (Lin et al., 2020). In addition, the impact of local activities such as high population density, industrial activities and wastewater treatment conditions, was also presented in terms of the predominance of fibers compared to fragments. Importantly, the species studied in Vietnam are all consumed entirely by humans, without removing the gastrointestinal tract. Therefore, all the microplastics measured, whatever the targeted organs where they were found, are directly transferred to humans by ingestion leading to potential risks to human health.

With these initial data, more studies are needed to elucidate the accumulation and excretion of microplastics in more aquatic species in Vietnam. Aquaculture was recently pointed out to emit fragments from degradation of plastic equipment used especially gears, leading to high microplastic exposure to cultivated organisms (Wu et al., 2020). Therefore, for contributing to the nation's food safety and public health, a national monitor program on microplastic contamination in aquacultural organisms is needed to give scientific glues for promulgation and implementation of policies on reducing plastic utilization in aquacultural activities and raising the awareness of plastic pollution.



We are likely eating and breathing microplastics due to pollution
Picture: Suc khoe va Doi song online

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Review policy and legal framework on plastic waste and microplastics waste management in Vietnam - Some experience lessons about microplastics management in the world

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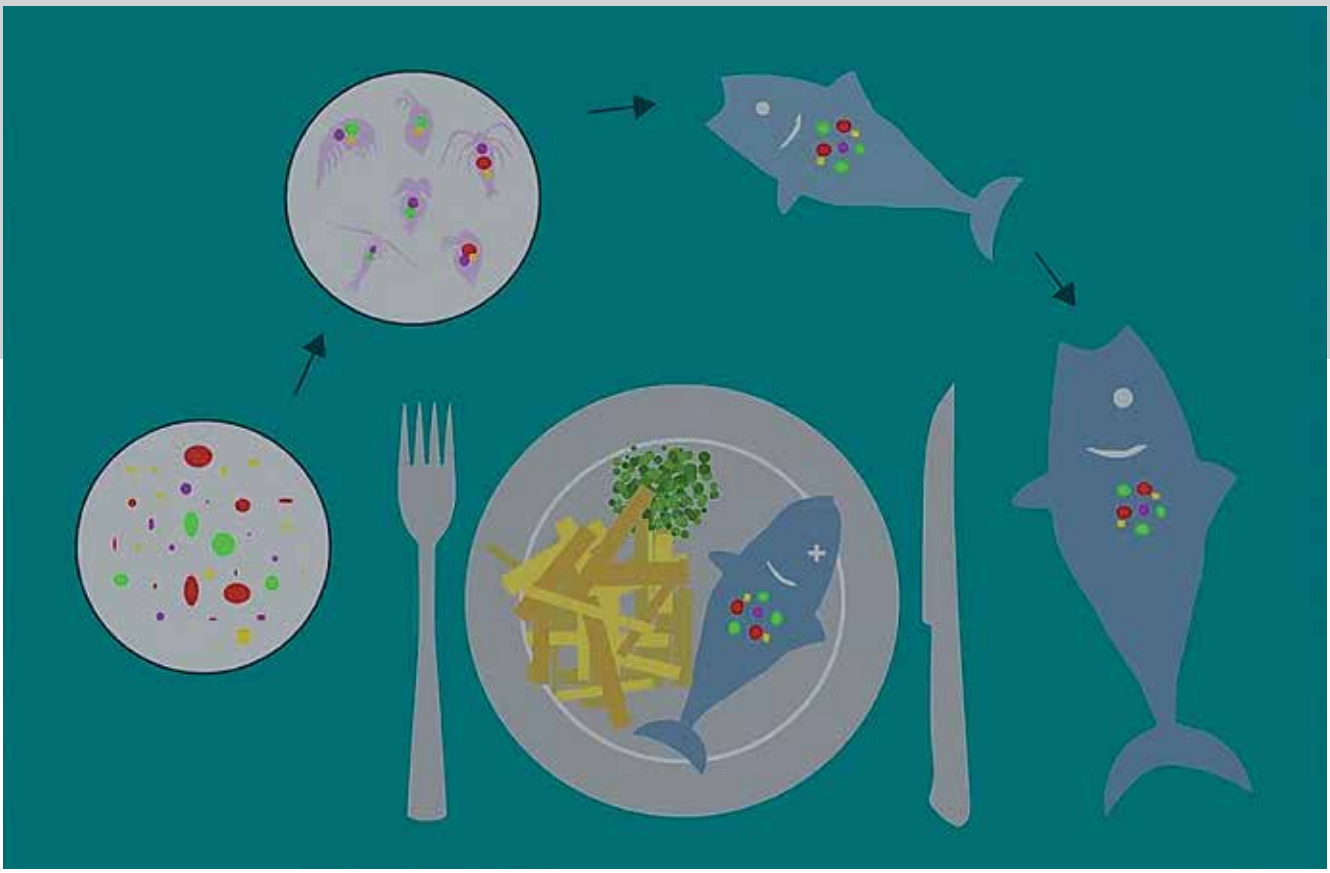
1. Policy framework on plastic waste and microplastic waste management in Vietnam

Recognizing its role in addressing the global plastic waste crisis, Vietnam, a responsible member of the United Nations, has committed to strong action to reduce plastic waste to protect the marine environment and ocean ecology. In 2017, Vietnam officially joined the list of 127 countries that passed the UN Environment Council Resolution of the United Nations Environment Program on marine plastic and microplastics waste. The Prime Minister signed the Prime Minister's Decision No.1746/QD-TTg dated December 4, 2019 on the National Action Plan for Ocean Plastic Waste Management to 2030, and the Directive No.33/CT-TTg dated 20/8/2020 by the Prime Minister on strengthening management, reuse, recycling, treatment and minimization of plastic waste.[1]

Considering the development of policies and legislation on plastic waste management is a central task, the Ministry of Natural Resources and Environment has been assigned to develop and improve the solid waste management institutions in the Law on Environmental Protection (2020) and other documents detailing the Law towards treating plastic waste and other kinds of waste as natural resources; review and propose to develop legal provisions on: managing re-exported plastic waste or returning imported plastic scrap not meeting the requirements of environmental protection, ecological labels; review, propose development or coordinate to develop new environmental technical regulations, standards and regulations for products and bags derived from recycled plastic, products containing microbead, nano-resin to prevent negative impacts on human health, ecological environment; propose regulations and roadmaps to ban the use of microplastics in the production of cosmetics, garments, fertilizers...

[1] *Directive No.33/CT-TTg dated 20/8/2020 by the Prime Minister on strengthening management, reuse, recycling, treatment and minimization of plastic waste.*



Each person consumes about 50,000 microplastics annually | Picture: Kinh te Moi truong

Regarding the development, implementation and review of strategies, schemes, projects and some specific tasks, the Ministry of Natural Resources and Environment develops and completes the Project on strengthening plastic waste management in Vietnam towards the integration of existing plastic waste schemes, programs and actions to ensure consistency, syncronization, efficiency and concentration of resources; summarizing the implementation of the Prime Minister's Decision No.582/QD-TTg dated April 11, 2013 approving the Project on enhancing environmental pollution control due to the use of non-biodegradable plastic bags in daily life to 2020 and propose solutions to limit, eventually do not use hard-to-decompose plastic bags in daily life, and integrate into the Project on strengthening plastic waste management in Vietnam.

In addition, MONRE needs to organize the effective implementation of the Prime Minister's Decision No.491/QD-TTg dated May 7, 2018 approving the adjustment of the National Strategy on integrated solid waste management to 2025, with a vision to 2050, focusing on the implementation of tasks and solutions to achieve the goal of using 100% environmentally friendly plastic bags in commercial centers and supermarkets for the purpose of a substitute for persistent plastic bags; restrict and proceed to terminate the import, production and supply of hard-to-decompose plastic bags from 2026 in trade centers and supermarkets for domestic purposes.

Currently, the Ministry of Finance is revising to submit the amendment and supplement of the Law on Environmental Protection Tax in the direction of expanding the taxpayers and increasing the tax rate for plastic bags, packaging and other plastic products; proposing taxation of virgin plastics; directing the inspection and examination to prevent acts of tax evasion to protect the environment, especially for plastic bags. The Ministry of Finance shall assume the prime responsibility for, and coordinate with

Changing lifestyle using nylon and plastics bags | Photo: Tuoi tre online

the Ministry of Natural Resources and Environment in, investigating and proposing financial policies to promote and encourage waste recycling and plastic waste recycling activities; incentives and support for eco-friendly plastic bags, recycled plastic products and environmentally friendly materials. Research and develop priority criteria or norms to apply public procurement for recycled and environmentally friendly products.

The Ministry of Industry and Trade directs the implementation of the target "Continue to promote and soon implement the Plan to implement the target until 2021 that the shops, markets and supermarkets in urban areas do not use disposable plastic products; by 2025, the whole country will not use disposable plastic products". Investigate and promulgate regulations on technical quality standards and regulations, designing plastic products to ensure for recycling and reuse; stipulating the minimum rate of recycled plastic content in plastic products, the durability and disclosing information about the durability of plastic products; develop guidelines on sustainable production and consumption of plastic products. Issue technical standards and regulations on the quality of recycled plastics and toxic additives in plastic materials.

People's Committees of provinces and centrally-run cities propagate and raise public awareness about minimizing generation of plastic waste, sorting waste and plastic waste; coordinating with socio-political organizations, social organizations to build movement and coalition against plastic waste; mobilize people and communities to limit or not use disposable plastic products (including persistent nylon bags, food-grade plastic bags, plastic bottles, straws, food containers, cups and tableware ...) to protect the environment.

2. Lessons on microplastics management in the world

Worldwide, there are many policy instruments and initiatives to manage microplastics at global, regional and national levels (Figure 1).

At the international level, based on the Millennium Development Goals, the UN General Assembly adopted the 2030 Agenda for Sustainable Development on 25 September 2015. Under this agenda, 17 Sustainable Development Goals with 169 related targets have been announced, in which Goal 12 "Ensure sustainable consumption and production patterns" emphasizes the goal of reduce, recycle and reuse. In 2015, G7 discussed options to tackle plastic pollution in the marine environment and adopted an action plan to combat plastic waste in the sea including sources from land and sea, raising awareness and outreach, as well as disposal actions. In 2015, the World Bank established the Pollution Management and Environmental Health (PMEH) program that included technical and financial assistance to reduce pollution and improve health for all, in which a component of PMEH related to integrated solid waste management to minimize marine environmental pollution from the mainland clearly refers to plastic waste.

At the regional level, tools to address (micro)plastic waste problems in the European Union include regional agreements, regional programs, legislation or activities that address (micro)plastic specific problems. EU policies can be classified into two categories, "water-based policies" such as water protection (Marine Strategy Framework Directive, Waste Framework Directive) and "land-based policies" such as waste management, plastics production and product design, circular economy and REACH (for chemicals).

At the national level, many developed countries have adopted legal and policy tools to tackle the microplastic problem.

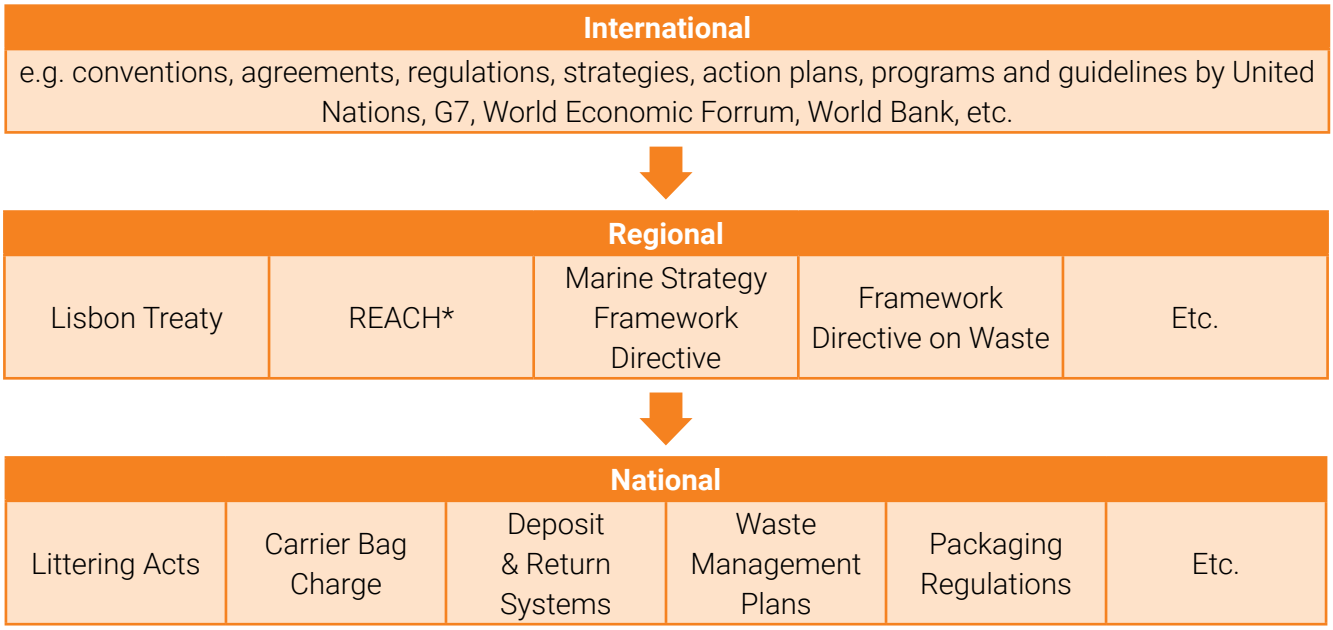


*Figure 1: Levels of regulatory and policy instruments and initiatives for the regulation, assessment, and management of freshwater (micro)plastic litter. * REACH Regulation concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals. (Source: Brennholt, Heß, & Reifferscheid, 2018).*

In the case of preventing littering, countries have a number of management tools, for example prohibit (of any kind) littering by prosecuting when littering and establish a system of penalty[2].

[2] *Brennholt N., Heß M., Reifferscheid G. (2018). Freshwater Microplastics: Challenges for Regulation and Management. In: Wagner M., Lambert S. (eds) Freshwater Microplastics. The Handbook of Environmental Chemistry, vol 58. Springer, Cham. https://doi.org/10.1007/978-3-319-61615-5_12*

In Europe, five countries - Austria, Belgium, Luxembourg, the Netherlands and Sweden - all attempted to urge the EU to ban microplastics from personal care products by 2015, expressing concerns about the possibility of they are harmful to human health when accumulated in seafood. Since then, Sweden has introduced its own ban on microplastics in cleaning products, starting January 1, 2018. Following the US footsteps in mid-2017, the UK government announced plan to ban microplastic cleaning cosmetics from 2018 and the production of these products by the end of 2017. The Italian parliament approved a proposal on December 19, 2017 to ban exfoliating particles in cosmetics since 2020. The Canadian federal government has announced a complete ban on the sale of shower gel, toothpaste and facial scrubs containing microplastic, effective from 1 month 7, 2018. Similarly, Korea has banned the use and sale of microplastics in all cosmetics since July 2018.

Many countries have in place waste management plans or programs to prevent and reduce waste, recover through reuse and recycling, and dispose of waste properly. Regulatory tools deal not only at the end (i.e. waste) but also at the beginning of the product life cycle or product design. For example, the UK's Packaging Regulations (Essential Requirement) 2003 urges manufacturers to design their products in a way that allows for reuse and recovery and minimizes the impact on the environment in packaging waste disposal process.

The plastic industry in the US and UK has implemented the "Operation Clean Sweep" to reduce the loss of microplastics to the environment, especially during transportation and delivery. The US NOAA established the National Marine Debris Program in 2006 and jointly issued the Honolulu Strategy in 2011 with UNEP[3]. This strategy can be seen as a global framework with a comprehensive effort to reduce the ecological, human health and economic impacts of marine waste, in which plastics (including microplastics) is considered a marine pollutant.

The deposit and return system encourages the proper disposal of waste (plastic) and thus offers the advantage of keeping plastic in the economic cycle. The EU Packaging and Packaging Waste Directive calls on member states to implement national deposit and return systems in which discarded plastic is collected and recycled for reuse as new packaging. This will contribute to reducing the amount of plastic waste input into the environment. For example, in Denmark, Dansk Retursystem A/S is a privately owned, non-profit organization regulated by statutory order, or another example of the deposit and return system is the Irish company Repak.

Extended Producer Responsibility (EPR) is a tool to ensure that the producers and importers introduce products to the market (or manufacturers) are responsible for the collection, recycling, and treatment of products they produce, thereby reducing the public financial burden of waste management and increasing recycling rates. The EPR program in OECD member countries applies different fees to plastic packaging manufacturers, depending on the type of plastic such as PET, HDPE, bioplastic, biodegradable plastic or plastic bag. The CITEO program in France sets fees for manufacturers of plastic bottles and packaging products that are primarily PET with added aluminum, PVC or silicon[4]. The program also applies fees for plastic products that do not have a recycling channel in France, for example plastic that is not PET, HDPE or PP. Currently, Vietnam is in the process of preparing to implement the EPR mechanism with manufacturers in Vietnam.

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[3] *Wang J., Zheng L., Li J. (2018). A critical review on the sources and instruments of marine microplastics and prospects on the relevant management in China. Waste Management & Research. 2018;36(10):898-911. doi:10.1177/0734242X18793504*

[4] *Han Tran Viet, Tran Bich Hong, Nguyen Thi Huong Ly (2019). Proposing the application of some economic tools in plastic waste management in Vietnam - Lessons learned in some countries around the world. Environment Magazine, Vietnamese Special Issue 3/2019.*

The prevention of plastic contamination requires the participation of manufacturers and consumers

Scientists around the world have identified the impact of very small plastic debris, called microplastics in the environment, on the health of humans and animals.

***Dr. Nguyen Dinh Dap** Communication Center for Natural Resources and Environment has an exchange on solutions to minimize and prevent microplastic pollution.*

The origin of microplastics in the environment

Now, a large amount of plastic waste continues to be disposed of around the world every single second. The United Nations' report shows that humankind annually disposes of enough plastic waste to cover four times of the Earth's surface area. Plastic waste fragments will be broken down under mechanical impact into small plastic debris less than 5mm in size, also known as microplastics.

Microplastics are classified into different types, based on origin. Primary microplastic particles are discharged directly into the environment from activities such as washing clothes made from synthetic fabric, the friction of tires in motion, from beauty products such as lotion ... Secondary microplastic particles are created from the destruction of plastic objects, such as plastic bags, nylon bags, plastic bottles, fishing nets ... accounting for about 69% to 81% of microplastic particles found in the ocean. and in the body of marine animals.

Going with the flow of rivers and streams, plastic debris move across rivers, streams, seas and oceans, causing microplastic pollution on a global scale. Microplastic pollution is mainly caused by the decomposition of plastic waste and this situation is occurring globally. Researchers find microplastics everywhere: in the air, soil, rivers, lakes, and even the deepest seas in the world.

Effects of microplastics on the environment and human health

If animals ingest microplastics, their airways will be blocked, leading to asphyxia, or their digestive system will be adversely affected, causing death. Microplastics can penetrate and destroy cells in the body of organisms in fresh water and in marine environment; They can be a medium for the accumulation of dangerous chemicals, and when animals ingest such chemicals, they will be poisoned, and this toxin is transferred to humans when humans eat these animals.

Microplastic particles are persistent, very difficult to decompose, nor can they be collected for recycling like other large plastic pieces, leading to microplastic accumulation in the environment. Microplastics also penetrate the groundwater. Scientific studies have shown that every marine organism can be contaminated with microplastics, which have been found by researchers in food, drinking water, air, and cooking salt ... This shows the potential danger of microplastics to human health.

Microplastics are also present in dust in respiratory tract when humans inhale. Because microplastics have a diameter of over 10 micrometres, they are usually captured and eliminated by the mucus system, upper respiratory tract hairs,

Corals taking microplastics | Photo: IAEA

Local people collecting waste by a river in Hoi An | Photo: Minh Hai

and eliminated through sneezing, coughing, sniffing, spitting mucus ... If microplastics are smaller in size, they go deeper and become trapped in the alveoli, making it hard to get rid of such microplastics. Microplastics can also enter the human body when people drink bottled water or eat fish contaminated with microplastics from the ocean.

Recently, the World Wide Fund for Nature (WWF) has released a study that shows that, on average, each person in the world can eat at least 5 grams of microplastics per week, equivalent to the mass of a credit card or an ATM card.

What countries have done to reduce pollution caused by microplastics

Currently, many EU member countries have issued a ban on the use of microplastics mainly in cosmetics production. In order to end the export of plastic waste to countries that cannot handle it, the European Commission has adopted a new regulation on the import, export and transportation of plastic waste, which has come into effect since January 2021.

The European Parliament has recommended that EU establish a continental ban on all microplastics used in the manufacture of cosmetics and detergents, and take actions to minimize microplastic waste from fabrics, tires, paints and cigarette filters.

Previously, back in 2019, the European Chemicals Agency proposed limiting the use of microplastics as well as formaldehyde and siloxane compounds in the production of a wide range of products such as cosmetics, detergents, paints, pigments, building materials, medicines, substances used in agriculture, oil and gas. This proposal was based on ECHA's conclusions in its assessment of the risks of these substances to the environment and to human health.

Vietnam's solutions to limit microplastic pollution

In 2018, the United Nations launched a theme "Beat plastic pollution". And in Vietnam, the Prime Minister also launched a nationwide movement to combat plastic waste in June 2019.

The revised Environmental Protection Law enacted at the end of 2020 contains new provisions for Extended Producer Responsibility (EPR) mechanism. Accordingly, the Law stipulates that producers and importers are responsible for recycling and waste disposal, including plastic waste. In terms of waste recycling responsibility, the Law on Environment Protection for the first time sets the recycling rate and requires companies to be responsible for collecting and recycling used products and packaging at a certain rate based on the volume of products or product packaging they bring to the market.

Microplastics - catastrophe for environment and health | Picture: Change.vn

To minimize the harmful effects of microplastics, it is necessary to initially limit and then not to use poor quality plastic, hard-to-decompose plastic bags.

To achieve this goal, it is necessary to launch propaganda campaigns and raise public awareness of the harmful effects of microplastics to the environment and human health; to implement solutions to orient domestic production and consumption of environmentally-friendly bags; to perfect mechanisms and policies to encourage the production of environmentally-friendly bags; to develop policies to limit the production and use of hard-to-decompose plastic bags in households in daily life; to raise environmental protection tax on non-biodegradable plastic bags; to create consumer markets for environmentally-friendly bag products; to promote scientific research, application and transfer of technologies to recycle hard-to-decompose plastic bag waste into more environmentally-friendly products; to produce biodegradable bags; to boost communication, popularize and raise public awareness of the harmful effects of hard-to-decompose plastic bags and encourage the reuse and use of environmentally-friendly bags.

IUCN staff and volunteers conducted beach debris audit in Ha Long Bay | Photo: IUCN Viet Nam

Plastic waste attacked mangroves
Photo: Nguyễn Thi Kim Cuc, Giao Long Commune, Giao Thuy District, Nam Dinh Province

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