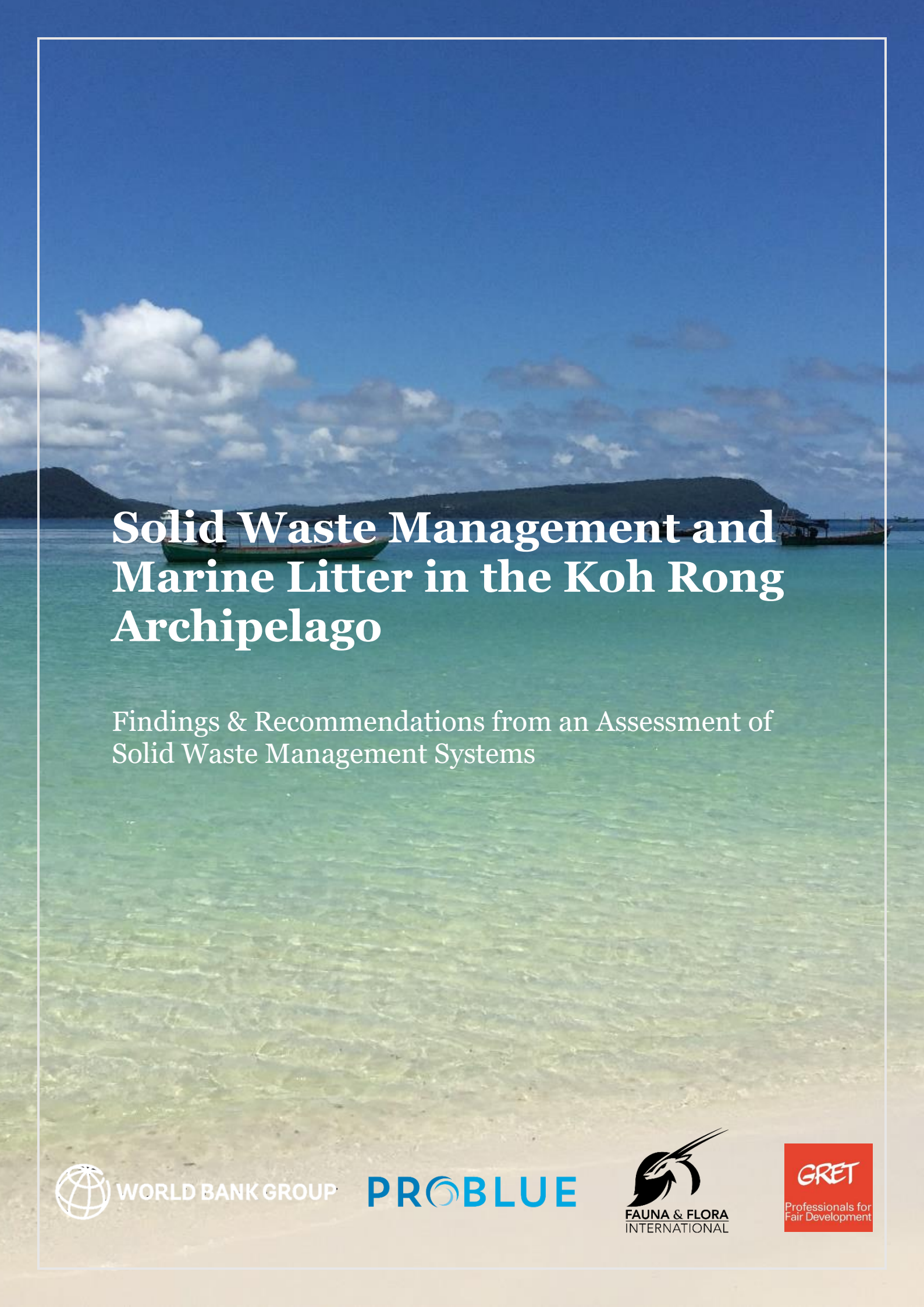

Solid Waste Management and Marine Litter in the Koh Rong Archipelago

Findings & Recommendations from an Assessment of Solid Waste Management Systems

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FAUNA & FLORA INTERNATIONAL
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Contents

A bag of rubbish on a beach in Koh Rong Sanloem Village.

(Credit: Bianca Roberts / FFI)

This report was prepared by Bianca Roberts as part of the services rendered by Coastal and Marine Conservation Programme, Fauna & Flora International (FFI) under consultancy by The World Bank Group (7198769).

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Cover photo: Bianca Roberts

About FFI

Established over a century ago, **FFI** is the world's oldest international wildlife conservation organisation. FFI's focus is on protecting biodiversity, which underpins healthy ecosystems and is critical for the life-support systems that humans and all other species rely on. FFI has been working on marine plastics since 2009, and was the first biodiversity conservation organisation to address the emerging threat from microplastics in our oceans.

The **Coastal & Marine Conservation Programme (CMCP)** is part of FFI's programme of work in Cambodia. The CMCP supports the RGC to protect coastal and marine biodiversity, sustainably manage fisheries resources and improve livelihoods of local fishers and communities. Over the past 10 years, the CMCP has focused on building community, government and local partner capacity for biodiversity conservation and the design and management of an MPA network, whilst tackling key threats such as illegal fishing and most recently, plastic pollution. www.fauna-flora.org

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Credit: Paul Colley

Abbreviations

ALDFG	Abandoned, Lost and Discarded Fishing Gear
CFi	Community Fisheries
CMIC	Chip Mong Insee Cement Corporation
CRBC	China Road and Bridge Corporation
CR	Circular Economy
CSR	Corporate Social Responsibility
EPR	Extended Producer Responsibility
ESF	Environmental and Social Fund
FFI	Fauna & Flora International – Cambodia Programme
FGD(s)	Focused-Group Discussion(s)
FiA	Fisheries Administration
HH/HHs	Household/s
IBA	Important Bird Area
IUU	Illegal, Unreported and Unregulated (fishing)
KII/KIIs	Key Informant Interview/s
KKRS	Koh Kapik Ramsar Site
KRA	Koh Rong Archipelago
KRECA	Koh Rong Environmental Conservation Association
KRM	Koh Rong Municipality
KRMNP	Koh Rong Marine Protected Area
KSA	Koh Sdach Archipelago
KSV	Koh Sdach Village
KSWM	Kompong Saom Solid Waste Management
MAFF	Ministry of Agriculture, Foresty and Fisheries
MoEF	Ministry of Economic and Finance
MFMA	Marine Fisheries Management Area
MoE	Ministry of Environment
MoTPW	Ministry of Transport and Public Work
MPA	Marine Protected Area
MSME / MSME's	Micro-Small-Medium Enterprises
MSW	Municipal Solid Waste
NCSD	National Council for Sustainable Development
NGO(s)	Non-Government Organization(s)
NPCI	National Plan for Control & Inspection
PET	polyethylene terephthalate
PPE	Personal Protective Equipment
PKWS	Peam Krasaop Wildlife Sanctuary
RGC	Royal Government of Cambodia
SNCDD	Sub-National Demographic Development Secretariat
SoCMoN	Global Socioeconomic Monitoring Initiative for Coastal Management
SSEZ	Sihanoukville Special Economic Zone
SUP	Single Use Plastic
SWM	Solid Waste Management
UDG	Union Development Group
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNCLOS	United Nations Convention on the Law of the Sea
WASH	Water, Sanitation & Hygiene

Executive Summary

Marine litter is a complex and multifaceted threat necessitating systemic reform and collaborative solutions. Innovation and coordinated action are essential, but interventions must be framed within the Cambodian context and empower local leadership and action. This study focuses on absence of adequate solid waste management (SWM) as a key driver of Cambodia's marine litter & plastic pollution. As such, the study assesses solid waste management (SWM) in the Koh Rong Municipality (KRA) with a focus on its relevance to marine litter and macro-plastic pollution in the Koh Rong Marine National Park (KRMNP). Findings from this assessment have been used to develop a series of policy and on-site recommendations to improve SWM and reduce marine plastic pollution in the KRMNP. This report and its recommendations also speak to broader action under The World Bank's National Plastics Action Plan and Road Map (draft, 2020).

Situated in the Gulf of Thailand, Cambodia's 435-kilometre coastline encompasses 69 islands and an array of interconnected ecosystems (7,18,23). These ecosystems support a diversity of species and the provision of essential goods and services (146,147). Marine ecosystems add considerable value to Cambodia's economy and prosperity, generating an annual US$12 million in benefits across the fisheries and tourism sectors (49). Marine fisheries represent around 1.14 % of the country's GDP (2014 data), with combined marine fisheries and aquaculture production totalling 751,000 tonnes in 2016 (90, 93). The primary threats to Cambodian marine ecosystems include illegal, unreported and unregulated (IUU) fishing, unregulated coastal development, habitat loss and, more recently, pollution (36,148,149). In the KRMNP, marine resources are integral to the livelihoods and wellbeing of local communities for their indispensable role in providing food sources and income. Both ecosystems & communities in the KRMNP are under threat from absent or deficient SWM systems and the resulting mismanaged waste & pollution.

In recent years, awareness of marine litter has grown rapidly, especially concerning plastic. Plastic pollution is one of the most widespread and persistent types of marine litter globally, causing lasting damage to species and habitats (60,85,104). The slow rate of plastic degradation (if at all), coupled with the rapidly growing quantity of plastic waste entering the environment, leads to the accumulation of plastic pollution in coastal and marine ecosystems worldwide. In Cambodia, the evidence base relating to marine litter and plastic pollution is still emerging. However, whilst knowledge gaps remain, the inescapable presence of mismanaged waste and high levels of plastic consumption, paired with SWM deficiencies, leave little room for doubt that marine litter, particularly plastic, is a threat to Cambodia. In 2018, Fauna & Flora International (FFI) conducted some of the first studies to quantify and characterise coastal and marine debris in Cambodia. This study found that in the absence of adequate SWM systems, coastal and island communities had no choice but to improperly dispose of their household (HH) waste, with 96.5% of respondents in the Koh Sdach Archipelago (KSA) disposing of their HH waste directly into the ocean or on the shoreline (49).

In Sihanoukville, the coastland city located some 20 km from the KRMNP, plastic was the most common shoreline debris type identified, making up 81% of all debris counted (49). Cigarette butts were the predominant plastic type found, followed by plastic food wrappers and plastic bags. These findings resonate with those of The Ocean Conservancy, which found the ten most common types of shoreline debris to be plastic, including, food wrappers, straws and stirrers, cutleries, beverage bottles, bottle caps and lids, grocery bags, cups and plates and cigarette butts (92). A later study carried out by The World Bank characterizing macro-plastic pollution in two coastal provinces (Preah Sihanouk and Koh Kong) also revealed consistent findings (171). This study recorded "a total of 50 categories of macro-plastic debris" across the study locations. Of the 1,035 items collected, the most common types of plastic were plastic wrappers and plastic bags and/or pieces of bags.

In Cambodia, plastic pollution and marine litter are rapidly entering the political agenda and national conscience. However, capacity and resourcing gaps, systemic barriers, and lack of information disempower locally-led action and hinder progress. At coastal and island sites, including the KRMNP, logistical and contextual complexities and infrastructure deficiencies undermine the effort. Key actors, including provincial authorities, communities, and SWM contractors, agree that mismanaged waste and pollution are problematic; that they need support to realise solutions.

Summary of Key Findings

Absent or deficient SWM systems: Nationally, SWM is characterised by a lack of proper waste collection and treatment facilities, limited technical expertise, unclear remits among staff members and limited coordination within and between ministries, as well as other governance challenges (49,63). Currently, the country's formal SWM methods center on landfilling of solid waste, but most dump sites lack adequate technical design, are not suitably sized and are typically only found in urban areas, with most coastal and island sites being under-provisioned, including the KRMNP (54,63,66). The study found that there are no formal SWM services in the KRMNP, but there are informal service providers in Koh Touch and Saracen Bay who collect and carry the waste by boat back to the landfill in Sihanoukville. Further, there are no purpose-built landfill sites - only informal dump sites - two of which have incinerators (in Koh Rong Sanloem Village and Dheam Takeo Village), although the safety and sustainability of these incinerators is a cause for concern. One bright spot was the finding that some HHs and businesses sort certain waste type for sale to waste pickers known as "Etchay." Typically, only aluminium is sold to the Etchay in the KRMNP. Plastic is not bought by the Etchay because of its low resale value and high overheads costs linked to logistical challenges, including the difficulty of transporting a critical mass of bulky plastic to the mainland for sale.

Limited or absent infrastructure & services paired with contextual complexities: Despite continuous development and economic growth, Cambodia faces considerable infrastructure challenges to meet the nation's rapidly increasing resource consumption and population growth (52-54). In coastal zones, there has been little investment in infrastructure outside of Sihanoukville, which has suffered from the unplanned and unregulated proliferation of development to meet the demands of the tourism sector (137). In the KRMNP, roads are either absent or in poor condition, making waste collection inefficient. Where waste collectors are active, they are poorly provisioned, making their jobs inefficient, and payment of waste collection fees by HHs is uncommon. Additionally, the transport of waste back to the mainland increases overheads for waste collectors and leads to waste leakage. The contextual complexities and challenges impact the profitability of SWM contractors, ultimately disincentivising improved service delivery. Finally, essential services - most notably the potable water supply - are insufficient in the KRMNP, resulting in communities relying on bottled water to meet their needs, increasing plastic use and plastic waste generation.

High consumption & reliance on plastic: A 2015 study found that Cambodia's plastic bag consumption was "extremely high" in urban cities, with 2,158 plastic bags consumed per person per year - a figure found to be ten times higher than the European Union and China (65). This is echoed by findings herein, which illustrated that over 70% of households surveyed in Koh Touch and Koh Rong Sanloem Villages reported being dependant on one or more plastic products to meet their daily food and water needs, with plastic bags and bottled water being considered most essential. Research Component 1, found that around 30% of HH waste and 23% of business waste was plastic (by weight). This is of particular significance, given the light weight of plastic. Further estimations in the study found that around 7 kg per year of plastic is likely leaking into the ocean from Koh Touch and Koh Rong Samloem Villages. This presents another critical concern, given the importance of coastal and marine ecosystems to the people and businesses of the KRMNP, and to Cambodia's blue economy as a whole.

The three most common business waste categories in Koh Rong Sanloem Village (by weight) were: 1) organic waste (53%), 2) plastic packaging (9%) and 3) paper and cardboard (8%).

The three most common business waste categories in Koh Touch (by weight) were: 1) organic waste (61%), 2) glass (15%) and 3) plastic bags, including pieces of bags (7%).

Damaging disposal behaviours and attitudes: A 2010 study estimated that 87% of Cambodia's total plastic waste was mismanaged (55,56,64). This study found that in the face of deficient or absent SWM systems, communities in the KRMNP often had no choice but to improperly dispose of their waste, with burying the waste on private property and burning in open areas being common forms of disposal. Where informal services exist, they are inefficient, incentivising improper disposal. Other behaviours limit the provision of waste management services. For example, waste collectors reported that payment for services is uncommon and that many citizens do not deposit their HH waste at designated collection points. These behaviours need to be addressed to support the establishment and improvement of SWM services in the KRMNP and reduce marine litter and plastic pollution.

Economic growth driving increased consumption and waste generation: Socioeconomic transformation and property development have rapidly intensified in Cambodia, including in coastal areas. However, investment in infrastructure and urban planning are limited, resulting limited formal waste management. The nation's new-found affluence has also shifted consumption patterns (56), and whilst figures vary, one study estimated that in 2017 Cambodia generated 730,000 tonnes of plastic waste, 48% of which was illegally disposed of into waterways or burned in open areas (90). In Sihanoukville, it was estimated that between 2016 and 2020, uncontrolled growth caused waste generation to increase by 400% (151). This is particularly concerning, given the proximity of Sihanoukville to the KRMNP and the high likelihood of waste leakage from this coastal city. Estimations of waste generation in the KRMNP face some complexities due to the global pandemic, but approximately 5-8 tonnes of waste were reported to be generated each day in the KRMNP prior to the pandemic. Whilst waste generation has decreased due to low tourist visits beause of the pandemic, it is anticipated that the sector will quickly rebound once travel restrictions ease, as will waste generation. Even in this period of greatly reduced waste generation, the communities of the KRMNP are struggling to manage, underscoring the need for urgent solutions. Further, the socio-economic impact of mismanaged waste presents an especially high risk to the KRMNP, given its reliance on the tourism sector as a key income generator.

Based upon the findings of the SWM system assessment the following recommendations have been formulated:

7.1 SWM System Establishment and Improvement Recommendations

- Recommendation 7.1.1. Improved residuals management that is safer for people and the environment.
- Recommendation 7.1.2: Investment in infrastructure, equipment & locally-led innovations that enable improved waste management to reduce marine plastic pollution in the KRMNP.
- Recommendation 7.1.3: Foster and empower local leadership, collaboration and planning between local leadership and formal private sector collection services.
- Recommendation 7.1.4: Engage and empower informal waste collection actors. And;
- Recommendation 7.1.5: Trialling & supporting circular economy MSMEs at coastal and island sites.

7.2 Institutional & Governance Recommendations

- Recommendation 7.2.1: Utilise existing governance instruments by articulating and addressing barriers to their implementation, including lack of capacity and enforcement.
- Recommendation 7.2.2: Develop new governance instruments that bridge gaps and target the most prolific and problematic plastics and their hotspots.

7.3 Private Sector and Citizen Engagement Recommendations

- Recommendation 7.3.1: Engagement of private sector to foster accountability, with a focus on sectors that most pollute and/or rely on coastal and marine ecosystems.
- Recommendation 7.3.2: Engagement of citizens to promote awareness and tools for improved waste management.

Stemming from these recommendations, a number of priority next steps for implementation have been set out, that is: 1) critical governance actions, 2) a model for improved waste management in the KRMNP, and 3) critical next steps for the tourism sector. Both the recommendations and the priority next steps can be found in Section 7 of this report.

1. Introduction

Marine litter is recognized as an urgent global threat with wide-ranging ecological and socio-economic impacts, undermining community wellbeing, economic development and ecosystem provisioning. Marine litter is defined by the United Nations Environment Programme (UNEP) as “any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment.” The slow rate of degradation of many marine litter items, especially plastics, together with the continuously growing quantity of plastic waste generated, has led to an increasing volume of litter in the ocean and on shorelines (70). Solutions to marine litter require systemic reform, widespread collaboration and innovative approaches that are framed by the local context (70,50).

Plastic pollution has attracted particular attention as one of the most ubiquitous, lasting and damaging types of marine litter. An estimated 380 million tonnes of plastics are produced every year, with nearly 50% of all plastic products being single-use in purpose (103). This leads to around 300 million tonnes of plastic waste being generated each year globally (78). If the current trend continues, it is projected that by 2050 approximately 12,000 Mt of plastic waste will either end up in landfills or the natural environment (79,81).

In East and Southeast Asia, marine plastic pollution exceeds global averages (85). As of 2015, seven countries in these regions have been listed as having the most mismanaged plastic waste (by mass) and producing more than half of land-based plastic pollution that enters the ocean (50,82,83). Given the known scale, reach, and persistence of marine plastic pollution, the region is presented with a mounting threat to people, the planet and the economy (49).

In Cambodia, studies on marine litter and plastic pollution are still emerging, although research to date has shown high plastic consumption in urban areas (64,65). In the KRMNP, island-based communities are particularly reliant on marine resources and ecosystems to support their wellbeing, including the tourism and marine fisheries sectors that underpin the livelihoods of many. Whilst studies have not yet been carried out, this alone suggests that the KRMNP is particularly vulnerable to marine litter & plastic pollution.

In a global review, mismanaged solid waste was found to be the largest source of macro-plastic pollution, with an estimated 3.87 million tonnes being lost in marine environments per annum (180) and around 80% of plastic debris found in the ocean today originating from land due to absent or deficient SWM systems & infrastructure (70,77). Managing increasing levels of solid waste is a challenge faced by many nations (181), particularly in Asia where rapid development has driven the generation of municipal waste (52). This trend is echoed in Cambodia, where formal SWM systems are rare and infrastructure development is lagging behind to meet the needs of the nation’s increasingly affluent, growing population (52-54). Further, where SWM systems do exist, they are struggling to cope with the nation’s increasing resource consumption and waste generation (151). Some 80% of the Cambodian population lives outside of urban areas - where SWM systems are limited or absent – leading to an array of undesirable waste disposal practices such as open burning (66%), burying of waste (11%), direct disposal into open areas (9%) and direct disposal into waterways (5%) (52,65,66). In the KRMNP, scoping studies reveal the limitations of the archipelago’s SWM systems and suggest that pollution is a growing threat, although little research has been conducted to date, with some of the first being captured in this report.

Credit: Bianca Roberts / FFI

2. Objectives

The purpose of this report is to set out the findings of a SWM system assessment conducted in the KRMNP, with a particular focus on elucidating links to marine litter in the form of macro-plastic pollution from land-based sources. These findings inform a series of site-specific and policy recommendations to improve SWM in the Koh Rong Municipality (within the KRMNP), with the ultimate goal of reducing plastic use and waste leakage from land and thereby reducing marine litter and plastic pollution. These recommendations dovetail with The World Bank's National Plastic Road Map.

The KRMNP was selected for this study because of its importance to Cambodia's blue economy. The KRMNP was the first large-scale marine protected area (MPA) in Cambodia and is a site of ecological significance (141). In recent years the KRMNP has become an attractive destination for both domestic and foreign tourists, attracting a number of large-scale development projects supporting the site's burgeoning tourism industry (141). This has had major implications for marine plastic pollution and waste management in KRMNP, with the tourism sector being both a key waste generator and relying on pristine coastal and marine ecosystems to thrive. Further, past engagement with these communities and scoping studies conducted by FFI indicate that many local stakeholders are concerned about marine plastic pollution and the inefficient, informal SWM systems currently in place in the KRMNP.

To understand the scale of mismanaged waste as it pertains to marine litter, the SWM system assessment includes the following components:

- Research Component 1. Waste characterisation study;
- Research Component 2: Assessment of the SWM systems; &
- Research Component 3: Assessment of socio-economic impacts of mismanaged waste on local communities and the economy.

Finally, it is acknowledged that the attributes of the study sites have changed due to the global COVID-19 pandemic, which will likely influence the findings of this study. Further details are set out in the study constraints and limitations in Section 4 of this report.

Credit: Bianca Roberts / FFI

3. Koh Rong Archipelago: Overview and Context

3.1. Demographics & Site Description

Administratively, Cambodia's coastline consists of three municipalities and four provinces:

- Koh Kong Province, bordering Thailand;
- Preah Sihanouk Province, including the Sihanoukville Municipality, the capital city of Sihanoukville and the KRMNP;
- Kampot province, including Kampot Municipality, and bordering Vietnam; and
- Kep Province, including Kep Municipality (4,5).

Preah Sihanouk Province is located in south-west Cambodia, covering an area of 2,537km^2 (153). The capital city of the province, Sihanoukville, is located on the coast of the Gulf of Thailand some 200 kilometres from Phnom Penh. Sihanoukville Municipality has a total land area of 868 km^2 containing three districts, 23 communes and 82 villages (4). Demographically, Sihanoukville is the third most populated city in Cambodia, having a total population of 302,887 with annual population growth of 2.8% and population density of 156 people per km^2 (138,139).

Situated within Preah Sihanouk Province, some 20km from Sihanoukville, is the Koh Rong Archipelago (KRA) (Figure 1), which in 2018 became Cambodia's first large-scale MPA, known as the KRMNP. This designation marked a significant milestone for the sustainable management of Cambodia's coastal and marine habitats and resources (163). The KRMNP encompasses the two main islands of Koh Rong and Koh Rong Sanloem and eight smaller islands, covering an area of 52,000 ha — roughly two-thirds the size of Bangkok city (164). The KRMNP is one of only two formal MPAs in Cambodia with active marine conservation management and patrols (154). This site includes a number of ecologically diverse and socio-economically vital habitats, including seagrass beds, coral reefs and mangroves (155).

FFI has been working with the Fisheries Administration (FiA) since 2010 to support the establishment of this crucial marine biodiversity hub. The KRMNP encompasses several critical sites, such as fisheries refugia to support seasonal stock recovery, recreational sites for tourism activities, and community-fishery sites that permit regulated small-scale fishing. These areas are managed and patrolled by Community Fisheries (CFi) teams and the FiA (163). Details of the legal and administrative designation and governance systems of the KRMNP can be found in companion reports by FFI focused on marine spatial planning (185) and marine protected area planning (186) in the KRMNP.

Koh Rong Municipality

In 2019, the Cambodian government established the Koh Rong Municipality, which has two communes, Koh Rong and Koh Rong Sanloem. The municipality has population 3,119 people and 811 households (HHs) across six villages and two islands, Koh Rong and Koh Rong Sanloem Islands. There are four distinguishable villages on Koh Rong island: Koh Touch in the south-east, Prek Svay in the north-east, Dheam Takeo in the east and Sok San in the west. For Kong Rong Sanloem Island, administrative changes mean that there is only one official village, "Koh Rong Sanloem Village," which is also the popular tourism site of Koh Rong Sanloem island and is commonly referred to as "M'pai Bae" Village by both local communities and foreigners.

According to sub-decree 113, municipalities in Cambodia are responsible for organizing SWM systems within their jurisdiction. This includes the right to collect fees for SWM services, the right to contract a private waste collector, and the right to delegate responsibilities to communes. As such, there is an opportunity to work directly with the two communes in the archipelago, although they must have explicit authorization and ideally receive funding from the municipality to manage and implement services. Municipalities receive funding from the national government for environmental services, including waste management and beach cleans. For the purpose of this report, the geographic focus is on the KRMNP. However, from a SWM governance perspective, the most relevant administrative framework is that of the Koh Rong Municipality.

Table 1. Breakdown of KRA Municipality[3]

Category	Number
Area	78 km^2
Population	3,119 people (811 HHs)
Communes	Koh Rong and Koh Rong Sanloem
Villages	5 villages across 2 islands

In 2014, FFI conducted a socio-economic baseline assessment of the KRA, which found that communities in the archipelago had moderate levels of economic activity and livelihood diversification at the HH level. Most HHs were found to engage in a mix of small business, fishing, tourism and small-scale agricultural activities. These findings indicated relative resilience to shocks and stressors, suggesting that HHs in KRA should be able to adapt to small changes in economic, social or environmental factors (37). In 2014, there were 540 HHs in the four administrative villages of the KRA, increasing to 811 HHs in 2019 (Commune data base)[4]. A follow-up socio-economic study in 2017 assessed the knowledge, attitudes and perceptions (KAP) of KRA stakeholders towards marine conservation management activities, and the findings illustrated strong local awareness of and compliance with marine management regulations. However, it also revealed poor tourism sector awareness and compliance and highlighted an underestimation of tourism impacts on the health of the marine ecosystems (158).

Credit: Andy Ball / FFI

[3] Figures per Koh Rong Municipality
[4] Data reported by Koh Rong and Koh Rong Samloem Communes

Figure 1. Map of Koh Rong Archipelago, including Koh Rong Sanloem Village and Koh Touch Village (Credit: GRET).

3.2 Marine Litter in Cambodia

Despite an emerging evidence base, investigation of the local context suggests an urgent need to address marine litter and plastic pollution in coastal Cambodia as the nation echoes regional trends with regards to socio-economic development, plastic consumption, waste generation and management. Set out below is the context and current state of knowledge about marine litter in Cambodia.

Economic Context

Global estimates suggest that plastic pollution costs around US$13 billion in economic damage to marine ecosystems annually, which includes losses to the fisheries, aquaculture and tourism sectors, and clean-up costs (75,76). Like many countries in Southeast Asia, Cambodia is experiencing rapid economic and population growth and urbanisation, leading to increased resource consumption and waste generation (86). In recent years Cambodia has claimed one of the fastest rates of improvement in the global Human Development Index (HDI), and whilst growth has slowed in the face of the global COVID-19 pandemic, it is expected to rebound in the coming years (1-3,86-89).

Notwithstanding its current status, Cambodia's economic rise over the last decade has brought about a shift in consumption patterns most evident in major cities like Phnom Penh, Siem Reap and the coastal epicenter of Sihanoukville (56). In 2017, Cambodia generated more than 10,000 tonnes of municipal solid waste (MSW) per day, 20% of which was plastic and around half of which (48%) was improperly disposed of, including into waterways (49,69). Sihanoukville was ranked the second highest producer of plastic waste nationally, and between 2016 and 2020 uncontrolled growth in this city led to a 400% increase in waste generation (45). Further, 60% of all waste collected from drains in Sihanoukville was found to be plastic bags (67). All of these suggest that this rapidly growing coastal city likely poses a direct threat to the coastal & marine ecosystems of the KRMNP in the form of waste leakage (90,91).

Environmental Context

Cambodia's coastal regions support abundant marine habitats and species (7,121). Goods and services provisioned by Cambodia's coastal and marine ecosystems not only support local livelihoods and subsistence, but also provide essential services such as carbon sequestration, maintenance of water quality, climate regulation and protection against severe weather events (122). Furthermore, these habitats host a diverse array of marine species, including charismatic fauna such as seahorses, Endangered Green Turtles (*Chelonia mydas*), Critically Endangered Hawksbill Turtles (*Eretmochelys imbricate*) and Endangered Whale Sharks (*Rhincodon typus*). Plastic pollution is harmful to marine species worldwide with plastic ingestion and entanglement being the most common form of interaction with marine life; though evidence regarding the spread of invasive species and increased incidence of disease driven by marine plastic pollution is also troubling (123-129). Whilst limited data is available in Cambodia, reports to the national sea turtle hotline in 2020 found that of 26 marine turtle sightings 81% were trapped in fishing gear (FFI draft data, 2020).

Political & Governance Context

In Cambodia, plastic pollution and marine litter are rapidly coming to the fore of the political agenda and national conscience, with a number of stakeholders across private, public and third sectors engaged in the reduction of marine litter and plastic pollution. In 2015, the Royal Government of Cambodia (RGC) announced an annual US$5 million fund to help 26 cities across the country "become cleaner" (67). In recent years, several key stakeholders including the RGC, intergovernmental agencies and development partners have launched projects focusing on reducing marine litter and plastic pollution in Cambodia, including FFI, The World Bank, UNDP, GIZ and UNEP, as well as, regional bodies such as ASEAN and COBSEA.

Social Context

A growing body of research is elucidating the risk of plastic to wellbeing, especially human health. Plastic pollution constitutes a surging public health emergency in low- and middle-income countries worldwide, and it is the most vulnerable people who bear the greatest burden of environmental degradation (99). When plastics break down, endocrine-disrupting toxins such as Bisphenol A leach into the food and drinks they contain or the environment once discarded (97,98). Further, through the

processes of bioaccumulation and biomagnification, micro-plastics are known to concentrate up trophic levels, accumulating in greater concentrations in predatory species such as sharks and tuna, which are commonly consumed by humans (99,100). Mismanaged waste, especially plastic, can block waterways and drains, enabling the spread of water- and mosquito-borne diseases (99). Although little data exist in Cambodia, a study conducted in the Koh Sdach Archipelago (KSA) found that the majority (75%) of respondents were “concerned” or “very concerned” about plastic waste, with the primary concern being blocked waterways and drains that could result in an increased incidence of water-borne diseases (49).

Remote, rural communities, including those in the KRMNP, face food and water insecurity and lack of adequate Water, Sanitation and Hygiene (WASH) infrastructure (107,108). This has implications for marine plastic pollution. Earlier observations from scoping studies suggest that remote coastal and island communities in Cambodia use a higher volume of plastic products based on their daily subsistence needs (49). For example, FFI’s scoping studies in Koh Sdach Village found that 27% of household waste was plastic, with plastic bottles being the most commonly identified plastic waste item. This figure is higher than in mainland sites, for example, around 21% of HH waste in Phnom Penh was found to be plastic (49,109).

Gender equity is another crucial aspect of the social impacts of marine plastic pollution. Gender norms in Cambodia position women as the primary care givers and managers of HHs, which means they typically govern the purchase, use and disposal of plastic products (65). Studies investigating plastic bag use in urban Cambodia found that women predominately operate market stalls, purchase goods for HHs and are the main food preparers. These social norms mean that women both utilise a disproportionate amount of plastic bags and generate a larger proportion of plastic waste (65,67). Furthermore, women form a substantial portion of the workforce in the informal waste management sector in Southeast Asia, despite that fact men often dominate paid waste management jobs (104).

3.3 Interdependence in the KRMNP: The Relationship between Private Sectors & Marine Litter

Economic growth and development are crucial for improved social and environmental outcomes in Cambodia, and conversely the blue economy of Cambodia relies on community wellbeing and biodiverse ecosystems. From a marine litter perspective in the KRMNP, this interdependence is expressed in the key private sectors, namely marine fisheries and tourism, both of which are driving growth and development, but also rely on healthy ecosystems that are being undermined by marine litter and plastic pollution. Further, these sectors are key resources users and waste generators and, in the absence of adequate SWM systems, contribute disproportionately to marine litter & plastic pollution. Understanding these interdependent relationships is key to systemic reform and motivating change that reduces marine litter and plastic pollution. Investigated below are these key sectors and their relationship to marine ecosystems and litter.

Tourism & Hospitality Sector

Marine litter and plastic pollution pose a threat to Cambodia’s economy, given that the nation’s coastal regions offer significant contributions via tourism sector, the second-largest driver of economic growth after construction sector (173). Total tourism revenue has steadily risen from US$100 million in 1995 to an all-time high of nearly US$5 billion in 2019 (accounting for 21% of the country’s GDP that year) (95,96,174). The increasing volume of uncollected plastic waste in coastal sites negatively impacts Cambodia’s tourism sector by deteriorating the aesthetics that attract tourists. According to one Cambodian study, 72% of tourists visiting Cambodia objected to the ubiquitous presence of litter, whilst 13% reported that the high volume of litter discouraged them from wanting to revisit Cambodia (67). Further, waste generation by tourists contributes to marine litter, especially at coastal sites such as the KRMNP where SWM systems are absent or deficient.

Despite recent uncertainty due to the COVID-19 pandemic, international tourism is well established in the KRMNP, which is now a drawcard for both domestic and international tourists, with continued growth forecast and further large-scale developments slated to meet tourism demands (51,156). Before the COVID-19 pandemic, the KRMNP received an average of 700-800 tourists per day, exceeding 1,000 tourists per day in high season[5]. Tourism in the KRMNP varies from village to village, with different

[5] Data reported by Koh Rong and Koh Rong Samloem Communes
[5] Based on a KII with the Governor of the Koh Rong Municipality, 2021.

offerings geared at different customer segments. For example, the Song Saa Private Island offers high-end, luxury accommodations. Just across the water, the neighbouring Palm Beach and Prek Savey village offer bungalow accommodations and a local community experience targeted at those looking for a more affordable stay or seeking a taste of village life. Koh Touch, also located on Koh Rong Island, offers a vibrant nightlife and supports an array of both high-end and cheaper accommodations.

Many businesses in the KRMNP are dependent on tourism to operate, including hospitality, food and beverage, massage and spa, as well as tourism experience businesses such as boat tours and dive shops. Most tourism-dependent businesses in the KRMNP increased in number between 2015 and 2019, but experienced a marked decline in 2020. The temporary or permanent closure of businesses there are associated with the decrease in visitors because of the pandemic. A detailed breakdown of island-based tourism in the KRMNP can be found in a companion report by FFI (187).

Tourism and coastal construction: Until recently, the tourism sector in the KRMNP has seen a continual growth, leading to rapid and often unregulated coastal development (141). Land in both Koh Rong and Koh Rong Sanloem islands was granted as a concession to the Royal Group in 2008, and there are plans to spend US$2 billion to transform the islands into a luxury-resort destination (156), including the development of a road network and an airport (157). Despite the growth of tourism associated development, a 2018 report highlighted “deteriorating environmental conditions” around the KRA due to a “lack of sanitation and inadequate solid waste management” (51).

Coastal development & tourism activities in Sihanoukville are also crucial to consider, given the proximity of this coastal city to the KRMNP. Preah Sihanouk province has played a vital role in fuelling Cambodia’s economy in recent decades, owing to its diverse economic activities and foreign investment (175). In terms of its tourism sector, Preah Sihanouk is one of the most accommodation-dense provinces in the kingdom (169), and the number of large-scale infrastructure developments have rapidly increased, with many being unregulated due to legislative and resourcing limitations (49,168). These large-scale infrastructure projects are in part driven by the Royal Government of Cambodia’s development plan, which aims to transform Sihanouk Province into a “multi-purpose economic zone…like Shenzhen, China” (145).

With the rise of tourism-related construction in Sihanoukville and the KRMNP, mismanaged waste has become a serious and widespread problem. In 2018, the Guardian described Sihanoukville as a city riddled with “mountains and mountains of plastics” (57). Plastic pollution and mismanaged waste were reportedly found at such high density on beaches and in the ocean that the shoreline and water could not be seen (49,165). The development of tourism-related infrastructure may bring about positive economic benefits. However, without systemic reform of the archipelago’s SWM systems and investment in infrastructure development, these benefits will likely be short-lived.

Marine Fisheries

Despite growth in the tourism sector, fishing remains an important livelihood in the KRMNP. Studies conducted in 2016 found that around 60-80% of local inhabitants engaged in fishing and fishing-related activities (167,37). Over 50% of catches were sold to traders in the KRMNP for distribution to national, regional and international markets, whilst the remaining 50% were consumed within the KRMNP, making it a vital subsistence source for local communities (167). Sustained growth in the tourism sector has led to changes in local livelihoods. According to one study in Koh Touch and Koh Rong Sanloem Villages, communities shifted from fishing as a primary income-generating activity to tourism because of the higher earning potential (141). In the nearby KSA, focus group discussions (FDGs) with community members revealed that tourism was an aspirational livelihood change, with respondents stating that they did not wish for their children to be fishers (49). Whilst more up-to-date data are lacking, anecdotal reports suggest the global pandemic may have caused communities to return marine fisheries, given the downturn in tourism in the last two years.

Fisheries sector waste: Early studies in the KRMNP & KSA suggest that abandoned, lost and discarded fishing gear (ALDFG) is a significant component of marine litter in Cambodia (49). Despite growth in the tourism sector, communities in the KRMNP still depend on fishing as an income source and to meet their daily subsistence needs, meaning they are not only vulnerable to the damaging impacts of ALDFG on coastal and marine ecosystems, but are also key generators of fisheries waste. Reef health checks conducted by FFI in KRMNP found that fishing nets made up 66% of the marine debris recorded (49).

Similarly, studies in the neighbouring KSA found that 78% of marine debris was used fishing gear, largely nets and monofilament lines. The next most common type of litter recorded was general plastic waste, making up 16% of items counted.

In Cambodia, fishing gear such as nets, monofilament lines, ropes and buoys are predominantly made of plastic and typically purchased from Thailand and Vietnam. Scoping studies conducted by FFI in KSA found that fishing nets were typically comprised of low-quality nylon polymers, with fishers reporting an average lifespan between one and three months before nets degraded beyond usability. Further, 52% of fishing HHs reported discarding nets directly in the ocean, and some 3,286-4,930 nets were estimated to enter the ocean from Koh Sdach village each year. This same study found that illegal, unreported and unregulated (IUU) fishing also contributes to marine litter, with enforcement activities prompting fishers to discard illegal gear into the ocean when approached by patrol teams. Further, illegal trawling (i.e., in waters of less than 20 metres deep) also leads to snagging of gear on reefs and rocks, damaging fragile habitats and species and resulting in ALDFG (25,49,163).

3.3 Infrastructure & Service Provision

Investment in infrastructure has largely focused on Sihanoukville to date as the coastal city was experiencing rapid, though arguably unstable, growth prior to the global pandemic and legislative changes regarding gambling in Cambodia. A historic lack of regulatory guidelines has resulted in the unplanned proliferation of tourist facilities in Sihanoukville, which is compounded by limited infrastructure and SWM systems that compromised environmental quality, increased land use conflicts and led to visitor dissatisfaction (172). In response to these challenges, the provincial government initiated the Integrated coastal management programme (CMP) in 2001 (adopted 2005) to sustainably manage coastal and marine resources through coastal use zoning, which prioritises improved zoning to both support the tourism sector and reduce pollution (172). More recent infrastructure development has included:

17-hectare landfill and industrial waste management facility: Located in Prey Nob District, this new 17-hectar landfill is a five-million-dollar project implemented by Heng Sambath Import-Export Company (143). Construction began in July 2020 and is expected to take up 17 months to complete. Once finished, the landfill is estimated to hold up to 880,000 cubic meters of waste in the first five years of its lifespan. Alongside this landfill development, it is reported that Chip Mong Insee Cement Corporation (CMIC) is building a new industrial waste management facility in the Sihanoukville Special Economic Zone (SSEZ) in order to offer industrial waste co-processing services to factories located within the economic zone (143). Given many island communities in the KRMNP transport their waste to mainland Sihanoukville for processing, both the landfill and Chip Mong facilities present opportunities for improved SWM at these island sites.

*Deep Seaport Expansion***:** Funded by the Japanese government, expansion of this US$209 million deep sea port is due to commence in 2021, supporting 70% of all Cambodia's exports and imports once completed (143,145). The port expansion is expected finish in 2028, and given the proximity of the port to the KRMNP, it is expected to contribute to increased marine debris during and after construction.

International Airport: The Cambodian government is working in partnership with Cambodia Airports to expand Preah .Sihanouk Province International Airport (145). This project promises to bring a greater number of tourists to the KRMNP. However, without investment in island-based infrastructure, increased tourism could mean increased waste generation met by deficient SWM systems.

Whilst infrastructure projects in Sihanouk province are geared towards improving the local economy and Cambodia's economy as a whole, there exists the possibility for these projects to also increase the amount of solid waste generated in the province based upon increases in tourist numbers and in-migration of workers seeking employment in the province.

An Overview of Solid Waste Management in Cambodia

In Cambodia, governance of SWM can be broadly broken down into national level and sub-national levels (as shown in Figure 2 below). Nationally, governance of SWM changed markedly after the approval of sub-decree 113, which established decentralization of service delivery and allows national government to delegate, in part or in whole, the responsibility to sub-national governing bodies, with a

range of responsibilities being transferred to municipalities and communes from national government (a detailed breakdown of existing and developing governance instruments can be found in Annex III of this report). In 2020, Cambodia's SWM systems reportedly came under review by the RGC, with the goal of improved service delivery and increased transparency and accountability, including reviews of the contractual agreements held with private waste contractors and fee structures. It is unclear, however, how this initiative will impact areas outside of urban centers, especially the coastal and marine sites which are the focus of this report.

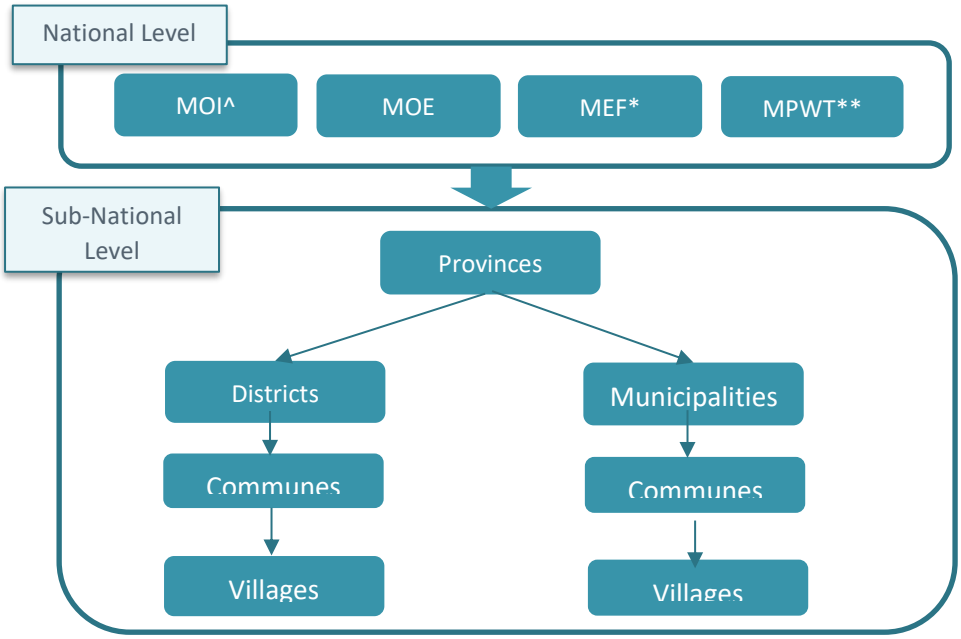


Figure 2. SWM governance framework in Cambodia.[6]

Generally speaking, SWM systems in Cambodia are still limited in terms of waste collection, transport, separation, disposal, and treatment technology. Two main actors, CINTRI and GAEA, provide collection services primarily in larger cities throughout Cambodia, though smaller service providers are frequently hired directly by local authorities, markets, or large waste producers in the private sector. These service providers often manage large and small dump sites, and sometimes provide services for separated waste collection (such as GAEA's glass collection service in Phnom Penh and Siem Reap). Whilst SWM systems exist in large cities, they are insufficient and often absent in peri-urban and rural areas, resulting in improper disposal practices. Burning of waste is common, as is disposal into waterways, as much of the population resides along the major rivers, lakes, and shorelines of the country. There are very few true recycling facilities in Cambodia (that is, those that turn recyclables into new products). However, recyclables are generally sorted and collected by informal waste pickers - known as "Etchay" in Khmer - for sale to larger transport networks who ultimately trade sorted but unprocessed materials across the border to Thailand and Vietnam.

[6] ^Ministry of the Interior, *Ministry of Economy and Finance, and ** Ministry of Public Works and Transport.

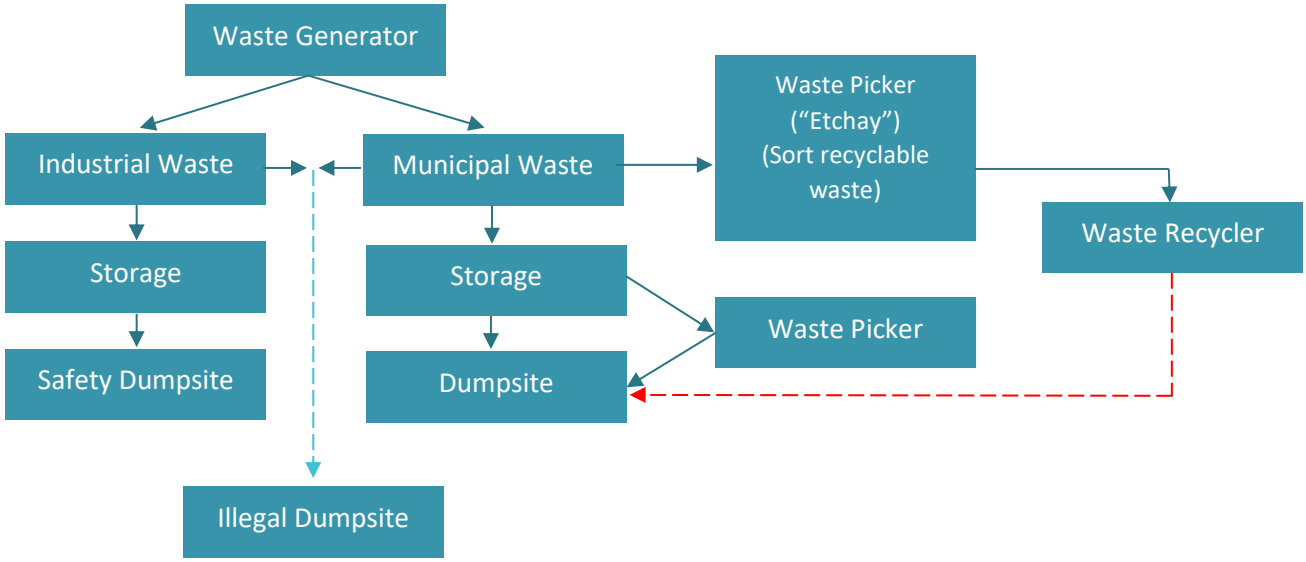
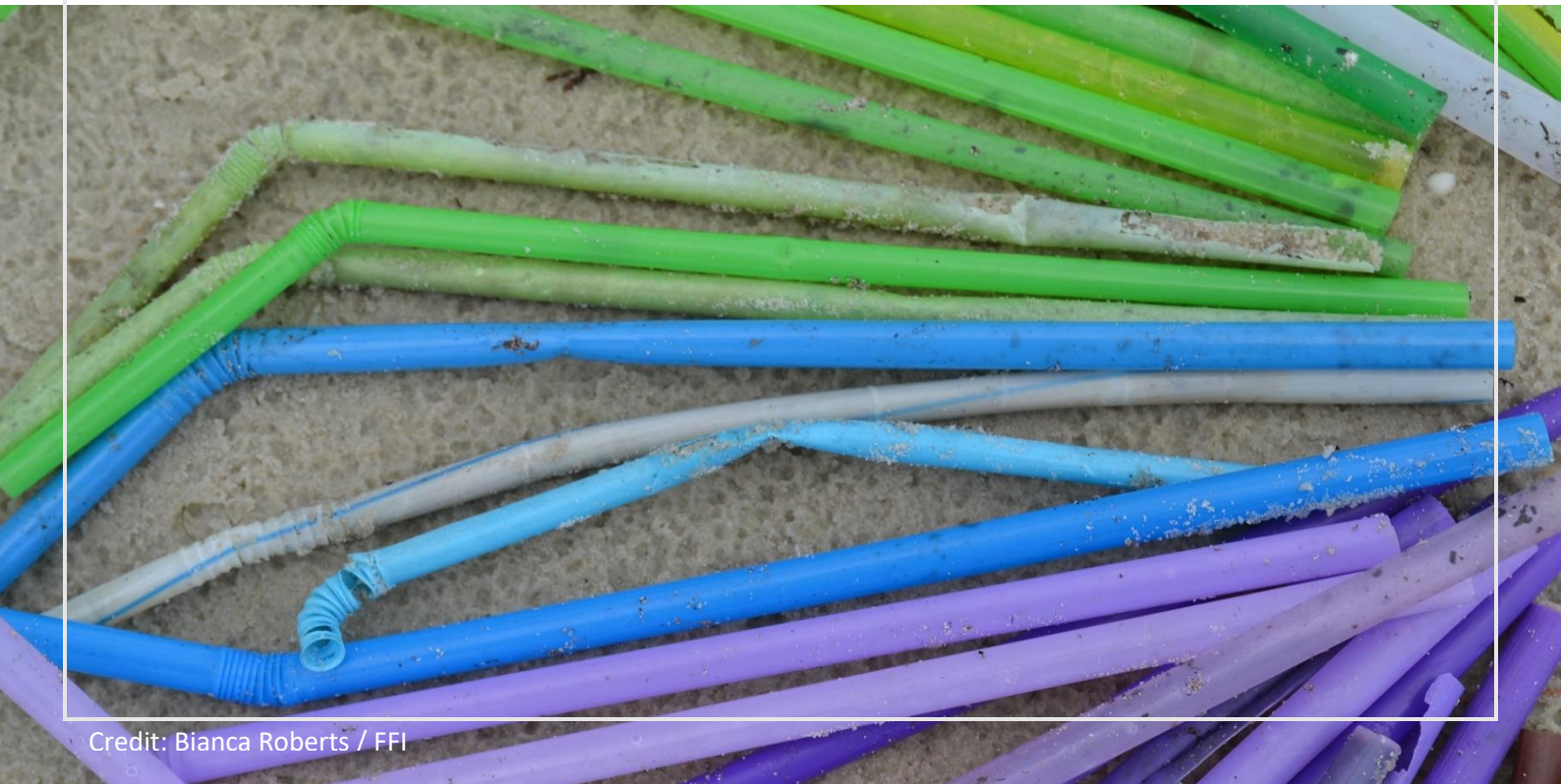


Figure 3. Flow chart of general solid waste management in Cambodia (source: MoE, Cambodia).

From a marine litter & plastic pollution perspective, absent or deficient SWM systems are thought to be the primary driver of this threat in Cambodia, though studies specifically detailing these links are still emerging. This is supported by global reviews and studies from neighbouring countries, which indicate that absent or deficient SWM systems are a key contributor to marine litter, including waste leakage from land into waterways (180). One such study from Indonesia found that uncollected waste contributed more to plastic waste discharges than leakages from final disposal sites (184). In the KRMNP, where there are no formal collection services, it is anticipated that high levels of uncollected waste are directly contributing to leakage from land, which is especially concerning given the growing use of plastic. This is further evidenced by a World Bank study (2019) focusing on the KRA, which found that with no effective waste management, plastic debris leaked into waterways from the mainland and ultimately travelled into the ocean, often by being washed ashore in the KRA. The most common types of macro-plastic recorded by this study were plastic shopping bags, food wrappers, drinking cups & beverage bottles and straws. Overall, the study illustrated that plastic waste is a significant component of debris in Cambodia's waterways, including marine and coastal zones. Further, the study found that direct disposal and leakage from land and into waterways were the main sources of debris. Additionally, the study observed that in the face of limited or absent SWM systems, burning of plastic was common, contributing to air pollution (171).



Credit: Bianca Roberts / FFI

4. Methodology

To meet the objectives of the research study and its recommendations, four broad methods of data collection were adopted:

- Quantification and characterisation of HH and business waste;
- Surveys of HHs and businesses;
- Key-informant interviews (KIIs) with relevant stakeholders; and
- Desk-based research and field-based observations.

Detailed methodologies are set out below.

4.1 Waste Characterisation Methodology

The waste characterization study seeks to quantify the weight, and categorize the types, of solid waste generated by HHs and businesses with a focus on plastic waste, recyclable waste and product use behaviours. The methodology follows “The Training Manual For Developing Solid Waste Management Plan” published by UNEP (170). The study is divided into two parts: 1) waste quantification and 2) waste composition, as set out below.

Waste was collected from HHs and businesses for a period of eight consecutive days, which represents one waste cycle, as defined by the UNEP methodology (170). Findings from previous waste characterization studies conducted in Cambodia were utilised to curate a list of waste categories (182). These categories were grouped based upon: 1) intended use to elucidate links to plastic use behaviours; 2) whether materials are recyclable or compostable (i.e. recyclable, non-recyclable or compostable); and 3) broad types of plastics. It is noted for the purpose of this study that the “recyclable” and “compostable” categories take into consideration what is most feasible in the local context, for example, paper & cardboard is categorised as “compostable” because paper recycling facilities don’t exist and the Etchay don’t typically collect this type of waste in the KRA. Moreover, some categories were added based upon past studies and other evidence, for example, a “fisheries waste” category was added due to fishing being a key livelihood in the KRMNP. Further, due to the global pandemic, “personal protective equipment” category was added to elucidate how the pandemic might have impacted plastic use and waste generation in the KRMNP. The following table summarises the waste categories used in the study:

Table 2: Summary of the Main Waste Categories

Type	Plastic Type	Recyclable / Non-recyclable / Compostable
Plastic bags, including pieces of bags	Typically polyethylene, soft plastic	Non-recyclable
Plastic drink bottles and caps	PET, hard plastic	Recyclable
Polystyrene	Hard plastic	Non-recyclable
Cigarettes / cigarette butts	Cellulose acetate, soft plastic	Non-recyclable
Plastic straws / stirrers	Plastic various, hard plastic	Non-recyclable
Lids / cups / cup holders	Plastic various, hard & soft plastic	Non-recyclable
Plastic packaging (crisp packets, sweet wrappers, noodle packet)	Plastic various, soft plastic	Non-recyclable
Other plastic bottles	Various plastics, HDPE, LDPE, Polypropylene, hard plastic	Recyclable
Tetra pack e.g. juice box, milk carton	Layered plastic, aluminium & paper, hard plastic	Non-recyclable
Food containers / takeaway containers	Polystyrene & other plastics, hard plastic	Non-recyclable
Rope / string	Various, can be plastic including nylon, soft plastic fibres	Non-recyclable
Fisheries waste (used fishing nets and lines)	Various, can be plastic including nylon, soft plastic fibres	Recyclable
Organic	N/A	Compostable
Glass	N/A	Recyclable
Aluminium cans & pieces	N/A	Recyclable
Metal other	N/A	Recyclable
Textile /cloth	Can be plastic but not counted as such for the purpose of the study as mostly cotton was found	Non-recyclable
Paper & cardboard	N/A	Compostable

Personal Protective Equipment (face masks, gloves)	Various plastic, soft plastic	Non-recyclable
Other (if found, specified by item)	*Described as found in the study*	*Described as found in the study*

To measure the weight of solid waste produced by HHs and businesses, the waste characterization study employed a three-step method of 1) collection, 2) sorting, and 3) weighing. Firstly, waste was collected directly from the source (i.e., each day for eight days, that is, from the businesses and HHs that agreed to participate in the study (written consent was collected). Following collection, the waste generated by each participating HH or business was weighed. Secondly, following waste collection, a hand-sorting method was employed to sort the waste into the specified categories, keeping HH and business waste separate for each day of the study. Thirdly, once sorted, each waste category was weighed (again keeping HH and business waste separate for each day of the study). Where the weight of waste exceeded 30kg per day, a randomized waste reduction technique was utilised to reduce the amount of waste samples for sorting. The method is illustrated in further detail in step 2 of waste mixing in Figure 4 below.

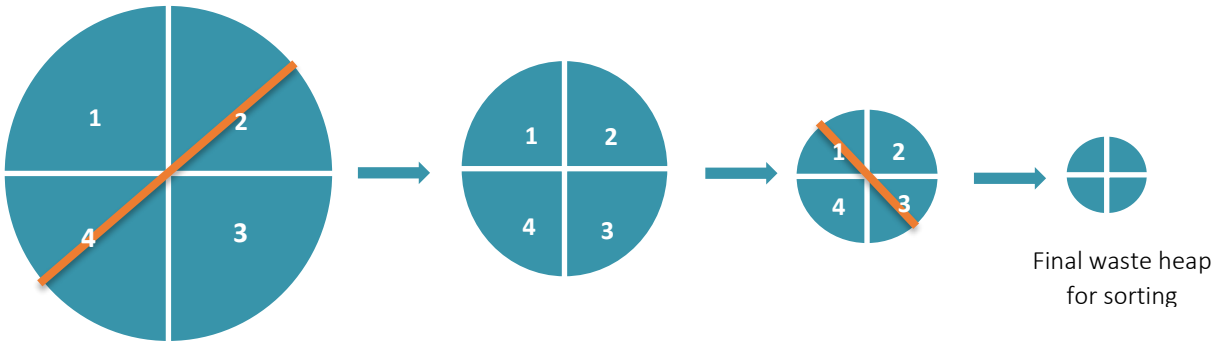


Figure 4. Randomized waste reduction method; the orange line represents divisions for the randomized portions to be removed.

Additionally, a small-scale brand audit was also carried out to identify the most prevalent brands of polyethylene terephthalate (PET) bottles present in HH and business waste. This audit focused on PET bottles due to anecdotal observations and scoping studies at neighbouring sites, which suggested a reliance on small bottles (<500ml) of water by communities to meet their potable water needs.

4.1.1 Focal Sites

For Research Component 1, two villages in the KRMNP were selected as focal sites: Koh Touch Village on Koh Rong Island and Koh Rong Sanloem Village on Koh Rong Sanloem Island. The villages are accessible from the mainland and had the largest populations and density of businesses, with each being a hub for coastal tourism (noting changes due to the pandemic, as discussed above). These factors suggest that the selected study sites are likely generating higher amount of waste compared to other villages in the KRMNP, are sites of waste leakage from land into the ocean, and are heavily reliant on healthy coastal and marine ecosystems to support tourism activities.

Koh Touch Village, Koh Rong Island: Although geographically located on Koh Rong Island, Koh Touch is an administrative village of Koh Rong Sanloem Commune. In terms of waste management practices, Koh Touch was selected to represent Koh Rong Commune, as it is more practically managed from the island level rather than the commune level. The village reportedly has a total population of 690 people (46% of which are female) and 137 HHs as of 2019 (176); however, these figures do not seem to have been updated since the pandemic, and at the time of conducting the study the research team found far fewer HH and businesses than expected. These site-based observations were confirmed by KIIs, surveys and anecdotal discussions, which revealed that a number of businesses had closed and many villagers had migrated to the mainland to find other employment because of the pandemic. At the time of data collection, the types of businesses found to still be in operation were predominantly street food vendors, grocers, clothes and/or souvenir shops, mini marts, laundry services, restaurants and/or cafes. Several small groups of local and foreign tourists (less than 10 people in each group) were seen visiting the island during the data collection and tended to stay for one or two nights. In terms of infrastructure, Koh Touch has three functioning piers, one short concrete road running parallels to the beach, and

some dirt roads that connect the village to other villages around the island. Most businesses tend to be located along the shoreline, whereas HHs are scattered up the hill in small clusters. The village has no school, health care facility, dumpsite or incinerator.


Credit: Terra Michaels / GRET

Koh Rong Sanloem Village, Koh Rong Sanloem Island: Koh Rong Sanloem Village sits administratively within Koh Rong Sanloem Commune. Reportedly, it has a total population of 467 people (56% of which are female) and 163 HHs (176). Similar to Koh Touch, the COVID-19 pandemic appears to have significantly impacted the village, with many people leaving to look for jobs elsewhere and many businesses closing down, especially those reliant on the tourist trade. At the time of the study, only a handful of guesthouses and restaurants/cafés, two mini marts, a few street food stalls were still open. Moreover, only one or two groups of foreign tourists were seen visiting the island at this time, each comprised of just two or three people who stayed for a few nights only. Further, due to the low number of visitors, many businesses were only open sporadically or for reduced hours, with many business owners taking turns to open on alternate days. With regards to infrastructure, Koh Rong Sanloem Village has one small pier, a short concrete road within the village, one primary school, one small health facility that appeared to be closed down, and a dumpsite with an incinerator. Like in Koh Touch, most businesses are located along the beach and are dependent on tourism, whilst most HHs are found some 200 metres from the shoreline. The village experiences scheduled power cuts three times a day, with each lasting around two hours. Anecdotal discussions with villagers suggested that the power cuts were due to the low numbers of tourists; that the local authorities will not cease power cuts until the tourist trade returns. There is also a large-scale resort being constructed, although it was unclear whether construction has been suspended because of the pandemic.

4.1.2 Waste Sampling for Characterisation

Businesses and HHs were provided with plastic garbage bags for waste storage for each day of the eight-day study period, and were asked to leave the waste on the street for collection by the research team. The research team collected the waste early each morning and began weighing, sorting and

characterizing the samples as soon as they were collected. Business and HH waste piles were handled separately to prevent crossover between the two sample groups. All data were recorded using a data tracking sheet, and once data collection was complete in each day, the team disposed of all the waste at the existing waste collection points or dumpsite in each village.

Household Sampling: HHs were selected using the convenience sampling method (meaning selection was based upon the actual presence of HHs available to join the study and accessibility of HHs to the researchers). In total, 16 HHs in Koh Touch Village and 21 HHs in Koh Rong Sanloem Village participated in the study. As mentioned earlier, many villagers have left because of COVID-19, thereby affecting the sample size. Further, many HHs live above the shops they own, a common occurrence throughout Cambodia known as “shop houses.” These participants were then counted as HHs in the study as their waste generation patterns were anticipated to be akin to that of HHs due to the lack of customers present at the study sites.

Business sampling: Businesses were also selected using convenience sampling (based upon the actual presence of businesses that were still operating at the time of data collection, accessibility for researchers and availability to join the study). Since many businesses had stopped operating at both study sites, a total of 13 businesses in Koh Touch and 12 businesses in Koh Rong Sanloem Village were included in the study. Most of the businesses were restaurants, cafes, bars and bungalow/guesthouse. Unlike shop houses, they focused on one or two services only (i.e., food/drinks and/or accommodation) and the premises were used solely for business operations.

Businesses sampled in Koh Touch Village were:

- three restaurants (23%);
- two hotels (15%);
- two cafes (15%);
- two bars (15%);
- one mini-mart (8%);
- one pharmacy (8%); and
- two small food shops / street vendors (15%).

Businesses sampled in Koh Rong Sanloem Village were:

- five restaurants (42%);
- one café (8%);
- one hotel (8%);
- three guesthouses (25%); and
- two mini-marts (17%).

Sample Size: The sample size for the waste characterization study was originally calculated using the Cochran formula with a 10% margin of error and a confidence level of 80%. However, during the field trip, the actual sample size (Table 3) was reduced due to lack of available participants and accessibility challenges (i.e., the hilly topography of the sites and poor roads).

Table 3. Waste Characterisation Study Planned and Actual Sample Size

No.	Item	Total Number	Number of Samples based on Cochran formula	Actual Sample Size
Koh Touch Village				
1	HH	249	33	16
2	Business	19	13	13
Koh Rong Sanloem Village				
4	HH	156	35	21
5	Business	28	17	12

4.2 Business and HH Surveys

As part of the study, businesses and HHs were surveyed to gather data regarding waste streams, waste generation, disposal behaviours and plastic consumption to inform and enrich all three of the research components. The survey design aims to articulate opportunities to adopt circular economy approaches, improve waste management and embed plastic reduction measures into on-the-ground and policy recommendations, with the goal to improve the economic, social and environmental outcomes of communities and businesses in the KRMNP. The HH and business surveys included 36 and 32 closed- and open-ended questions respectively to gather both quantitative and qualitative data. Data were sex-differentiated to support the articulation of gender sensitivities and gender equity opportunities.

In total, 44 HHs and 15 businesses in Koh Touch Village and 55 HHs and 14 businesses in Koh Rong Sanloem Village were surveyed. Data were collected using the KoBoCollect software app V1.30.1. Consent to participant was verbally obtained and recorded at the start of the survey. Data management took place daily to detect and rectify any errors or inconsistencies.

In more depth, the topics explored in both surveys included:

- Socio-demographic information;
- Current SWM practices (including waste generation, sorting, storage & disposal);
- Waste collection services (including availability/modality, access, cost & willingness to pay);
- Plastic use and disposal behaviour and knowledge;
- Attitude and perceptions around SWM and marine/plastic litters;
- Socio-economic impact of mismanaged waste; and
- Sanitation and electricity use and access (primarily utilised for a complementary report (187).

Data for Research Component 3 were collected from HHs, businesses and key stakeholders (local and provincial authorities and island waste collectors). Impacts-specific questions were included in the HH and business surveys and KII interview guides to capture the socio-economic impacts of mismanaged solid waste on the local communities and the economy.

Sample Size: The sample size for the household and business survey was originally calculated using on the Cochran formula with a 10% margin of error and a confidence level of 90%. However, in both Koh Rong Sanloem Village and Koh Touch, the actual HH sample size (Table 4) was reduced due to accessibility issues and limited participant availability related to the pandemic.

Table 4. Planned and Actual Sample Size for HH and business Surveys

No.	Target Area	HH			Business		
		Total Number	# of Samples (Cochran)	# of Samples (Actual)	Total Number	# of Samples (Cochran)	# of Samples (Actual)
1	Koh Touch	156	48	44	19	15	15
2	Koh Rong Sanloem Village	249	54	55	28	20	14
Total:		**405**	**101**	**99**	**47**	**35**	**29**

Gender: Survey data were gender disaggregated. Among respondents for the HH surveys, 64% were female and 36% were male in Koh Touch. In Koh Rong Sanloem Village, 73% of respondents were female and 27% were male. The higher rate of female participation in the surveys speaks to the traditional gender roles of women in Cambodia: women act as the keeper of their household, are responsible for doing work/chores to maintain the home and provide daily care for children, whilst men primarily work outside of the house to earn income. For businesses, 60% of businesses (n=9) were owned by women and 40% (n=6) were owned by men in Koh Touch. In Koh Rong Sanloem Village, half of the business owners were female.

4.3 Key Informant Interviews

Key Informant Interviews (KIIs) were conducted to collect data pertaining to the context and status of SWM in the KRMNP. KIIs were utilized as a tool to collect in-depth qualitative information about the

local context and needs of key stakeholders (see Section 4.5 for list of stakeholders interviewed), in order to inform solutions and motivate engagement. Structured interview questionnaires were designed, which incorporated open- and closed- questions that gathered descriptive data to enrich the quantitative and qualitative findings from the other methodologies employed. Thematic analysis of interview data was employed to identify and analyse key answer patterns that emerged in the answers of interviewees.

4.4 Desk Research and Field Observations

Targeted field visits were conducted as part of the larger study to observe the on-the-ground situation and context with regards to infrastructure, waste disposal behaviours, plastic use and waste packaging, collection and treatment. Extensive desk research was also used in the design of the study and the final report.

4.5 Data Collection, Sampling & Analysis

All data collection took place in July, 2021. A team of ten researchers were involved in the data collection (number of researchers was limited due to the COVID pandemic). Data collection for the waste characterization and HH and business surveys took place in Koh Touch and Koh Rong Sanloem Villages, whilst KIIs took place in the KRA more broadly and in Sihanoukville. The data collected included:

- A total of 1,670.37 kg of both HH and business waste collected in Koh Touch and Koh Rong Sanloem villages;
- A brand audit of the PET bottles found in the sorted HH and business waste in the two villages;
- A total of 99 HH surveys and 29 business surveys;
- A total of seven KIIs conducted with key stakeholders, including:
    - Sihanouk Provincial Department of Environment (PDoE);
    - Municipal governors of Koh Rong;
    - Commune chiefs of Koh Rong and Koh Rong Sanloem;
    - Informal waste collectors;
    - Sihanoukville-based waste collection company, Kompong Soam Solid Waste Management (KSWM); and
    - Koh Rong Environmental Conservation Association (KRECA).

4.6 Study Constraints and Limitations

COVID-19 Pandemic: COVID-19 has constrained this study in several ways. Firstly, many villagers have left the communities to look for work elsewhere, which limited the number of HHs included in the study. Secondly, the pandemic has severely hampered tourist activities on the islands, resulting in the closure of many businesses at the study sites. In the absence of tourists, it was expected that the amount of waste and type of waste generated was not representative of that generated pre-pandemic. Thirdly, the pandemic-related restrictions greatly hindered data collection activities, delaying or preventing travel to and around the study sites, reducing the number of researchers able to join in the study, limiting the willingness to participate of some HHs and businesses, and leading to protective measure taken during and after the course of the study to ensure the safety of both the communities and the researchers. Finally, during the course of the study there was a COVID-19 outbreak in the KRMNP, which led to at least one HH ceasing participation in the waste characterisation study. This may have impacted the waste generation rates in Koh Rong Sanloem Village.

Large-scale construction & property development: The current large-scale construction projects, many of which are tourism-dependant, are key stakeholders and are likely to be major contributors to marine litter and plastic pollution. That said, it is beyond the scope of this study to include these large-scale development projects in the study given their size, accessibility and willingness to participate. Further, targeted research is needed to fully assess the impact of large-scale coastal development on waste generation and marine pollution, though such an output would require the enthusiastic engagement of these powerful stakeholders.

Presence of the study team: The duration of the data collection was 20 days, with most of the team spending around 10 days in each study site. During this period, it appeared that the team, comprised of 10 people, was the largest visiting group staying at each site and that the duration of stay was much

longer than that of the other tourists observed. Due to COVID-19 and the nature of waste characterisation studies, all team members were required to follow safety measures, including wearing PPE. As such, the research team itself generated waste over the course of the study. To mitigate the impact of this on the results, guesthouses in which the team stayed were excluded from the waste characterisation study.

Geographical Constraints: Whilst many people have migrated from the study villages, there were some outlier HHs in the study villages who were not captured in the study. The hilly topography of these islands and poor roads, combined with the arduous nature of the waste characterization study, manual methods of waste collection and the limited number of people in the team, meant that only HHs and businesses located in accessible areas were included in the data collection.

Definition of "business" and "household": As set out above, the pandemic has led to a significant downturn in visitors to the KRMNP, whilst many businesses on the island rely on tourists as their primary customer base. With so few visitors, the distinction between HH and business was less concrete than usual, with many businesses generating very little or no waste. Further, "shop houses" (i.e., HHs with small businesses attached) are common in Cambodia. Based upon the limited customer base on the islands, these hybrid operations were counted as HHs for the purposes of this study, which may also blur the distinction between business and HH in the findings.

Credit: Bianca Roberts / FFI

5. Results & Findings

5.1 Socio-economic Status Indicators

The results of the HH surveys illustrated the following regarding the socio-economic status of HHs in the KRMNP:

Housing: Housing status or types of housing is one key indicator used to inform socio-economic status. According to the survey results, there are five types of housing status in Koh Touch and Koh Rong Sanloem Village:

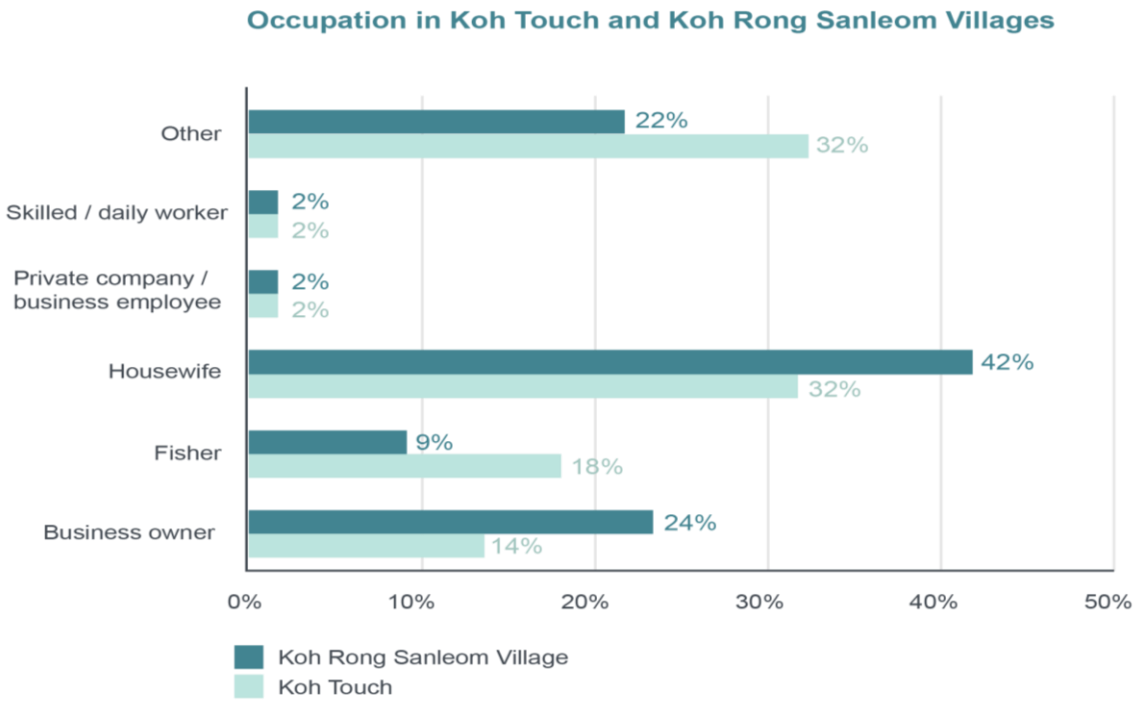
- bamboo and/or thatched roof (18%),
- house with zinc roof (25%),
- wood and/or ply wood house (32%),
- brick and/or concrete house (23%); and
- tarpaulin and/or tent (2%).

Housing material and roof type are accepted indicators of socio-economic status, with brick and/or concrete houses indicating wealth and zinc roofs or tarpaulin (tent) houses indicating lower socio-economic status. In Koh Rong Sanloem Village, 42% of houses were made from wood and/or plywood, 40% were brick and/or concrete, whilst 71% of roofs were zinc (none were made from tarpaulins or tents). Overall, this indicates a moderate socio-economic status in this village. In Koh Touch, most houses were made from wood and/or plywood, and 64% had zinc roofs and 20% had tarpaulin roofs. Relatively speaking, the higher quantity of tarpaulins roofs suggests the socio-economic status is medium to low in Koh Touch, and certainly lower than Koh Rong Samloem Village. In both Koh Touch and Koh Rong Sanloem Village, each HH had an average of five family members.

In Koh Touch village, 47% of all HHs lived uphill near a freshwater source, 33% lived within 50 meters of the beach, and 20% lived on beachfront. In Koh Rong Sanloem Village, 36% of all study HHs lived within 100 meters or more from the beach, 27% lived within 50 meters from the beach, 18% lived near or up the hill, 5% lived on beachfront, and 5% lived near the village's incinerator.

Education: Educational status speak to vulnerability of communities, but crucially for this study it speaks to practical implications for the proposed recommendations. The HH surveys found that 32% of all HH respondents in Koh Touch Village and 31% in Koh Rong Sanloem Village were illiterate. With over a third of the people unable to read or write, it is crucial that awareness raising, education and outreach, and social and behavioural change (SBC) campaigns targeted at improving SWM and reducing marine litter & plastic pollution are delivered in multiple formats and via multiple channels to reach all community members.

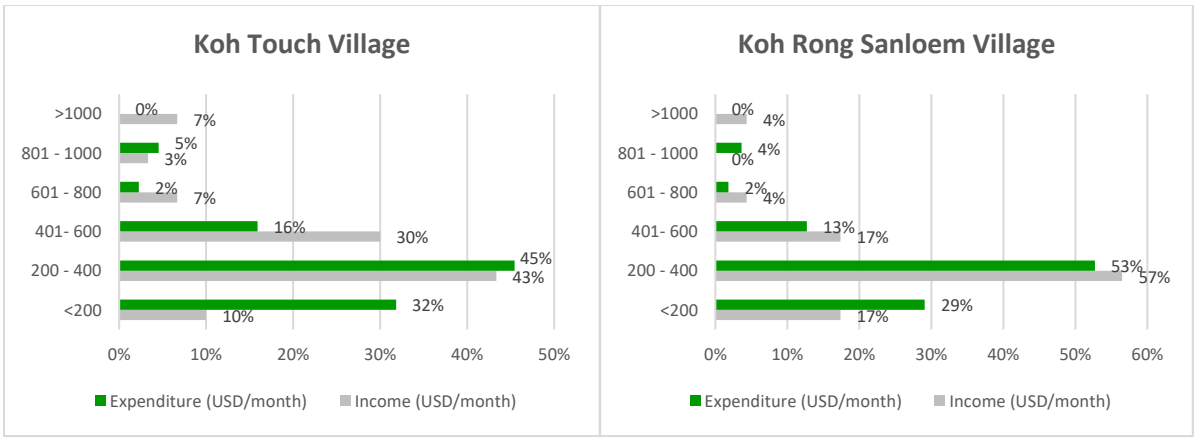
Primary Livelihood & Occupation: The majority of respondents in Koh Touch Village described their occupation as housewife (32%), fisher (18%) or business owner (14%). Similarly, in Koh Rong Sanloem Village, most of respondents were housewives (42%), business owners (24%) or fishers (9%). Other occupations mentioned in the surveys included construction worker, cleaner, street vendor, and unemployed. Given the gender norm that women are expected to be the manager of households or "housewife" and that most survey respondents were women (because the surveys took place in the time day when most men tended to absent from the house), it is unsurprising to see "housewife" at the top of the occupational groups mentioned here.



Graph 1: Main occupation of HH respondents in Koh Touch and Koh Rong Sanloem Villages

Income & Expenditure: Income and expenditure are indicators of the financial health of each HH, which can also inform the design of the on-site recommendations to ensure they are contextually viable. When questioned about monthly income, 68% of respondents in Koh Touch Village and 42% in Koh Rong Sanloem Village were willing to share this information. The results showed that maximum income is US$1,500 per month and US$1,200 per month in Koh Rong Sanloem and Koh Touch Villages respectively, whilst minimum income is US$50 per month in Koh Rong Sanloem Village and US$100 per month in Koh Touch Village.

Similarly, expenditure varies according to primary and secondary needs of each HH. Expenditure includes the cost of food, water, services (i.e., payments for electricity, local transportation and phone services), and health care. Results showed that, on average, each HH spent around US$300 per month on the aforementioned needs. In Koh Rong Sanloem Village, the minimum expenditure was around US$20 per month and the maximum was US$845 per month. Whereas in Koh Touch Village the minimum expenditure was around US$28 per month and the maximum was US$950 per month. This suggests that the cost of living is likely higher in Koh Touch than in Koh Rong Sanloem Village.



Graph 2: Monthly income and expenditure in Koh Touch & Koh Ron Sanloem Villages

5.2 Research Component 1. Waste Characterization Study

5.2.1 Waste Quantities

Household Waste: In total, 743.63 kg of HH waste was sorted across the two study sites for the eight-day study period. In Koh Touch, the total HH waste sorted and characterised was 413.79 kg, and in Koh Rong Sanloem Village the total waste sorted and characterised was 329.85 kg. In Koh Rong Sanloem Village, the sum of the HH waste collected did not exceed more than 30kg a day for most days in the eight-day waste cycle, and as such no waste reduction method was employed; the entirety of the waste collected was sorted and characterised. In Koh Touch Village, waste quartering was employed to reduce the waste collected to a sortable weight (30 kg max).

On average, HHs in Koh Touch generated around 0.67 kg of waste per person per day. In Koh Rong Sanloem Village, HHs generated 0.46 kg per person per day. Recent studies in Sihanoukville and Kep, found that HH waste generation is about 0.64 and 0.52 kg/person/day, respectively (UN Habitat, draft, 2021[7]). Comparatively, previous studies found that waste generation rate in urban areas of Cambodia report range from 0.73 kg/person/day in Phnom Penh (69) to 0.78 kg/person per day in Battambang (63).

The findings are overall reasonable, though it is noted that the Koh Rong Sanloem waste generation results are lower than expected, especially when compared to similar coastal sites, such a Kep (UN Habitat, draft, 2021[7]).This may be due to the fact that Koh Touch had better overall involvement in the study, as well as greater tourist activity, whilst in Koh Rong Samloem village there was a COVID-19 outbreak, which may have affected the waste quantities. Therefore, it is likely that the Koh Touch waste generation results are more representative of the KRA HH waste generation amounts overall.

Business Waste: In total, 926.74 kg of business waste was collected from both sites over the eight-day period. A waste quartering method was employed to reduce the total amount of waste for sorting, with a total 322.10 kg of business waste being characterised. On average, businesses in Koh Touch generated around 7.6 kg of waste per day, whereas those in Koh Rong Sanloem Village generated around 1.53 kg per day. Given the lower tourist activity in the latter site, it is not surprising that the business waste generation was notably smaller.

Summary: Based on the findings from this study, it is estimated that current waste generation rates are around 550 kg per day in Koh Touch and 175 kg per day in Koh Rong Sanloem Village. Assuming business waste generation rates on Koh Touch for the whole island, about 2.2 tons per day are generated per day for KRA overall (Table 5).

The Global Pandemic & Tourism Downturn - Impacts on Waste Generation

For pre-COVID-19 figures, it is assumed that the generation rate from HHs remained the same before and during the pandemic, though there are fewer people living on the islands; and that the figure from Koh Touch Village (0.67kg/person/day) is a better representation for the whole KRA. However, the waste generation rates are not representative of the overall business activity before the pandemic, therefore a secondary resource by JICA, which details waste generation rate by different types of businesses was referenced instead (189). The result estimates that Koh Touch Village generated a total of 1,115kg of waste per day (460 kg from HHs and 655kg from businesses), whilst Koh Rong Sanloem Village generated around 685kg of waste per day (315kg from HHs and 370kg from businesses). The whole KRA therefore generated an estimated 4.9 tonnes of waste per day, where 2.1 tonnes came from HHs and a further 2.8 tonnes was generated by businesses.

This finding is in line with the report from KRA municipality, which estimates that pre-pandemic solid waste generation was between 5 to 8 tonnes/day on weekdays, mainly from businesses related to the tourism industry. However, because of the pandemic, between 70 to 80% of all businesses in these villages were reported have to stopped running; the resulting business waste is also only a fraction (likely <15%) of the estimated pre-pandemic rates. Using the reported tourist numbers in 2019 (about 266,000) and an estimated length of stay of 3.07 days (the average for both international and domestic

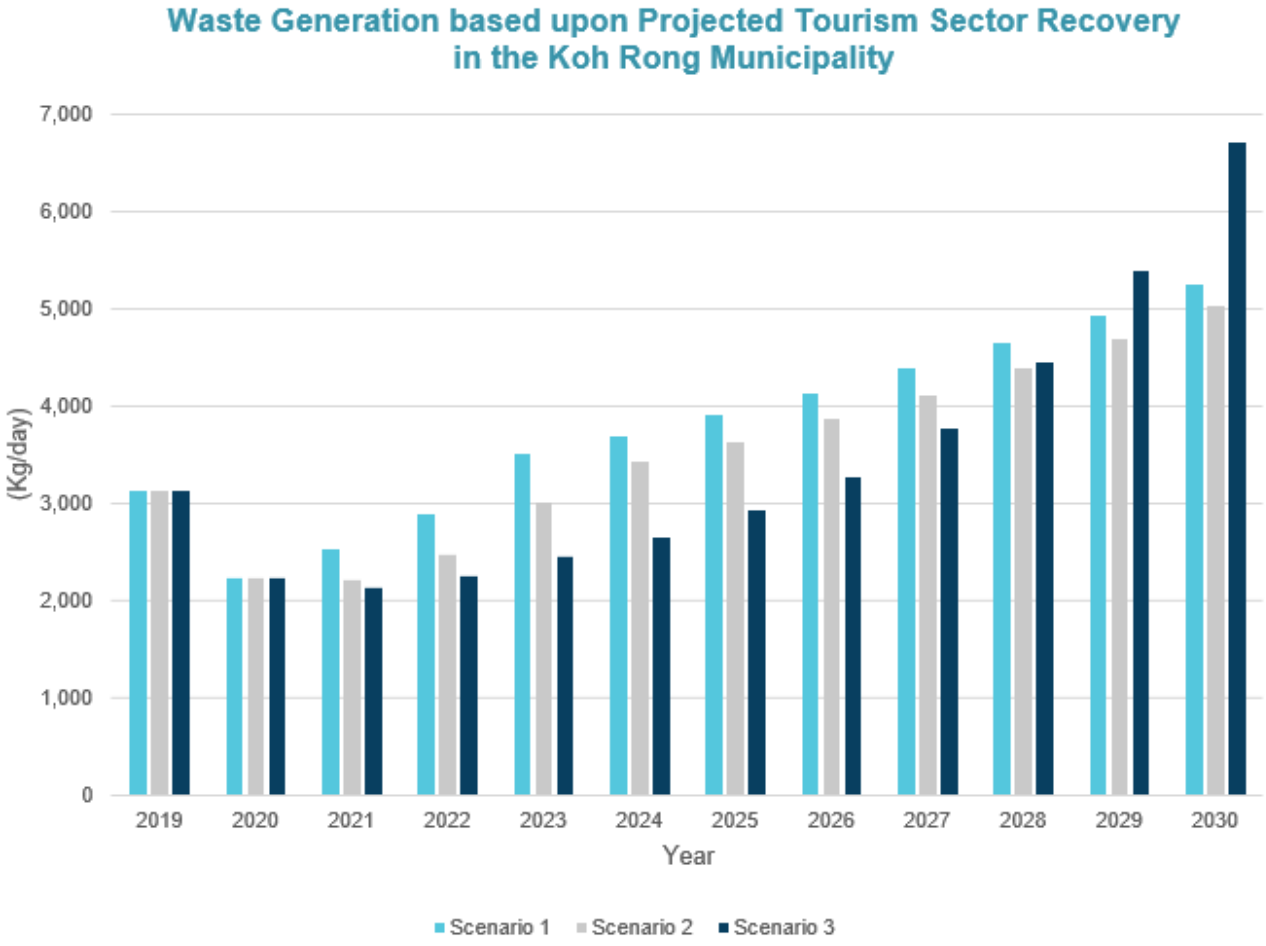
[7] UN Habitat Waste Wise Cities WaCT Study in Sihanoukville, presentation slides dated November 23, 2021 and UN Habitat Waste Wise Cities WaCT Study in Kep, presentation slides dated November 11, 2021

tourists), the result is that tourists generate between 1.25 and 2.63 kg/day). These findings are in line with data from a case study in Thailand (190), which estimates that 1.74 kg of waste are produced each day per tourist.

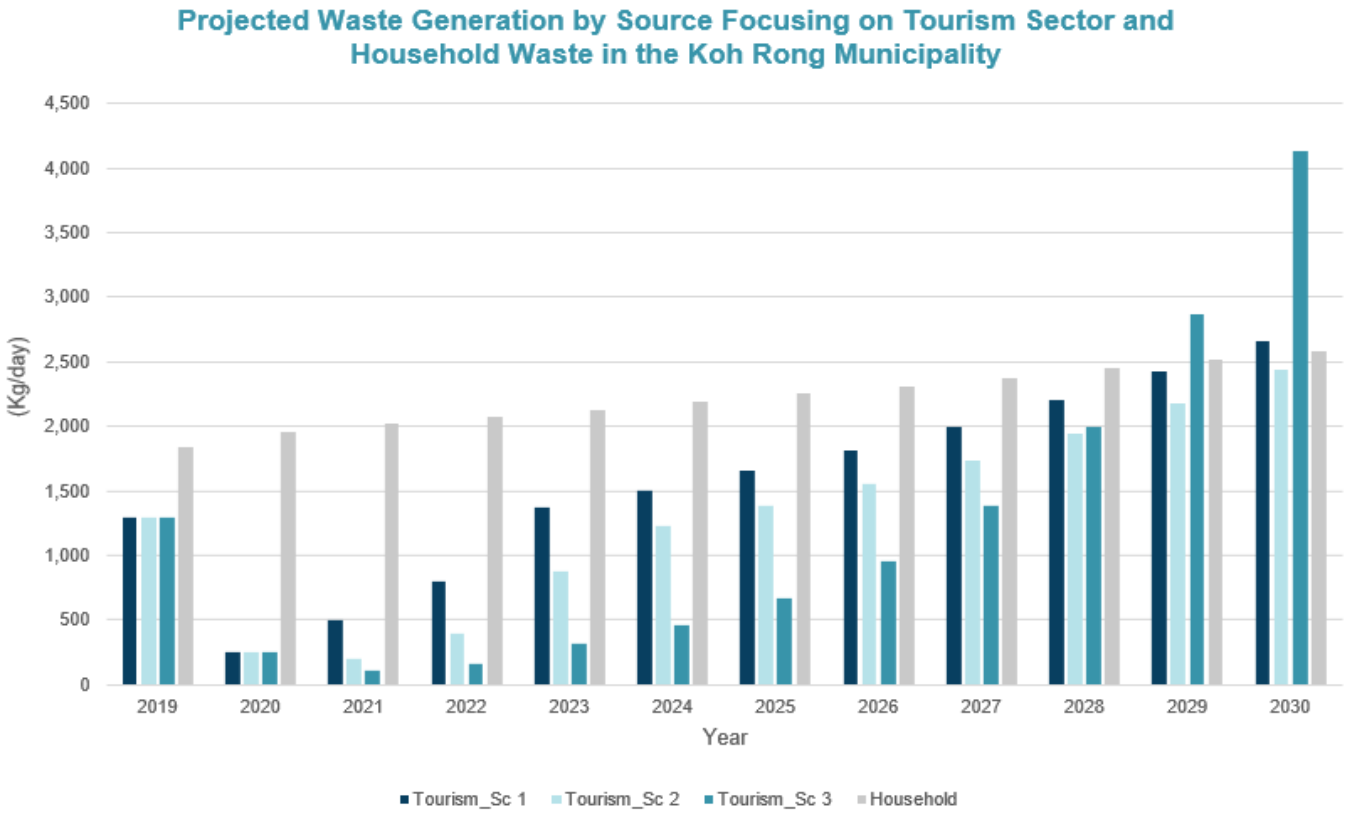
Table 5: Estimation of waste generation in Koh Touch and Koh Rong Sanloem Villages

Waste Generation	Koh Touch (Kg/day)		Koh Rong Sanloem Village (Kg/day)		All KRA (T/day)	
Waste Generator	Before COVID-19	During COVID-19	Before COVID-19	During COVID-19	Before COVID-19	During COVID-19
Household	460	400	315	155	2.1	1.5
Business	655	150	370	20	2.8-5.9	0.1-0.7
Total	**1,115**	**550**	**685**	**175**	**4.9-8.0**	**1.6-2.2**

Waste generation in Koh Rong Municipality was estimated and projected from 2019 to 2030 based on population and tourism data. Since the COVID-19 pandemic has strongly impacted tourism, the number of tourists was projected based on three different scenarios (187). Assuming significant tourism activity at existing businesses, the projection (see Graphs 4 and 5 below) shows that total waste generation in the KRA has fallen from more than five tonnes per day in 2019 to half that in 2020. In reality, 2020 and 2021 were less than this projection because of the KRA having significantly less tourism activity, despite some open businesses. Regardless, in the next 10 years, waste is expected to increase rapidly to 10 to 15 tons per day, depending on the tourism scenario.



Graph 4. Project waste generation in the Koh Rong Municipality based upon tourism sector recovery.



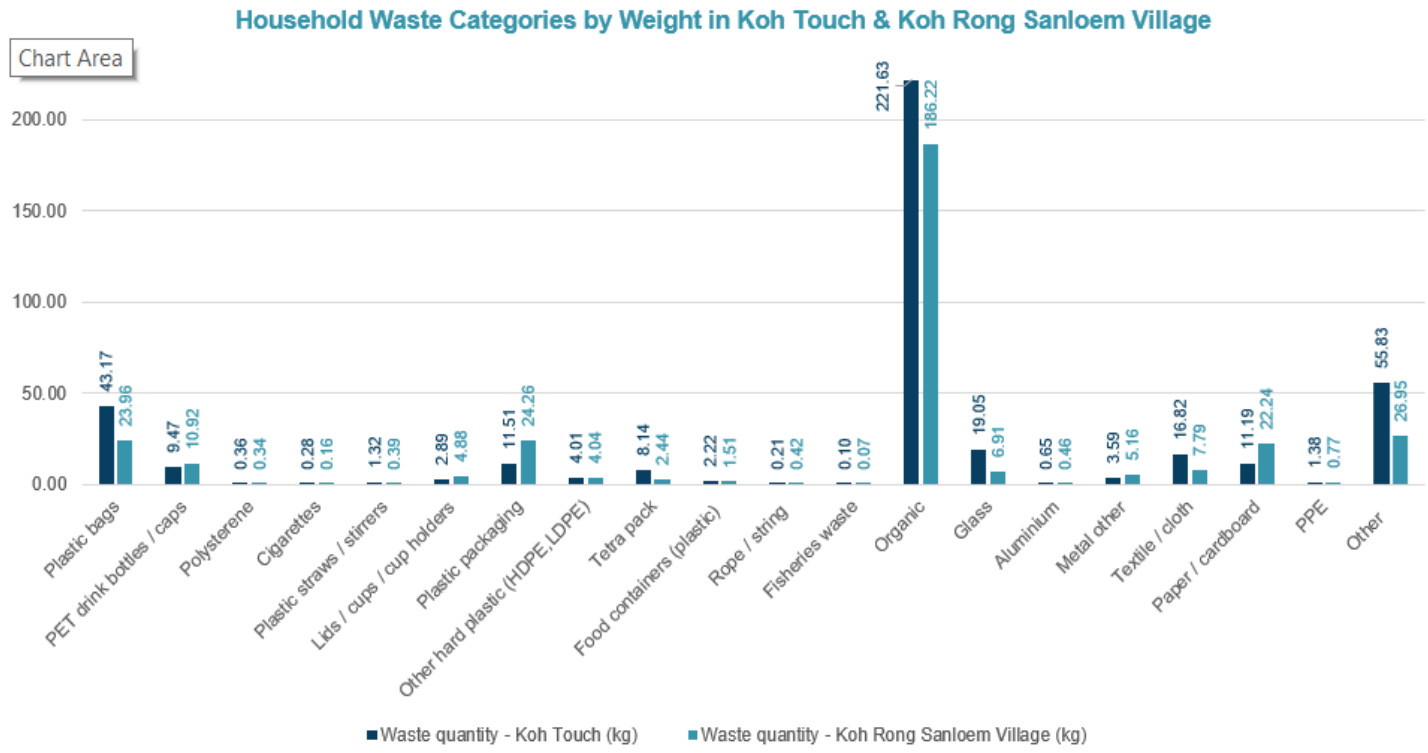
Graph 5. Projected waste generation by source focusing on tourism sector and HH waste in the Koh Rong Municipality

5.2.2 Waste Characterization

Household Waste: The majority of the HH waste generated was found to be either compostable (67%) or recyclable (9%) (by weight). Whilst the amount of recyclable waste is low, it is noted that very little aluminium was found in HH waste (0.15%), which is attributed to the fact that HHs separate aluminium waste for sale to the Etchay (waste pickers). This speaks to possible opportunities for informal sector engagement and recycling interventions in the KRMNP. Organic waste made up 52% of the total HH waste sorted across both sites (by weight), not surprising given the high-water content of organic waste. Again, this speaks to the possibility of community-based composting programmes. Plastic waste accounted for 30% of the total HH waste sorted, which is considerable given the light weight of most plastics. In Koh Touch, the three highest-weight waste categories for HHs were: organic waste (54%), used diapers (12%) and plastic bags, including pieces of bags (10%). Similarly, in Koh Rong Sanloem Village, the three highest-weight waste categories (by weight) for HHs were: organic waste (56%), plastic bags, including pieces (7%) and plastic packaging (7%) (see Graph 6 for more details).

The total amount of PPE sorted at both sites represented less than 0.3% of waste (roughly 2.15 kg in total), which was much lower than anticipated. It should be noted that, across the two sites, the use of face mask as a protective measure against COVID-19 was observed to be relatively low as both the sites had all been fully vaccinated at the time of data collection and in general there appeared to be a relaxed attitude among the local communities toward the use of PPE to protect against COVID-19.

30% of HH waste was plastic, which is considerable given the light weight of most plastics.



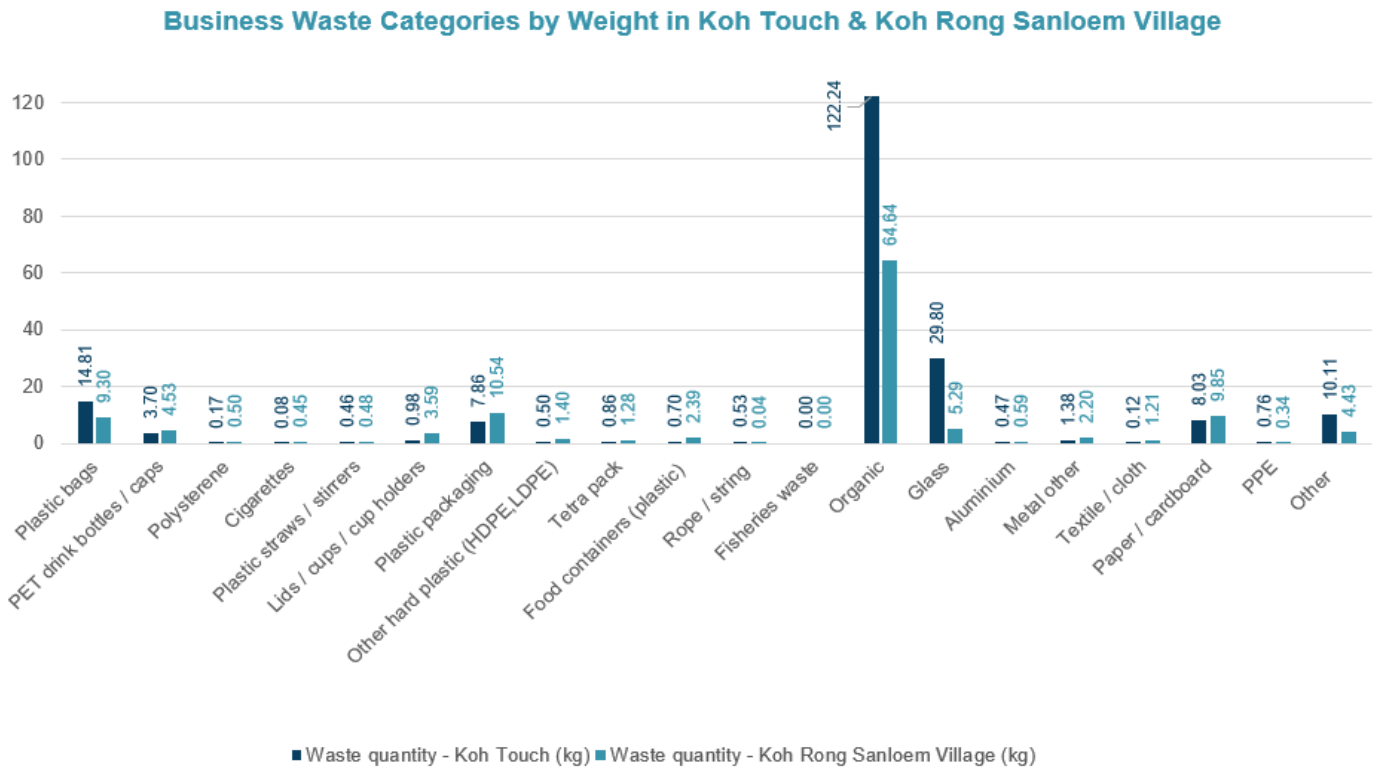
Graph 6: Koh Touch & Koh Rong Sanloem Village HH waste quantities by category (by weight, kg)

Business Waste: The majority of the business waste generated was found to be either compostable (64%) or recyclable (16%), and as with HH waste very little aluminium was found (0.33%) (by weight). The majority of waste across both sites was organic, making up 58% of the total waste sorted. Plastic waste was the second most common, comprising 23% of the total waste sorted. Again, this is significant, given the generally light weight of plastic. A total of 1.1 kg of disposable face masks was sorted from business waste across both sites.

23% of business waste was plastic - the second most common category, after organic waste.

In Koh Touch, the three most common waste categories (by weight) for businesses were: organic waste (61%), glass (15%) and plastic bags, including pieces of bags (7%). It is important to note that there were two groups of tourists (not exceeding 10 people per group) present for two days during the Koh Touch data collection. In these two days alone, around 92% of the total glass waste was generated, being mostly Tiger brand beer bottles. This suggests that the presence of tourists greatly impacts both the amount and type of waste generated by businesses, although further study is needed to validate this. In Koh Rong Sanloem Village, the three most common waste categories (by weight) for businesses were: organic waste (53%), plastic packaging (9%) and paper and cardboard (8%) (see Graph 7 for further details).

Credit: Bianca Roberts / FFI



Graph 7: Koh Touch and Koh Rong Sanloem Village business waste quantities by category (by weight, kg)

5.2.3 Plastic use behaviours

Households: According to the survey results, daily shopping for food and other goods was the most common reason for plastic use and plastic waste generation by HHs across both study sites. When speaking of plastic use, respondents focused exclusively on plastic bag consumption and made little mention of other plastic products consumed in their households until prompted. 61% of all Koh Touch respondents and 76% of all Koh Rong Sanloem Village respondents spoke to the use of plastic by retailors, explaining that when shopping for food, drinks or other goods at the market, food or retail store, their purchases were always placed into plastic bags. This was supported by the business surveys, in which retailors (18% in Koh Touch & 21% in Koh Rong Sanloem Village) reported that plastic bags are needed to package products sold to customers. Moreover, a small proportion of respondents (5% in Koh Touch & 1% in Koh Rong Sanloem Village) reported that their plastic waste included packaging of goods bought and delivered from the mainland.

Households were asked what type of plastic products they depend on to meet their subsistence needs, and how essential these products were to meeting those needs. In Koh Touch, 72% of all respondents said that their HH depends on one or more plastic product. These plastic items were deemed to be an essential part of ensuring HHs could meet their daily food and water needs. Whilst the majority of HHs reported relying on one or more plastic product, nearly one third (28%) claimed they did not depend on any plastic products. For HHs relying on one or more plastic product, bags were considered the most essential item (75%), followed by portable bottled water (31%) (sized 350ml, 500ml or 1.5L), large bottles of water (16%) (20L), food containers/wrapping (9%), cutlery (3%), cups (3%) and straws/drink stirrers (3%).

In Koh Rong Sanloem Village, 70% of all respondents reported their HH depends on one or more plastic product to meet they daily food and water needs, whilst 30% said they do not rely on any plastic products. As in Koh Touch, plastic bags were considered most essential by HHs who depended on one or more plastic product (100%), followed by portable bottled water (28%), cutlery (3%), cups (3%) and

straws/stirrers (3%). Large bottles of water (20L) and plastic food container/wrap were also used, but were less frequently mentioned than in Koh Touch.

It is worth noting that, except for the large, 20L bottles of water, all the plastic products listed above are single-use plastics (SUPs), for which alternative materials and models exist. When buying the large bottles of water for drinking, HHs pay US$5 for the first bottle of water and then, upon returning the empty bottle to the retailer, pay only US$1 for a refill. This scheme, also called “Thkk Sa’at” or “clean water” in English, is common throughout Cambodia.

72% of respondents advised that their HH depends on one or more plastic product to meet their daily needs.

Businesses: Business respondents were asked what types of plastic products were used or purchased daily in their businesses. The survey results indicated that the majority of businesses across both study sites commonly used or sold a number of plastic products. *In Koh Touch,* plastic bags were the most commonly used or purchased plastic product in surveyed businesses (60%), followed by portable bottled water (53%), cups (53%), food containers/wrapping (47%), straws / stirrers (40%), cutlery (33%), other bottled drinks (soft drink/juice/etc.) (20%). Large bottles of water and polystyrene boxes (used for carrying meat, seafood and/or vegetables) were also used and or purchased (7%).

In Koh Rong Sanloem Village, portable bottled water was the most commonly used or purchased plastic product in surveyed businesses (58%), followed by plastic bags (50%), plastic food container/wrap (29%), bottled drinks other than water (21%), cutlery (21%), large bottles of water (14%), straws/stirrers (14%), and cups (7%). Here it is critical to note that two (14%) of the surveyed businesses in Koh Rong Sanloem Village reported not using any plastic products at their businesses. Instead, they employed eco-friendly approaches, such as using biodegradable takeaway food containers (i.e., made from bamboo or paper), using large bottles of water to allow customers to refill their water bottles as needed, and/or using glassware and metal cutlery when serving dine-in guests. However, as reported by a number of respondents, these businesses tended to be foreign-owned and/or cater to foreign tourists who reportedly prefer not to use SUP products.

The majority of businesses commonly used a number of plastic products, including, plastic bags, bottled drinks, food containers, cutlery, cups, and straws/stirrers.

Respondents who owned accommodation businesses were also asked to estimate how much on average their guests used the aforementioned plastic products per day. Not all respondents provided the number for unspecified reasons. However, for those who did, the findings are summarized in the following table. In general, the average amount of plastic consumption per guest per day in Koh Rong Sanloem Village appeared to be twice as high as that in Koh Touch.

Table 6. Estimation of Plastic Product Consumption per Guest per Day

Plastic Product	Koh Touch Village	Koh Rong Sanloem Village
Plastic bag	1 bag	2 bags
Portable bottled water (350ml, 500ml or 1.5L)	1 bottle	2 bottles
Bottled soft drink/juice/etc.	1 bottle	2 bottles
Big bottled water (20L)	N/A*	N/A*

Plastic food container/wrap	1 food container	2 food containers
Plastic cutlery (spoon/fork/knife)	1 cutlery	2 cutleries
Plastic cup	1 cup	1 cup
Plastic straw/stirrer	1 straw/stirrer	2 straws/stirrers

*As described above, large bottles of water (20L) are typically re-filled after the water is consumed.

5.2.4 Brand Audit, Water Supply & Plastic Use in the KRMNP

To build upon past scoping studies, support the recommendations and solidify field observations, a small-scale brand audit of PET bottles was carried out as part of the waste characterisation study. Households were found to be the main generator of PET bottle waste, producing 71% of this waste type; with businesses generating 29% of PET bottle waste.

Of all the PET bottle waste, 63% of bottles were Cambodian brands and 2% were imported brands. This presents opportunities for increased accountability of Cambodian bottled drink companies, such as Extended Producer Responsibility (EPR) schemes or bottle return schemes. The most common brands of PET bottle waste were Cambodia Water (37% of all PET bottles) and Vital (12%) and Samphois (10%).

The majority (80%) of PET water bottles were less than 500ml in size, which suggests that HHs purchase multiple small bottles of water to drink each day. Anecdotal evidence suggest that people prefer to drink smaller bottles of water because they prefer cold water (49). As set out in Section 5.2.3 (above), portable bottled water (i.e. sized 350ml, 500ml or 1.5L) and large (20L) bottles of water are considered essential to meet the daily subsistence needs of HHs at both study sites. Despite HHs using the large, refillable bottles of water (or “Thhk Sa’at”), the brand audit suggests that people still buy small bottles of water each day to drink, supporting the anecdotal evidence that people prefer cold water or perhaps that people simply aren’t in the habit of refilling reusable bottles to carry with them during the day.

Findings from the brand audit and plastic use study evidence that water security challenges lead to increased plastic consumption & heightened reliance on plastic in the KRMNP. Surveys in the KRMNP found that spring water is the main water source used by HHs and businesses (though did not differentiate between types of water usage, for example, drinking, washing, and so on). Tourism business operators, such as hotels and restaurants, were found to be the biggest consumers of water in the archipelago. Further, the spring water source in Koh Touch usually faces shortages from March to April, relying on sources in neighbouring Deum Thkov Village to bridge the supply gap. The spring water sources in Koh Rong Sanloem Village and Saracen Bay provide adequate supply of water year round. Groundwater is a secondary water source in the KRMNP, supplying hotels and guesthouses as a standalone water source or combined with piped water during shortages or peak season for tourism. Groundwater is not preferred by consumers due to its high iron content, which gives the water a bad taste, also leading to bottled water consumption. To reduce reliance on bottled water, improvement of the piped water supply in the KRMNP is needed.

Credit: Bianca Roberts / FFI

5.3 Research Component 2. SWM System Assessment

Despite Cambodia's rapid development and economic growth, the infrastructure, capacity and resources for waste management remain limited, especially at logistically and contextually challenging coastal and island locales, such as the KRMNP (51-54). The amount of waste produced annually in Cambodia is increasing in line with economic growth, presenting a challenge to already overburdened systems; and it is estimated that the majority of Cambodia's waste is not processed through formal systems (50,55-59). Whilst political will and enthusiasm to reform SWM systems is strong across the private, public and third sectors, and governance around Solid Waste Management (SWM) has evolved, gaps remain. Solid waste management in KRMNP faces similar challenges to other coastal and island sites in Cambodia. Limiting factors include logistical complexities, infrastructure limitations, capacity and resourcing shortfalls, limited markets to support circular economy (CE), high overhead and operating costs, and low fee payment that reduces profit margins and disincentivizes improved service provision by formal actors. The assessment of the SWM systems in the KRMNP found that the current informal and ad hoc systems are unsafe, inadequate and unsustainable. In the KRMNP, no formal waste collection services exist; rather, private individuals at some sites are paid to transport waste to the mainland (Sihanoukville) for a fee (Table 7). There are currently few waste separation activities, no door-to-door collection services, and no recycling facilities, with the exception of aluminium cans, which are sold to the Etchay.

The KRMNP Waste Cycle

Few government-managed activities exist, all without formal collection contracts, though the KRA municipality receives funding from the Ministry of Environment (MoE) and/or the Ministry of Agriculture, Forestry and Fisheries (MAFF) totalling 156 million riels (~US$38,000) per annum to support SWM, which is utilised to organize community and beach clean-up activities.

Table 7. Snapshot of SWM in KRA Municipality (Source: KIIs)

Category	Number
Amount of waste generation	5 – 8 tonnes/day (pre-pandemic, as reported by KRA municipality)
Informal Collector	Self-transport to collection/disposal points: informal recycle collection; informal boat transport by two waste collectors
Collection fee (US$/month)	It is included in goods shipping: - Restaurant: US$150 - Ingredient shop: US$80-90 - Pharmacy: US$30
Disposal site	None; Incinerator; Dumpsters at Tomnub Rolok port (for transport to mainland landfill)

5.3.1 Overview of Waste Flows

Households: In Koh Touch, the vast majority of respondents (93%, n=41) of all respondents (n=44) disposed of their HH waste once a day or a few times a week. The most common methods of waste disposal were using the informal waste service at the piers (63% of all respondents), self-burning of waste (61% of all respondents), and selling recyclable waste (mostly aluminium cans) to the Etchay (54% of all respondents). Other waste disposal methods included burying the waste (25%), throwing waste directly into the sea (around 5%), and dumping waste in one own's backyard (2%).

In Koh Rong Sanloem Village, around 70% (n=38) of all respondents (n=55) disposed of their HH waste once a day or a few times a week. The most common methods of waste disposal were selling recyclable waste to the Etchay (81% of all respondents, again mostly aluminium) and disposing at the community dumpsite for incineration (76%). Other methods included burying the waste (16%), dumping the waste in one owns backyard (3%), throwing the waste on the beach or open land (3%), disposing of waste at the food of the hill (around 2%), and burning the waste at home (around 2%). No home composting was reported.

Businesses: In Koh Touch, the majority (87%) of all study businesses reported disposing of their waste once a day or few times a week. Interestingly, all the businesses surveyed (100%) reported using waste transport service at the piers to dispose of their waste, although 27% of these businesses also said they burned their waste.

In Koh Rong Sanloem Village, half (50%) of all the businesses surveyed said they disposed of their waste once a week, whilst the other half (50%) reported disposing of their week once a day or few times a week. Unsurprisingly, all the business respondents said they took their waste to the community's incinerator for burning. However, a small proportion (21%) of all the respondents also said they composted some of their waste (i.e., food/kitchen waste) to use for fertilizing their garden.

The below figures illustrate the SWM value chain for each village, with components detailed in the sections below.

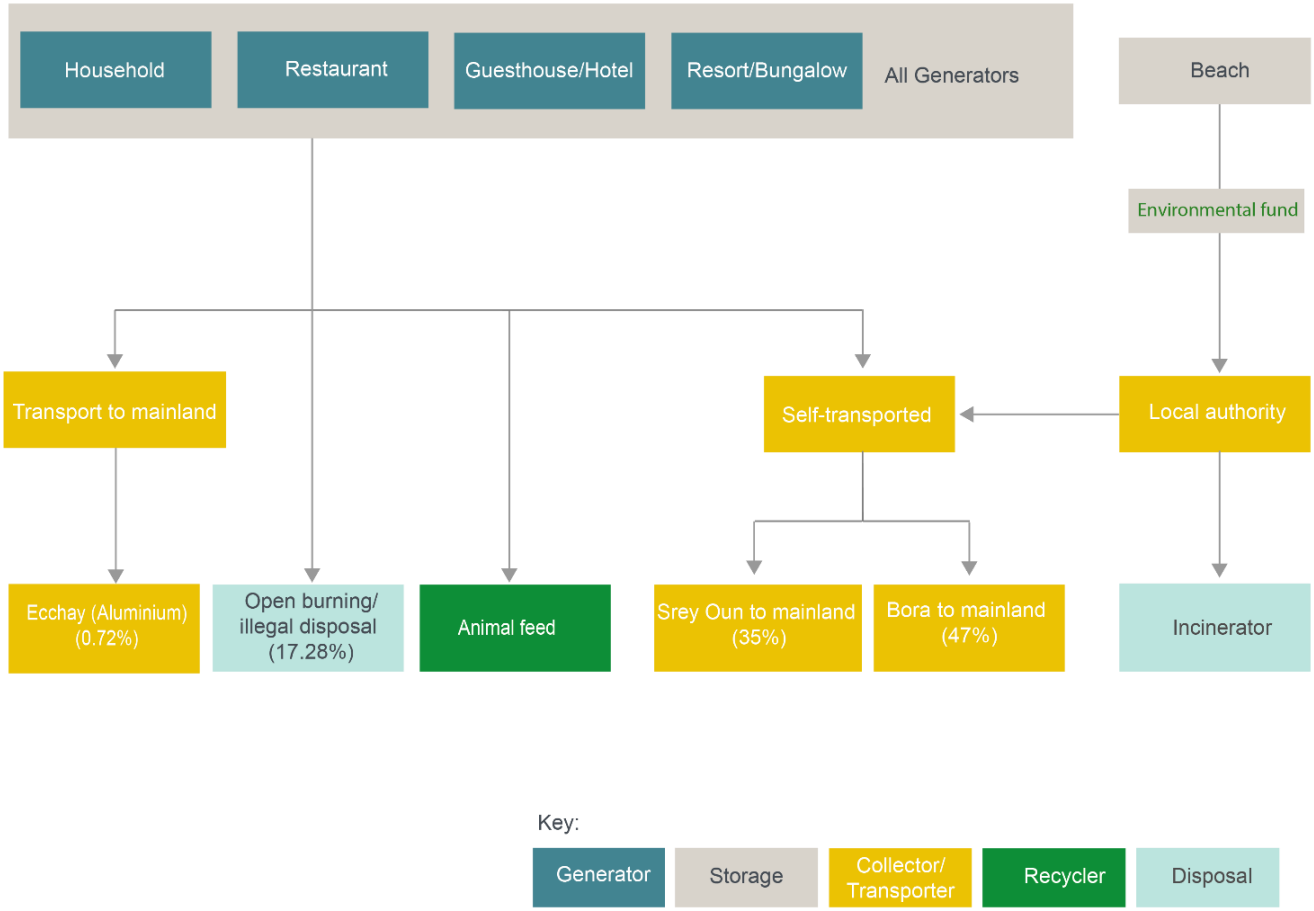


Figure 8. Flow diagram of SWM value chain in Koh Touch Village.

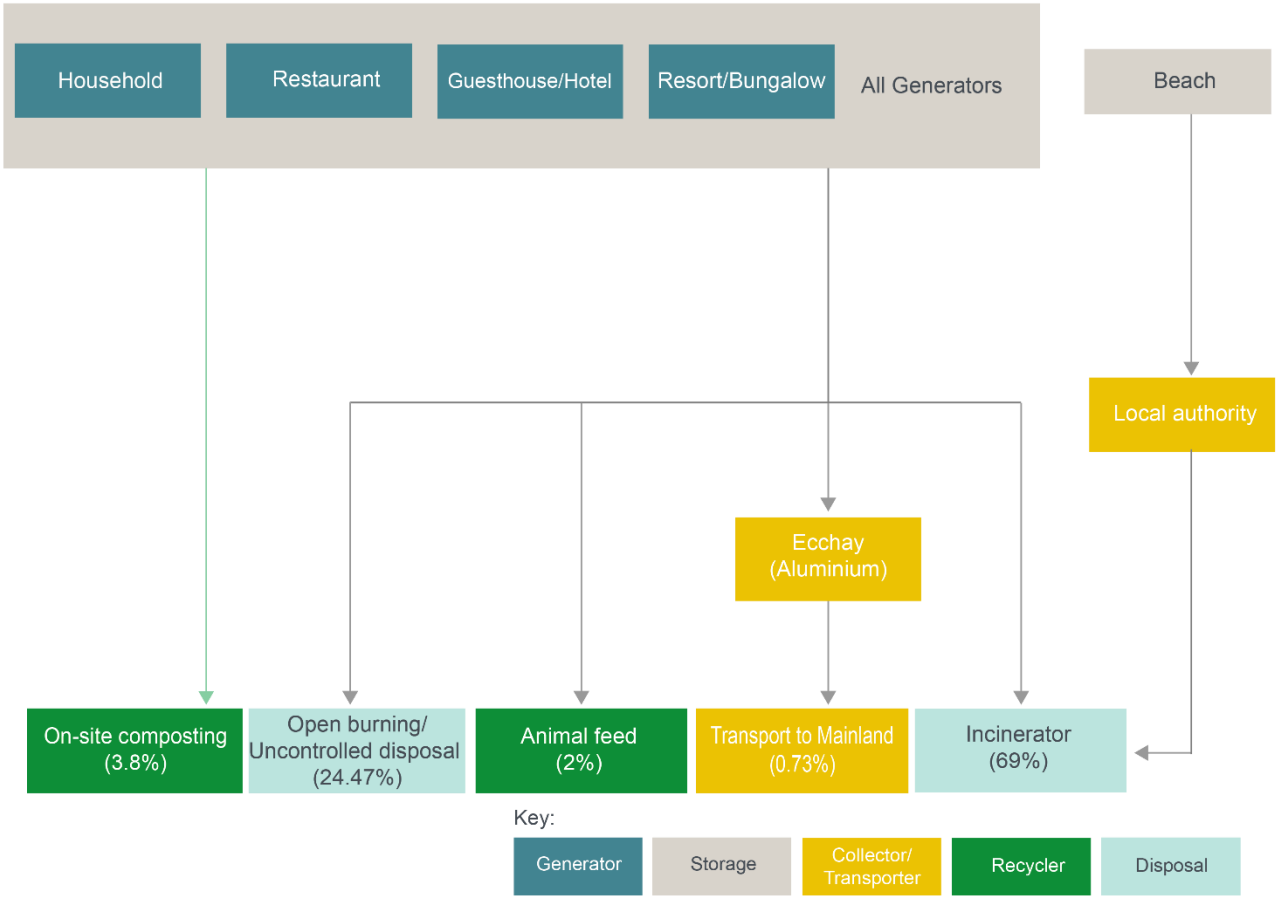


Figure 9. Flow diagram of SWM value chain in Koh Rong Sanloem Village.

5.3.2 Waste Separation

Households: According to HH survey results in both study sites, waste sorting and/or separation was practiced unevenly across these locales. In Koh Touch, only 18% (n=8) of all respondents said their HH sorted or separated their daily waste, whilst the other 82% (n=36) said their HH waste was not sorted or separated. In contrast, 70% (n=39) of all respondents in Koh Rong Sanloem Village said their HH sorted waste, whilst the other 30% (n=16) said no waste sorting/separation was practiced in their HH. Furthermore, respondents reported that their HH waste was sorted into more than one category. This unsurprisingly reflects the fact that HH waste was composed of different materials. In total, six waste-sorting categories were identified, which consisted of: for sale, for compost (food/kitchen waste), for giving away to others, for dumping/throwing away, for burning, and other.

In Koh Touch Village, 62% (n=5) of all HHs who sorted their waste (n=8) informed that they kept some of their HH waste for selling; 50% (n=4) said some of their HH waste was kept for giving away to others; 38% (n=3) kept some of their HH waste for dumping or throwing away; 25% (n=2) kept food and/or kitchen waste for making compost; and 25% (n=2) kept some of their HH waste for burning. Whereas in Koh Rong Sanloem Village, 87% (n=34) of all HHs who sorted their waste (n=39) reported that they kept some of their waste for selling; 74% (n=29) said they kept some of their waste for burning; 15% (n=6) said they kept food/kitchen for composting; 8% (n=3) said they kept some of their waste for giving away to other people; 3% (n=1) said they kept some of their waste for throwing away; and 12% (n=12) said they kept their food waste (that is, rice) for feeding their chicken or ducks. The type of waste HHs kept for selling was solely aluminium cans, including beers and soft/energy drinks, which were observed to be consumed on a regular basis and in considerable quantity in both study sites. Plastic waste sorting was found to be uncommon across study sites. In Koh Touch, only 2% (n=1) of all respondents (n=44) reported sorting plastic bags to reuse for waste containment, whilst in Koh Rong Sanloem Village none of the respondents said they sorted their plastic waste at all.

Businesses: Waste sorting was found to be widely practiced by businesses in both study sites, with 67% of all the businesses surveyed in Koh Touch and 79% of all businesses surveyed in Koh Rong Sanloem Village reporting that they sorted their business waste prior to disposal.

Like HHs, businesses reported sorting their waste into more than one category. In Koh Touch, the top three categories businesses used to sort their waste into were: 1) for selling (50%), 2) for dumping or throwing away (50%), and 3) for compost (30%). No businesses reported recycling (except compost and sale of aluminium to the Etchay) or reusing any of their waste. On the other hand, in Koh Rong Sanloem Village, the top three categories businesses sorted their waste into were: 1) for compost (63%), 2) for giving away to others (54%), and 3) for reuse (30%). Field observations suggested that reused materials include glass for water containers or decoration and plastic bags for waste packaging. Sorting waste into recycling was found at a smaller scale, with around 9% of all the surveyed businesses in Koh Touch and none of the surveyed businesses in Koh Rong Sanloem Village reported following this practice. Aluminium beer cans were primarily the waste type businesses kept for selling purpose.

Businesses in both study sites were also asked whether they sorted or separated their plastic waste. 20% of all businesses surveyed in Koh Touch and 29% in Koh Rong Sanloem Village reported doing so, although it was unclear how the sorted plastic waste was dealt with afterward or why these businesses decided to do so in the first place (as it was not part of the survey questions). For those businesses who reported not sorting their plastic waste, the main reasons for not doing so were lack of time and/or their view that such practice was unnecessary.

Separation of aluminium cans for sale to the Etchay, Koh Touch Village.

(Credit: Bianca Roberts / FFI).

5.3.3 Waste Storage

In Koh Touch Village, waste is generally packed in plastic bag, placed in basket/garbage bin and/or any type of available container (carton box, wood basket, foam box, zinc basket, rice sack, etc.) for transport to the collection point at the pier. Improperly packaged waste is highly likely to leak into the ocean, is susceptible to scattering from animal scavengers (rats, cats and dogs), and is off-putting for tourists. Neither pier has a proper waste storage or collection area. Instead the waste is piled along the edge of each pier for loading onto the transport boat, again suggesting a high likelihood of waste leakage from the pier or from transport boats into the ocean (see Figure 10). However, HHs and businesses are not allowed to dispose of their waste before 5 pm in order to avoid crowding the piers with heaps of waste and possibly disturbing tourists arriving at the island with the waste scene. In Koh Rong Samloem Village, waste storage was similar, with various containment devises being used for storing and carrying waste to the incinerator.

Regarding plastic leakage, recent studies in Sihanoukville and Kep estimated that roughly 2.0kg and 6.8 kg, respectively, leak into the ocean per person per year from uncollected waste (UN Habitat, draft, 2021[8]). This is in line with plastic waste leakage modelled in similar studies in the region (188), where it was estimated that 5kg per capita leaks into waterways in Southeast Asia. Based upon these studies and the findings herein, it is assumed that the leakage rates from HHs in the KRMNP are similar to Kep, with an estimated 7kg per year of uncollected plastic waste likely leaking into the ocean.

Despite being mandated by sub-decree 113, no public trash bins or other storage devices were found at the time of this data collection in either Koh Touch or Koh Rong Samloem Village, and trash of different kinds were observed in places such as streets, some beaches, vacant lands and waterways. Beach-clean and underwater debris removal activities take place in some villages. This, coupled with the absence of tourist visits, likely explains why some beaches appeared largely free of rubbish.

5.3.4 Waste Collection and Transport

A portion of the sanitation fund provided by MoE/MAFF (156 million Riels or US$38,000 annually) supports public services for waste cleaning and collecting in community and along the beach, as well as management of the incinerator in Koh Rong Sanloem Village (discussed below). The quantity of funds spent on collection are not clear, though little waste was observed on the beaches, likely due to this clean-up activity coupled with low tourism.

There are few private waste collection services for households and businesses on either island, and virtually no door-to-door services. Instead, “collection” is typically undertaken by households and businesses, who themselves deliver waste to transport service providers or disposal sites. Prior to the COVID-19 pandemic, the formal waste collection company, Kampong Soam Solid Waste Management (KSWM), based in Sihanoukville, indicated that these transport services delivered 4 tonnes of waste daily to Tomnub Rolok port in Sihanoukville, but this has since reduced to 2 tonnes/day. The findings from the household surveys concur: a number of HHs reported they no longer used this transport service as a result of their reduced income due to the pandemic.

This is entirely true for Koh Rong Samloem Village where no collection nor transport services exist, and households bring their waste to the incinerator. There are a few notable exceptions, though services are small in quantity, such as in nearby Saracen Bay where the collection is also operated by an informal collector. For businesses, the collector charges according to the size of the establishments. The collected wastes are transported to the mainland via the supply boat.

In Daem Thkov Village on Koh Rong island, there is presence of an NGO association called KRECA (Koh Rong Environmental Conservation Association). Fees are paid based on voluntary donation, thus making them unable to expand services to other areas of KRA as of now. KRECA sorts waste into three types: organic waste (for composting), recyclables (for reuse, recycle, incineration, or transport to mainland), and other waste (for incineration). They estimate that 45% of their collected waste is organic and 32% is plastic.

[8] UN Habitat Waste Wise Cities WaCT Study in Sihanoukville, presentation slides dated November 23, 2021 and UN Habitat Waste Wise Cities WaCT Study in Kep, presentation slides dated November 11, 2021

In Koh Touch Village, there are two privately owned waste transport services, which carry waste from the pier to the mainland. According to interviews with the waste collectors and local authorities, the current services follow a somewhat informal operation model. Neither of the waste collectors offer door-to-door waste collection, and all villagers and businesses (e.g., restaurants, resorts/hotels/guesthouse, etc.) are required to carry their waste to the collection point (pier) of the respective service provider they use. One of the piers is commonly referred to as Pier Bora, and the other is known as Pier 52. The monthly fee varies between US$20 to US$150 or US$1.25 per push cart (with a maximum loading capacity at 300 kg) at one disposal time. The below figure shows the flow of solid waste management in Koh Touch Village. There is no waste separation practice and recycling activities on the island with the exception of aluminium cans, which are sold or given to the Etchay.

Two to three times each week, the Koh Touch waste collectors transport the waste from their operating pier via shipping boats that also carry other goods to Tomnub Rolok port in mainland Sihanoukville (around 27 km from the island) where the waste is kept in an assigned dumper. The waste is not sorted or treated before disposal. KSWM then transports the waste (as it is collected from the island) daily for disposal at the city's dump site.

Common waste management practices include burning, burying & selling recyclable waste (mostly aluminum).

Photos showing waste awaiting transport to the mainland in Koh Touch Village. The high likelihood of waste leakage from waste collection points (i.e. piers) and transport boats is illustrated (credit: Hoklis Chhay / GRET).

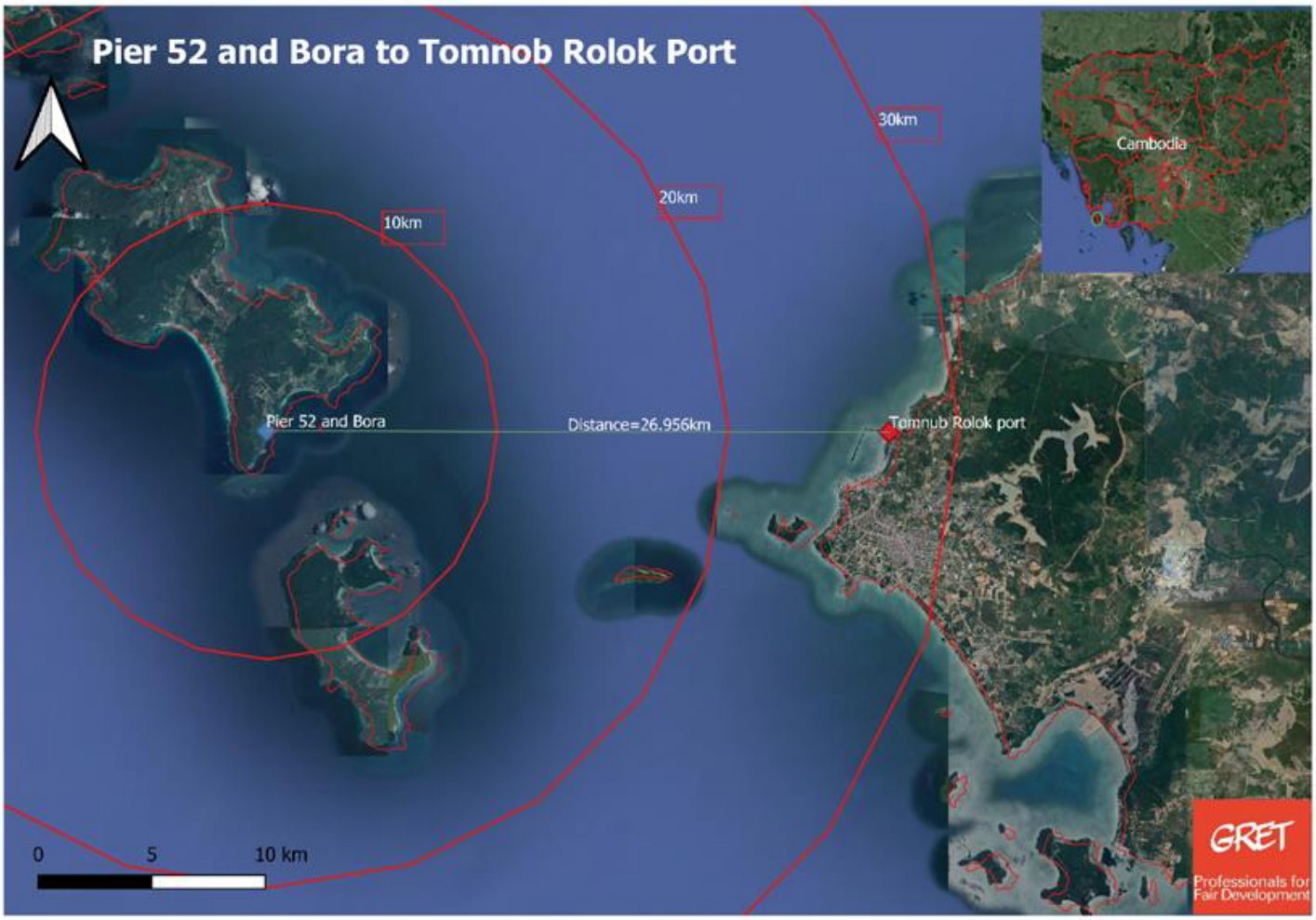


Figure 10. Location and distance from collection point to Tomnub Rolok port in Sihanoukville

5.3.5 Waste Disposal and Treatment

Koh Touch is absent of centralized disposal and treatment, but the waste transported to the mainland finally rests in the city dumpsite. Sihanoukville's "landfill" in an open dump site that is located around 30 km away from the city center. Currently, all the waste disposed at the landfill is burned on a daily basis to reduce the amount of new waste accumulating there. The landfill is also reported to be an active site visited by waste scavengers who collect aluminium for sale.

In Daem Thkov Village, there are two Incinerators with capacity of 1 tonne/day. These incinerators were provided by the MoE and are now managed by the commune. At the time of the study, neither incinerator was operational for reasons including: lack of funding, the incinerators being too old to operate efficiently, and limited access to the incinerators as the dirt roads there were flooded by seasonal rains. As mention above, KRECA provides collection service for business sector in this village and separates collected waste into three types (i.e., food waste for making compost, beach waste for making compost and burning in the incinerator, and plastic waste for reuse and recycling).

In Koh Rong Sanloem Village, residents and business establishments carry their waste to the incinerator, where it is burnt free of charge. The incinerator was provided by the MoE in 2019, following a request from the Commune Chief. It is located near Koh Rong Sanloem primary school and at a distance of around 200 metres from the main beach. At the time of the study, there was one male staff employed with a monthly salary of US$150 by the commune authority to operate the incinerator. According to the commune authority, there is currently a shortage of both staff and capacity to operate the incinerator. As a result, once the waste is burned, the ash is usually left to pile up next to the incinerator itself (see pictures below). It is unclear how the waste ash is managed afterward, although

it is likely that the ash is further disposed of on open lands nearby. This presents a risk to the residents and the environment, given that soot and solid ash from burnt plastic waste (especially at low temperatures) possess a high potential of causing health and environmental harms (183).

Reportedly all waste, except for glass, is burnt in the incinerator. Staff operate the incinerator from 6 A.M. to 5 P.M., using wood as the primary fuel source. However, incineration does not take place daily but only when there is a lot of waste accumulated at the site. Due to the lack of collection services, those who live far from or who cannot carry their waste to the incinerator manage their waste by open burning and/or by burying or composting food waste or using scrap to feed animals.

There are no public waste bins seen on the beach or other public spaces, and the presence of litter observed in the community, including in waterways, suggests open dumping is likely common, despite this practice being illegal and banned under Cambodian law. During the course of the study, researchers witnesses large plumes of smoke coming from the incinerator, which could get carried away by wind and settle all over the community, posing a threat to the health of residents and the environment since burnt plastic is known to release toxic gases and known carcinogens like Dioxins, Furans, Mercury and Polychlorinated Biphenyls into the atmosphere (183). There are no waste recycling facilities on the islands, though as discussed above, some HHs and businesses compost their food waste, and some businesses reuse glass and restrict plastic waste by reducing plastic use.

Incinerator in Koh Rong Sanloem Village (Credit: Hoklis chhay / GRET)

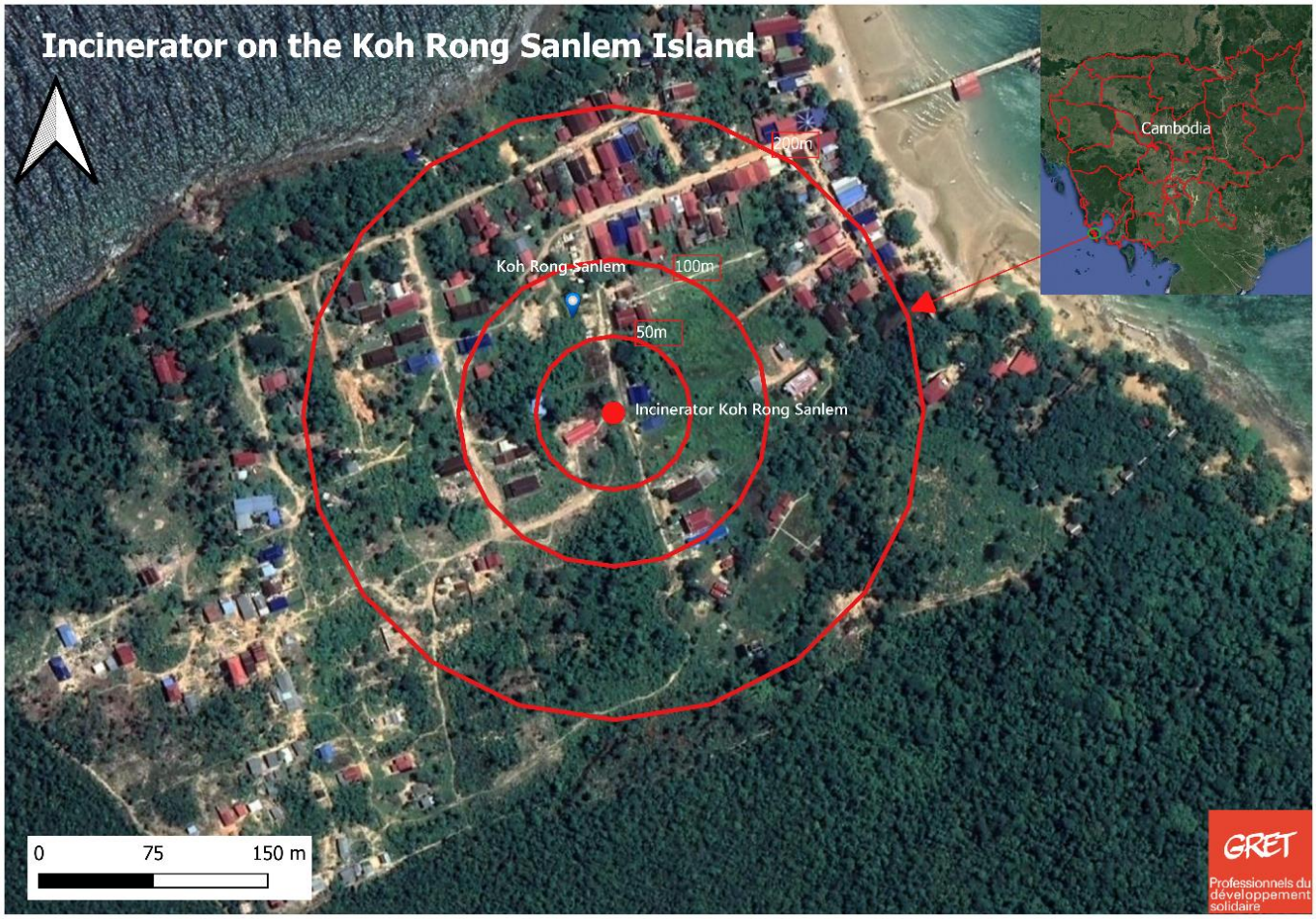


Figure 11. Location of incinerator in Koh Rong Sanloem Village.

5.4 Collected & Uncollected Waste

Collected and uncollected waste can be estimated based on the total amount of waste generated (by weight) by each waste generator and the total amount of waste (by weight) deposited at the final collection or disposal site. Household and business survey data, as well as KII data provided by local authorities and waste collectors, were used to make the estimation (as these data offered a more holistic picture of waste generation, collection and disposal in the two villages not only during but also before COVID-19).

The collected waste in each village represented the sum of all the waste deposited at the final collection point (the two piers in Koh Touch Village, and the incinerator in Koh Rong Sanloem Village). Whereas the uncollected waste represented any remaining waste out of total generated waste that HHs or businesses disposed of using disposal methods other than waste collection service (and was calculated by subtracting the amount of collected waste from the total amount of generated waste in each village).

Likewise, the amount of collected and uncollected waste was estimated based on the types of waste disposal methods obtained in the HHs and business surveys. In Koh Touch, before COVID-19 the amount of waste collected or deposited at the two piers was around 915kg per day (280kg of which came from HHs and 635kg of waste from businesses). The amount of uncollected waste was then around 180kg and 20kg from HHs and businesses, respectively (see Table 8). Most of the uncollected waste belonged to HHs who did not use waste collection service, whilst the businesses mainly reported using waste collection service to dispose of their waste.

According to the survey findings, uncollected waste was then disposed of using methods including: self-burning the waste (61% of all respondents), selling sellable waste (i.e., aluminium-type waste such as

beer cans) to the Etchay (54%), burying the waste (25%), throwing waste directly into the sea (around 5%), and dumping the waste in their backyard (2%).

In Koh Rong Sanloem Village, the total amount of waste collected or deposited at the incinerator before COVID-19 was estimated at 475kg per day (130kg of which came from HHs and 345kg of which came from businesses). The amount of uncollected waste was around 210kg per day (585kg total minus 475kg of collected waste) (see Table 8). Around 88% (185kg) of the uncollected waste belonged to HHs and the other 12% (25kg) to businesses.

Findings from the HH surveys illustrate that uncollected waste from HHs in Koh Rong Sanloem Village was then disposed of using one of these methods: selling sellable waste (i.e., aluminium-type waste such as beer cans) to Etchay (81% of all respondents), burying the waste (16%), dumping the waste in their backyard (3%), throwing the waste on the beach or open land (3%), disposing the waste at the foot of the hill (2%), and self-burning the waste (2%). The uncollected waste from businesses in Koh Rong Sanloem Village was mainly food waste, and a small proportion (21%) of all business respondents kept this waste for making compost or fertilizer.

During the COVID-19 pandemic, 395kg/day of waste is carried to the two piers whilst 155kg/day of waste remains uncollected on the island in Koh Touch Village. In Koh Rong Sanloem Village, about 84kg/day of waste is taken to the incinerator and 91kg/day is disposed of illegally or composted as shown in Table 9.

Table 8: Estimated amount of collected & nncollected waste in Koh Touch & Koh Rong Sanloem villages, pre-COVID-19

Waste Generator	Koh Touch Village			Koh Rong Sanloem Village		
	Estimated amount of waste generated	Estimated amount of waste deposited at the two piers	Estimated amount of waste uncollected	Estimated amount of waste generated	Estimated amount of waste deposited at incinerator	Estimated amount of waste uncollected
Households		280	180		130	185
Businesses		635	20		345	25
Total	**1,115 (kg/day)**	**915(kg/day)**	**200(kg/day)**	**585 (kg/day)**	**475 (kg/day)**	**210 (kg/day)**

Table 9: Estimated amount of collected & uncollected waste in Koh Touch & Koh Rong Sanloem villages, during COVID-19

Waste Generator	Koh Touch Village			Koh Rong Sanloem Village		
	Estimated amount of waste generated	Estimated amount of waste deposited at the two piers	Estimated amount of waste uncollected	Estimated amount of waste generated	Estimated amount of waste deposited at incinerator	Estimated amount of waste uncollected
Households		245	155		65	90
Businesses		150	0		19	1
Total	**780 (kg/day)**	**395 (kg/day)**	**155 (kg/day)**	**355 (kg/day)**	**84 (kg/day)**	**91 (kg/day)**

5.5 Research Component 3. Assessment of socio-economic impacts of mismanaged waste on local communities and economy

Results of from both the surveys and KIIs revealed that as a major island destination for tourists, the KRMNP is highly susceptible to the presence of mismanaged solid waste. As one key informant explained, “because of COVID-19, the number of tourists [visiting] is low…but in the future when there is increase in the number of tourists, it requires good [solid waste] management and beaches must be clean to attract tourists.” Such explanation not only highlights the importance of having adequate SWM

in place to cope with the amount of solid waste generated on the archipelago, but also speaks to the potential impacts mismanaged waste can pose to the local communities and economy. In fact, survey results showed that in Koh Touch village, the vast majority of all study respondents (90% of HHs; 100% of businesses) expressed concern about mismanaged waste in their community, and all of them consistently pointed to the possible decline of tourist visits and thus their source of income when the beaches and local environment were filled with trash. However, when looking at this concern at village leve, in Koh Rong Sanloem village, 60% of HHs were not concerned about mismanaged waste, whilst 85% of businesses were concerned. This indicates a misalignment between understanding of waste impacts: businesses universally consider mismanaged waste a threat, whilst other generators, like HHs, fail to understand the potential impacts on the archipelago's main source of economic activity, namely tourism. This indicates a lack of awareness, particularly among HHs, about how mismanaged waste can impact livelihoods.

In a companion report focused on island-based tourism (187), links between SWM are reviewed through an analysis of tourist reviews regarding KRMNP. A consistent theme that emerged was negative tourist reviews regarding litter and pollution and the impacts this had on cleanliness and aesthetics of the archipelago, as seen in some of the online comments by foreign visitors below:

"I will not recommend anyone to visit Koh Rong island the village and beaches closer to the village are extremely polluted with trash." (Comment mentioned online on January 2020)

"The number one issue we encountered was all the rubbish, and the questionable cleanliness of the water in the ocean. The beaches may look beautiful from a distance, but on closer inspection you can see litter washed up on the shore, bits of plastic floating in the water, and pools of black water trickling along parts of the beach." (Comment mentioned online on September 2019)

63% percent of HH respondents from both sites said they spent 10 minutes per day managing waste, whilst the remainder spent 30 minutes or more cleaning waste. One respondent in Koh Touch even reported spending up to 3 hours per day on waste management. Assuming a month of 24 working days and minimum wage of US$200 per month in Cambodia, minimum payment for working hours are roughly US$1 per hour. Around a third of respondents reported spending an average of 45 minutes per day on waste management due to lack of collection. This means that for one-third of households, there is roughly US$18 per month or nearly 10% income lost on waste management, which could be spent on other activities. This impact disproportionally affects women; roughly 72% of households reported women being the main managers of waste in the household.

Time spent by businesses on waste management is higher, with one-third (29%) spending only 10 minutes per day on waste management, whilst nearly half (43%) reporting spending 30 minutes per day and the remainder one hour or more. However, it should be noted that like tourism, waste washing up from the ocean is also reported as a seasonal occurrence. In particular, the tides bring a lot of waste in November and December, which also coincides with the dry, cool season and the beginning of the northern hemisphere tourism. Although the data collection did not take place during this time, one former manager of a resort located on a long stretch of beach noted that from September to December, they would hire staff for 12 man-hours per day only to collect waste washing up from the ocean. To use the same daily rates as above for 30 days per month for four months, it costs nearly US$1,500 during this period simply to manage waste.

Although direct impacts to the local economy were difficult to measure with the scope, available baseline data and budget of this study, according to some key informants, mismanaged waste on the KRMNP can negatively impact the local economy by necessitating the need to clean up public beaches littered with trash. It was reported that prior to COVID-19, there were two staff employed by the KRA municipality to clean beaches although the staff had discontinued their work because of the pandemic. Moreover, it was informed that "one to two campaigns [happened] every three months to clean waste along the beach" and "to raise awareness among participants, including students" to keep beaches clean. A large portion of the waste collected in these campaigns was reported to be "plastic bags," "[water/drink] bottles," "food packaging," and "fishing nets." Each campaign was said to cost one million riels, which included expenses on "[bottled] drinking water, refreshment and campaign banners" and were "participated [in] by 100 to 150 people." However, according to the same key informants, this cost did not take into account the cost of other materials (e.g., participant T-shirt) that were sponsored by the resorts and/or big companies. This means the total cost of each beach clean-up activity would likely

be higher than the amount provided. Taking a global look at economic impact, one study showed that for every dollar lost in from marine tourism in Asia due to mismanaged waste, it would cost US$0.89 to clean up – meaning US$0.11 could be earned on every dollar spent for clean-up activities (178).

Health concerns were also raised by respondents in both survey sites. Although none of the respondents reported they or their family members had thus far fallen sick from unsafe disposal (i.e. burning) of solid waste, particularly plastics, there appeared to be a strong consensus in their answers that such waste disposal practice can lead to "respiratory problems" by "inhaling toxic smoke." Most respondents were not able to estimate the cost of treatment; however, according to one respondent, it could cost "US$50 dollars" to visit the doctor to receive treatment. It is worth noting that in the absence of actual medical bills and records, it is not possible to verify if HHs would indeed spend the stated amount of money to treat any illness contracted through exposure to toxins from waste burning. Whilst such studies to quantify health impacts of mismanaged waste are limited, a WSP study from 2008 regarding the impacts of poor sanitation showed that economic losses were US$32 per capita, 42% (US$13 per person) of which are due to health costs (premature death, healthcare costs, and loss of productivity) – all elements of concern being related to mismanaged waste (179). Whilst many of these costs may be due to diarrheal disease and related illnesses from poor quality water, mismanaged waste has an additional health impact: illness from burning. A more recent study showed that loss of life expectancy from poor air quality in East Asia was nearly 4 years, and difficult though it is to attribute this entirely to burning of waste, it still indicates the dire impacts if practiced regularly by households or staff of poorly managed incinerators (177). In any case, this reported cost is likely an understated one when factoring in other expenses that would incur on HHs such as travel, accommodation and food, not to the mention the cost of time lost due to the illness or having to take care of sick family members.

Lastly, environment impacts of mismanaged waste were detectable across the study sites. Both observational and interview data suggested that the accumulated amount of waste from HHs and businesses could sometimes surpass the performance capacity of the local SWM infrastructure and waste collection service to handle it. This was reported to be certainly true before the outbreak of COVID-19 when the tourism sector was still performing well. Interview data also indicated that in one study site (Koh Touch), the majority of HHs and businesses had poor or ineffective practice of waste packaging, which often led to waste leakage on the piers (collection points) and possibly into the ocean. Both survey respondents and KII interviewees in this study site commonly expressed their fear of losing tourists, citing "smell" and "presence of [HH and business] waste" on the piers as a potential deterrent for tourists to not want to visit the island. It was explained that because waste collectors did not transport HH and business waste daily to the mainland for further disposal at landfill, the waste pile would frequently sit messy on the piers, creating unpleasant appearance and smell that can put off tourists the moment they stepped off the ferry. Importantly, this underscores the indirect impacts that mismanaged waste in the KRMNP can affect its marine ecosystems on which both the people and economy depend.

White Beach, Koh Touch Village
(credit: Bianca Roberts / FFI).

6. Synthesis of Key Findings: Gaps, Challenges & Opportunities

A number of gaps, challenges and opportunities have been identified through the data collected, which illustrates the context of SWM and land-based sources of marine plastic pollution in the Koh Rong Archipelago:

Challenge 1: Deficient or absent SWM paired with increasing waste generation: Despite Cambodia's rapid development and economic growth, infrastructure and administrative resources for waste management remain limited, especially outside of urban centers (51-54). A similar pattern is observed in the KRMNP where SWM services are deficient – relying on individuals without sufficient infrastructure, resources or capacity to enable safe management of waste. Findings from KRMNP suggest that as tourism sector returns following the global pandemic, the current SWM systems, which are insufficient to manage amount of waste generated even in this period of tourism downturn, will not be able to cope with the influx of waste generated as the recovering tourism sector. Projection of growth and recovery of the tourism sector following the pandemic (Section 5) illustrate that under the highest growth scenario, waste generation will rapidly increase to over 6.5 tonnes/day by 2030.

Challenge 2: Little incentive for service provision or for improving service provision: The Royal Government of Cambodia (RGC) is currently reviewing the agreements held with all private waste contractors in Cambodia, with the view to increasing the quality of service, transparency and accountability of these service providers. Interviews with private waste contractors highlight the contextual and logistical challenges of SWM in Cambodia, especially at coastal sites, and the impact this has on the profitability of their businesses. Informal and formal contractors speak to a number of challenges that undermine profitability, including difficulty establishing a skilled workforce, infrastructure limitations, difficulty in collecting fees from HHs, and high overhead costs. With informal and private sector waste contractors facing significant challenges, the important role of the public sector is emphasized: it is crucial that the RGC is supporting provincial and local authorities with sufficient resources to deliver SWM services to the KRMNP. This means that as part of establishing SWM systems in KRMNP there needs to be investment in infrastructure development, social and behavioural change campaigns and law enforcement supported by the RGC.

Challenge 3: High plastic consumption & reliance on plastic to meet subsistence needs: In Cambodia, the rate of plastic consumed is rising in line with the Nation's rapid economic and population growth not only in urban areas but also at coastal and island sites (64,65,67). Studies in KRMNP showed a high rate of plastic use and absent or deficient infrastructure and service provision, suggesting that reliance on plastic may be partly to meet water and food security needs. That is, some of the highest waste types (by weight) were plastic packaging and plastic bags, including those used for food and beverage transport to the archipelago. Further, the brand audit illustrated that HHs rely on bottled water to meet their daily potable water needs, specifically small 500ml bottles, with the majority being Cambodian brands. The small size of the bottles suggests people buy multiple small bottles of water to drink each day (as opposed to one large bottle). This supports anecdotal evidence that people prefer to drink cold water in the form of small bottles of refrigerated water from the shop (this has also been used as a rationale for failed water filter provision programmes in the islands). Across the two main study sites, around 70% of HHs reported depending on one or more plastic products, including plastic bottles and bags, as well as cutlery, straws and cups. Similarly, businesses across the study sites reported reliance on a number of plastic products, primarily plastic bags, portable bottled water (sized 350ml, 500ml or 1.5L) and large bottles of water (20L).

Challenge 4: Social norms surrounding disposal behaviours: In the face of absent or deficient SWM systems, individuals and businesses often have no alternative but to improperly dispose of their waste. As seen at other coastal and island sites, this often takes the form of open disposal or littering on land and/or open burning (which is also true in the KRMNP). Anecdotal reports also suggest that direct disposal into the ocean from leisure vessels, waste leakage from the pier and from waste transport vessels is also common. As set out above, waste separation and cleaning are uncommon in Cambodia, which makes some activities (for example, recycling) inefficient, hampers the potential of circular economy and leads to inefficiencies for the Etchay. Findings suggest that damaging disposal behaviours could in part be driven by lack of understanding of socio-economic impacts of mismanaged waste, particularly among HHs. Fee payment by HHs for waste collection services is also uncommon, hampering the profitability of waste collection services and demotivating improved service delivery.

Challenge 5: Contextual & logistical barriers at coastal and island sites, including infrastructure & socio-economic barriers: Moderate livelihood diversity and socio-economic status, remote and logistically challenging locales, limited infrastructure and increasing pressure on coastal and marine ecosystems all lead to heightened vulnerability for communities in the KRMNP, threatening their wellbeing. For example, socio-economic status and impact findings illustrated a moderate socio-economic status and possible changes in livelihood diversity, with numerous sites relying on the tourist trade to directly or indirectly support their income source – a sector now experiencing a significant downturn due to the global pandemic and at risk from deficient SWM systems, service and infrastructure limitations. Further, surveys showed that around one-third of respondents were not literate, suggesting that awareness raising and information collateral, training and SBC campaigns will need to be delivered in multiple formats via an array of channels to be effective. Infrastructure challenges including power cuts and poor roads mean that SWM activities such as waste collection and transport are logistically challenging and costly, especially during the rainy season.

Challenge 6: Risk of time and financial loss due to deficient or absent SWM: Significant time, and therefore income, is being spent on waste management due to deficient or absent SWM systems. A third of HHs - predominantly female HH members - are spending 45 minutes or more on waste management, resulting in an estimated loss of 10% of an individual's income. Businesses located on beaches also spend time on shoreline waste management, with one reporting spending 12 hours per day on beach cleans during the four months when the currents wash the most waste ashore; costing an estimated US$1,500 during this period. Finally, both HHs and businesses are concerned about future impacts, with 90% of respondents expressing concern about the impact of waste on the tourism sector, which underpins the incomes of many in the KRMNP. Whilst the economic impact was not measured, a global study found that for every dollar lost on tourism, it would cost US$0.89 to clean up mismanaged waste and invest in SWM infrastructure and planning, meaning there is a financial benefit to improved SWM. With the projected waste quantities expected to double or even triple in the coming decade, this represents a significant risk for the tourism sector and communities of the KRMNP.

Gap 1: Research and Information gaps: The World Bank & FFI's research is some of the first to investigate marine plastic pollution in Cambodia, and the information gaps are considerable. In addition to knowledge gaps surrounding marine plastic pollution sources, sinks and hotspots, FFI identified a number of opportunities for further study including:

- Mapping of marine litter pathways & leakage, including waste travelling via freshwater ecosystems or off-land in the KRMNP;
- Articulation of cultural and social norms to prompt lasting behavioural change that supports adoption of SWM systems and reduces marine litter and plastic pollution;
- Quantifying and characterizing waste generated by larger scale private sector actors, most notably from the construction and development sectors and marine fisheries, as a means to engage these actors in marine plastic pollution reduction and SWM strategies.

Gap 2: Limited capacity: A number of capacity gaps exist across key stakeholder groups, including:

- Technical skills required to assess, monitor and manage solid waste and plastic pollution, which is a focus for key government actors, including those leading on planning and monitoring to reduce marine litter; and community partners supporting data collection on marine litter;
- Impacts of plastic pollution environmentally, socially and economically, which is especially important to motivate behavioural change and participation in on-the-ground action by communities, private sector & local authorities;
- Understanding of governance frameworks (e.g. sub-decrees) and the means to operationalise these mechanisms, including for improved enforcement. This is essential for all actors across private, public & third sectors, as well as, communities; and
- Understanding of circular economy (CE) approaches and their potential benefits is important for government, including local authorities and those seeking to establish CE-driven micro, small & medium enterprises (MSMEs).

Opportunity 1: Underutilized governance frameworks: Whilst governance around SWM and plastic management has evolved over time and political will is strong among national and sub-national authorities, gaps remain and limited capacity, resourcing and enforcement mean existing governance mechanisms are rarely utilised to their full potential. Key Informant Interviews highlight there is limited awareness of the existing SWM and plastic management policies and legislation across various

ministries and levels of government. Barriers to implementation of existing governance instruments have been identified as:

- Limited technical capacity that prevents data collection and research, and hinders locally led solutions. This is especially pertinent in the case of contextually and logistically challenging sites such as the KRMNP;
- Limited inner- and cross-ministerial coordination & collaboration, of particular concern given the decentralised governance landscape. This is also a crucial consideration for enforcement activities in the KRMNP, with the MoE having the leading legal mandate but MAFF having the strongest on-the-ground presence, that is, enforcement activities will require significant cross-ministerial collaboration to be effective;
- Challenges surrounding transparency and accountability, which presents resourcing limitations and barriers to coordination and transparent management of cash flows related to waste management, including fees collected and penalties from enforcement activities; and
- Clear communication and intentional change management, including a lack of awareness among Government employees and other key actors of the existence of laws and regulations, and their particular roles within these. For the KRMNP this would need to focus on local authorities and private sector actors, including tourism business owners and large-scale construction & development projects.

Opportunity 2: Political momentum and enthusiasm: The bright spot on the marine plastic pollution agenda is the incredible momentum and enthusiasm across Cambodia to address this threat, which is now coming to the fore of both national and regional political agendas. The key to success will be collaboration and coordination of efforts, and ensuring that vulnerable stakeholders, including women and formal waste actors, are empowered and their voices heard. With regards to the KRMNP, it is crucial that these remote and isolated communities, local and provincial authorities, and other waste sector actors have a voice in sub-national and national fora and are supported to lead solutions. The enthusiasm of these coastal communities should be utilised and fostered to trial on viable, contextually relevant on-the-ground solutions.

7. Recommendations

The findings set out in this report have been synthesized to develop recommendations targeted at reducing marine litter and plastic pollution in the KRMNP. A detailed breakdown of the recommendation framework is set out in Annex IV of this report. Abbreviated below, the recommendations take into consideration the context of the KRMNP, as well as upstream interventions needed to realise site-based change. Further, to support strategic, productive collaboration, the following recommendations take into consideration key national strategies and emerging governance instruments, including The World Bank's report 'Solid Waste Plastics Management: Improving Financial and Environmental Sustainability in Solid Waste Management and Plastics' (draft, 2020). The following recommendations are proposed:

7.1 SWM System Establishment and Improvement Recommendations

- Recommendation 7.1.1. Improved residuals management that is safer for people and the environment.
- Recommendation 7.1.2: Investment in infrastructure, equipment & locally-led innovations that enable improved waste management, stemming marine plastic pollution in the KRMNP.
- Recommendation 7.1.3: Foster and empower local leadership, collaboration and planning between local leadership and formal private sector collection services.
- Recommendation 7.1.4: Engage and empower informal waste collection actors. And;
- Recommendation 7.1.5: Trialling & supporting circular economy MSMEs at coastal and island sites.

7.2 Institutional & Governance Recommendations

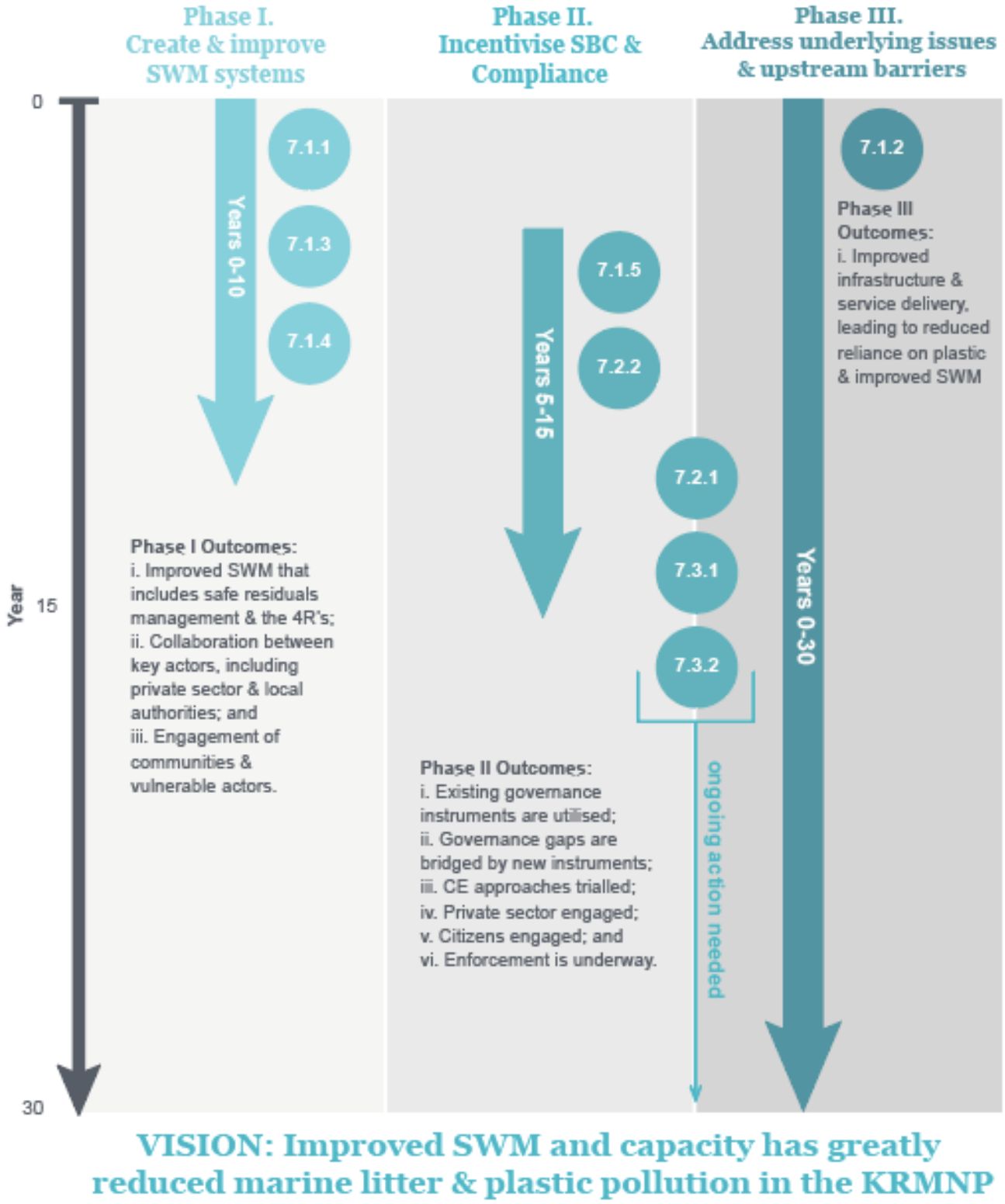
- Recommendation 7.2.1: Utilise existing governance instruments by articulating and addressing barriers to their implementation, including lack of capacity and enforcement.
- Recommendation 7.2.2: Develop new governance instruments that bridge gaps and target the most prolific and problematic plastics and hotspots.

7.3 Private Sector and Citizen Engagement Recommendations

- Recommendation 7.3.1: Engagement of private sector to foster accountability, with a focus on sectors that are most polluting of and/or reliant on coastal and marine ecosystems.
- Recommendation 7.3.2: Engagement of citizens to promote awareness and tools for improved waste management.

7.4 Timeframe for Recommendation Implementation

Based upon the above recommendations the following timeline has been developed including the outcomes and vision:



VISION: Improved SWM and capacity has greatly reduced marine litter & plastic pollution in the KRMNP

7.5. Priority Next Steps for Implementation

From the detailed Recommendations a set of priority next steps have been identified in the form of 1) critical governance actions, 2) a model for improved waste management in the KRMNP and 3) critical next steps for the tourism sector.

7.5.1 Critical Governance Actions

Strengthening governance is key to enabling local leadership and supporting buy-in of interventions to reduce marine plastic pollution, especially given Cambodia's decentralised governance landscape. As touched upon previously, enabling governance mechanisms exist and could be more fully utilised to reduce marine plastic pollution. The implementation and enforcement of existing legislation and regulations should be handled with contextual understanding and paired with capacity building. In other words, constituents should not be penalised for non-compliance with systems that do not exist or have been formalised with little or no investment in change management. Priority focal areas for strengthened governance are:

- capacity development of authorities, HHs and businesses to support uptake and implementation of existing legislation;
- ensuring different levels of government and ministries are collaborating and understand their own unique roles and responsibilities;
- ensuring that democratic and consultative approaches are adopted to enable local engagement, ensuring systems meet the needs of constituents; and
- establishing operational and administrative structures that support effective and transparent management systems.

7.5.2 A Model for Improved Waste Management & Reduced Marine Plastic Pollution in the KRMNP

Synthesising the above recommendations, a model for improved solid waste management & reduced marine plastic pollution in the KRMNP is set out below. This model is framed by a ten-year timeline: the priority next steps are those that are feasible to achieve in the next decade, assuming appropriate capacity and resourcing are available. Aside from the island-based solutions, this model also considers where certain types of waste or contextual consideration necessitate management solutions on the mainland coast. The model includes six components as set out below:

I. Plastic reduction: Reducing unnecessary and wasteful plastic use, thereby curtailing plastic waste and pollution generation, is viewed as a high priority recommendation. Whilst the subsequent actions are integral to minimizing marine litter and plastic pollution, they seek to manage and mitigate this threat rather than prevent it in the first instance. Reducing the volume of plastic used also supports the following actions, minimizing the burden on SWM systems and stakeholders. Whilst plastic pollution is a multifaceted threat, plastic products themselves deliver many benefits, especially to communities in the KRMNP with limited access to resources, infrastructure and essential service provision, such as clean water. As such the focus for plastic reduction needs to be on unnecessary and wasteful plastic products, especially SUPs. Priority next steps to reduce plastic use by communities in the KRMNP are:

- work with businesses & HH to increase uptake of plastic alternative materials and models through education and awareness raising and increased access to alternatives. This could include subsides and/or a small grants scheme to support the uptake of plastic alternative materials and models;
- restrictions or taxes on certain plastic products in key areas, e.g. bans or taxes on plastic bags at wet markets or shops (as supported by sub-decree 168); and
- Improved provision of goods and services that reduce the reliance on plastic products, for example, improved water supply to reduce reliance on bottled water.

It is noted that improved potable water supply is crucial to reduce reliance on plastic but is a much longer term outcome that necessitates significant investments in infrastructure. The complementary report titled, 'Koh Rong Marine National Park: Market Analysis and Demand Assessment for Sustainable Island Tourism' breaks down investment cost estimations and sets out a 30 year timeframe for increased water capacity in the KRMNP (187).

II. Promotion of waste separation, packaging & storage: As set out above, waste separation is a crucial step in improving SWM, enabling CE enterprises and supporting vulnerable actors, most notably the Etchay. It is recommended that HH and business waste be separated into three main streams:

1. *recyclables,* such as plastics and aluminium, for down-cycling into new products or sale by the Etchay;
2. *organic waste and other compostable*, to support organic waste composting at a HH level and/or by MSMEs or community composting centers (could be subsidized or funded by community grants scheme); and
3. residuals for co-processing on the mainland by ChipMong.

As part of promoting waste separation it is recommended that bins be provided by government or subsidised to foster waste separation behaviours at a HH and business level (per sub-decree 113). Further, training of HH, businesses and other key stakeholders will be critical to ensure viability of this new approach & support improved packaging of waste to reduce leakage during collection and transport. Simple & accessible options for improved storage to prevent waste leakage include:

- utilising bins;
- funding to establish waste banks at key locations in each village, starting with one trial location to test proof of concept in the KRMNP context. More specifically, this could take the form of recyclables banks, where separated waste could be compacted and stored until a sufficient volume is amassed for export and sale on the mainland. This would support economies of scale and profitability as well as ensure secure storage of recyclables, thereby reducing waste leakage. In particular, they could be placed and promoted near key tourism points (like piers) to encourage tourists to also deliver waste.
- funding to set up safe storage facilities that prevents leakage prior to transport, that is, designated, secure locations on land for HH and businesses to deposit their waste prior to transport to the mainland (rather than leaving waste on the pier from which leakage is highly likely);
- Safe storage during transport to the mainland, that is, securing waste on transport boats to prevent leakage into the ocean.

III. Improved waste collection: In order to reduce dumping and leakage from land and keep waste separated improved waste collection is needed. Ideally, waste collectors would be working with HH and businesses to ensure they are following waste separation and collection guidelines, for example, disposal into the correct bin. Training of waste collectors will be crucial to ensure waste is kept separate at the point of collection (waste collectors have been witnessed re-combining separated waste at the time of collection, rendering waste separation by businesses & HH irrelevant). To support collectors day to day, resourcing is essential, that is ensuring collectors have access to PPE, collection equipment and transport (pick-up trucks or tractors). Further, improved waste collection would see collectors working with other actors to support the SWM system as a whole, that is, waste collectors would engage with the Etchay, waste transporters and CE MSMEs to ensure the separated waste is directed as need through the waste value chain. Finally, models such as that used by Plastic Fisher could support collection of plastic debris from water bodies.

IV. Trial of Circular Economy (CE) MSME's for KRMNP: Improved separation and collection will lower overheads, supporting CE MSMEs to operate profitably. Further, new legislation that is currently in development is proposed to include tax cuts and subsidies to reduce operating costs for CE enterprises. Possible CE business models, based upon the local context & existing opportunities, are:

- Waste compaction to support the Etchay to transport a critical mass of plastics and other recyclables for sale, enabling them to reduce costs and maximise profits;
- Downcycling of plastic to produce new materials or products, focusing on those that reduce demand for plastics, for example, reusable boxes for transporting goods, eskies to keep water cold or roofing materials. On the Cambodian mainland global organisation, iDE, have down cycling enterprises that produce roofing materials from plastic waste; and
- Community composting enterprises or MSMEs.

V. Improved Disposal & Residuals Management: It is recommended that residuals be shipped to ChipMong for co-processing at their Kampot facility, given the volume of waste and safety of current incinerators operating in the KRMNP. ChipMong's high-temperature co-processing kilns meet EU Emissions standards, follow strict health and safety standards, and would utilize waste to generate energy. This option is particularly positive when paired with Recommendation 7.1.5 and 7.3.2, that is,

recyclable waste is separated for use by on-site circular economy MSMEs or community composting facilities, and any non-recyclable residuals are safely incinerated by the ChipMong facility at Kampot. This is of particular importance because the high water content of organic waste in HH and businesses waste may impede incineration at ChipMong, so separation & compositing of organic waste supports co-processing. Further, if recyclables are separated and utilised HH and businesses will pay less for incineration at ChipMong because the volume of waste is reduced. Priority type(s) of waste that should be transported and disposed of on the mainland are:

- non-recyclable plastics, especially as unsafe incineration poses threats to health from toxic chemicals when burnt at low temp / ash is toxic and enters the food chain;
- other non-recyclable waste.

VI. Increased enforcement & targeted SBC: To reduce damaging disposal behaviours, including by private sector, enforcement and long term social and behavioural change campaigns are needed. Step 6 of the model needs to follow systemic reform and creation of SWM systems. Training and equipping enforcement officers and government officials is a priority and should support the transparent management of funds. Further, fees collected should be channelled back into funding enforcement & community improvement activities to support sustainability. Enforcement activities should be launched iteratively, commencing with SBC campaigns & targeted education to ensure uptake of the new system and understanding of rules and regulations among businesses and HHs. Enforcement and community improvement activities (such as small grants schemes), could also be funded via the fees collected for entry to the KRMNP (187).

Estimated Costing for Improved Waste Management & Reduced Marine Plastic Pollution in the KRMNP

It is noted the below cost estimation assumes the entirety of the model would be implemented, including suggested options or options that may be funded via other mechanisms (e.g. government funding). Cost estimations are based upon a number of sources, including from reports and budgets for similar projects in Cambodia and neighbouring countries and current prices advertised online.

Activity	Quantity	Estimated cost ('000 USD)	References & Assumptions
Development of strategy & action plan in support of the model.	N/A	$25-$50	Based upon budgets of similar or past projects developing similar outputs.
I. Plastic Reduction			
Awareness raising to promote behavioural change that reduces plastic use;	5 year	$150 - $200	Based upon budgets of similar or past projects developing similar outputs.
Subsides / small grants scheme to support the uptake of plastic alternative materials and models	10 year	$125-$250	Based upon budgets of similar or past projects developing similar outputs.
Improvement to water supply services & infrastructure	~10 years (by 2030)	~$908	Based upon Recommendations in companion report (187).
II. Promotion of Waste Separation & storage			
Provision of public bins that support waste separation	10 bins for each area x 5	$4 -$7	Based upon Recommendations in companion report (187).
Awareness raising & education to promote waste separation and storage	5 years	$5-10	Based upon budgets of similar or past projects developing similar outputs..
Subsidies to support HHs and businesses to purchase bins that support waste separation	$10,000 worth of subsidies for each village X 5 villages	$50	Based upon budgets of similar or past projects developing similar outputs.
Funding to trial a waste bank in one village	1 village, 5 years	$20	Based upon budgets of similar or past projects developing similar outputs.

Funding to set up safe storage of residual waste prior to transport i.e., designated, secure locations on land for pick up by waste collector	5 villages	$1-$5	Based upon budgets of similar or past projects developing similar outputs.
Safe storage during transport e.g. securing waste on transport boats to prevent leakage into the ocean	2 current collectors	$1-$5	Based upon budgets of similar or past projects developing similar outputs.
III. Improved Waste collection			
Training of waste collectors to support waste separation & collection	$5,000 per village X 5 villages	$25	Based upon budgets of similar or past projects developing similar outputs.
Awareness raising & education to support waste collection & fee payment	5 years	$5-10	Based upon budgets of similar or past projects developing similar outputs.
Provisioning of waste collectors (i.e. PPE, collection equipment and transport)	$50,000 per village X 5 villages	$250	Based upon budgets of similar or past projects developing similar outputs.
Funding to support low-cost, low-tech methods to collect waste from water ways	$2,000-$5,000 per village X 5 villages	$10-$25	Based upon budgets of similar or past projects developing similar outputs.
IV. Trial of Circular Economy (CE) MSME's for KRMNP			
Purchase of waste compactors	$5,000 X 5 villages	$25	Based upon desk research investigating the cost of waste compactors.
Purchase of equipment for down-cycling	$30,000 X 2 islands	$60	Based upon desk research investigating the cost of down cycling equipment.
Compost			
Establishment of a working group / recruit focal person or representative	N/A	$5 - $10	Based upon Recommendations in companion report (187).
Subsidy on composting equipment	20-25 compost plant	$70 - $130	Based upon Recommendations in companion report (187).
Training on technical composting	2 training for each area x 5	$35 - $65	Based upon Recommendations in companion report (187).
V. Improved Disposal & Residuals Management			
No cost, HH & businesses would pay as part of their waste collection fees.			
VI. Increased enforcement & targeted SBC			
Training of enforcement officers & government officials / local authorities.	$5,000 X 5 villages	$25	Based upon budgets of similar or past projects developing similar outputs.
Equipping enforcement officers	$10,000 X 5 villages for 2 years	$100	Based upon budgets of similar or past projects developing similar outputs.
Targeted SBC & education to support knowledge of rules & regulations and enable fair enforcement	2 year	$50-$100	Based upon budgets of similar or past projects developing similar outputs.
TOTAL		**$1,041 - $1,422**	

7.5.3 Critical Next Steps for the Tourism Sector

Sustainable growth of tourism sector not only depends on healthy ecosystems but should also incentivize their protection. Safeguarding the natural environment is key, and in the KRMNP reducing marine litter & plastic pollution is crucial. As absent of deficient SWM systems are a primary driver of marine litter & plastic pollution in the KRMNP, reforms of these systems and reduction of plastic use is essential for the tourism sector to thrive – and to meet the increased waste generation that is likely to occur as the sector grows. Priority next steps to reduce plastic use, waste generation & marine litter stemming from the tourism sector are:

- *Environmental training* for staff at tourism and tourism-related businesses, including of relevant national legislation, such as sub-decrees 113 and 168;
- *Targeted promotional tools for awareness raising of tourists* regarding the KRMNP designation, relevant legislation of Cambodia and how they can safeguard coastal communities and ecosystems, specifically through appropriate disposal of waste and reduced use of plastic especially single use plastics;
- *Fines for non-compliance*, including illegal dumping of waste on land and into the ocean from boat tours;
- Per the recommendations of the companion report by FFI (187*), establishing a code of conduct/practice* for scuba diving, snorkelling and other water sports operations should be implemented and monitored; and crucially the code should include guidelines on the appropriate disposal of waste;
- *Establishing a small grants scheme* to support locally-owned tourism & tourism related businesses to adopt practices or purchase tool that reduce plastic use or recycling; and
- Engaging *tourists in coastal clean-up and awareness raising activities*, for example, via initiatives such as Green Fins or Project AWARE;
- Working with tourism businesses to *phase out wasteful and unnecessary plastics, especially SUPs, and adopt alternative models and materials*, for example, water refill stations (which are already in use by some businesses); and
- As touched upon above, working with the RGC *to ensure that the entry fee for the KRMNP* gathers funds that are utilised to improve and support SWM and infrastructure development in the archipelago.

Credit: Bianca Roberts / FFI

8. Conclusion

Marine plastic pollution is a complex and acute challenge that necessitates urgent action. Alongside global momentum, awareness around marine litter and plastic pollution is ever growing in Cambodia. This motivation is an essential to reduce preventable plastic use and combat marine litter. It is acknowledged that environmental degradation disproportionately impacts vulnerable peoples, and as such measures that engage and empower those most severely impacted, including communities in the KRMNP who face logistical and contextual challenges intensified by the global pandemic, should be prioritised. Engagement of women and vulnerable waste sector actors is critical to support lasting change & ensure equity of approach.

This report sets out recommendations and priority next steps to guide a contextually appropriate response to marine plastic pollution in the KRMNP by addressing a key driver of marine litter in the archipelago—that is, absent and deficient SWM systems. System reform & creation is needed, and in order for this to be successful upstream interventions and significant investment in developing underlying infrastructure are essential. Leadership from and ownership by government actors, including local authorities, is essential to support systems establishment and longevity and will require capacity development to build technical skills, knowledge of existing legislation and collaboration across and within ministries with leading mandates on SWM and plastic management.

Credit: Bianca Roberts / FFI

Annexures

Annex I. COVID-19 Pandemic & Plastic Pollution

The global COVID-19 pandemic has exposed Cambodia to many unanticipated issues. The key drivers of the country's economic growth — construction, tourism, and merchandise exports (e.g., garment, footwear) — together representing 70% of the growth and 39% of all paid employment, were hard-hit by the pandemic (87,105). The national poverty rate is expected to rise between 3 and 11 percentage points as households engaging in these sectors stand to lose as much as 50% of their income for a period of at least six months (105,106,173).

Globally the unintended impacts born of this pandemic are only beginning to unfold as countries around the world continue to ramp up efforts to contain and eventually stop the spread of the virus through necessary mandates (e.g., mask wearing, social distancing), enforcement of lockdowns and mass vaccination (117). Unsurprisingly the demand for and use of plastic in the form of disposable face masks and other PPE have proliferated due to the pandemic at a scale previously unknown in history (111). In the first quarter of 2020 alone, the global market for single-use, disposable face masks was reported to top US$74.90 billion in value, and it is expected to expand at a compound annual growth rate of 53% in the next seven years (2020-2027) (112). The continuation and escalation of COVID-19 cases around the world has led to an estimated monthly use of 129 billion single-use face masks and 65 billion gloves, with roughly 3.4 billion face masks/shields disposed of daily (113,114).

The pandemic has also exacerbated the use of plastic packaging for takeout food orders and grocery deliveries worldwide (115). The global packaging market size during the pandemic is forecasted to jump from US$909.2 billion in 2019 to US$1,012.6 billion by 2021, with the plastic packaging segment dominating the market during this projected period (116). In fear of potential COVID-19 transmission, federal and state governments in several countries including the United States, the United Kingdom and India have followed measures such as: temporary lifting of single-use plastic bag bans, bans on reusable bags, cups and food containers, and suspension of any bills to further ban single-use plastic bag—all of which undermine previous efforts made to prevent plastics pollution through the 3Rs principle of reduce, reuse & recycle (117).

In Cambodia, the government has mandated that individuals wear masks in public places in the capital city of Phnom Penh and four other high-risk provinces (including Preah Sihanouk, Kandal, Prey Veng and Siem Reap). Whilst this new law is essential to protect the Nation's citizens, it is expected to drive an increase in the use of disposable masks and other PPEs in the country and, in the absence of adequate SWM systems, lead to increased waste leakage into the environment.

Annex II. Key Actors and Stakeholders

A number of stakeholders across private, public and third sectors are engaged in the reduction of marine plastic pollution in Cambodia with increasing momentum and enthusiasm being generated nationally and regionally. At present several key stakeholders including government, intergovernmental agencies and development partners are at work on various projects on or related to marine plastic pollution in Cambodia, as detailed below.

II.i Public Sector

Ministry of Environment (MoE): Founded in 1993, MoE is the main governing body with the mandate to protect coastal and marine environments. MoE also has the remit for management of protected areas and National Parks (4). In regard to marine plastic pollution, MoE plays a leading role in SWM and plastic bag management as mandated in sub-decrees 27, 36, 113 and 168.

The *National Council for Sustainable Development (NCSD),* was established in 2015 as an inter-ministerial council chaired by MoE. The NCSD is a policy-making body focused on promoting sustainable development and ensuring economic, environmental, social and cultural balance in Cambodia (131).

Between January 2019 and December 2020, NCSD, MoE and the National Committee for Sub-National Democratic Development Secretariat (NCDDS) worked on a project (under the acronym of BESD),

which is co-funded by the Government of Sweden and UNDP to reduce plastic pollution in Cambodia through 4R-strategies (refuse, reduce, reuse and recycle) (132). With the aim to address challenges caused by plastic wastes, the project implemented specific activities as follows (132)[9]:

- Conduct research about plastic problems and identify solutions;
- Develop policy and regulations about single-use plastic waste management;
- Raise awareness about plastic waste problems and measures to reduce plastic use;
- Build a stakeholder coalition to address plastic waste problems; and
- Support plastic-recycling business**.**

Ministry of Agriculture, Fisheries & Forestry (MAFF) / Fisheries Administration (FiA): MFAA is responsible for the management of coastal mangrove forests, wildlife and fisheries, with the FiA (established in 2006) being the key agency for managing coastal and marine resources, particularly fisheries resources (133).

Municipal/District Authorities: Local authorities at the municipal and district level are required by law to ensure SWM services are provided in their jurisdiction, including provision of bins/dumpsters. They have the right to collect fees for services and, in practice, often contract private formal collectors to provide services door-to-door and/or in public areas.

II.ii Private Sector

Tourism sector: As mentioned previously, tourism is the second largest sector driving economic growth in Cambodia (86). In 2016, coastal tourism in Preah Sihanouk Province alone produced a revenue of US$96 million (90). Over the years coastal regions have seen increased tourist traction (135), and they received more than 4.3 million local and foreign tourists in 2019 prior to the outbreak of COVID-19 pandemic (48). These coastal regions were also the top most visited destination in 2019 by local tourists, compared to Phnom Penh and Siem Reap (48). In June 2020, the Sihanoukville provincial administration announced a total investment of more than US$10 billion to expand the tourism and hotel services, which aims at “attracting [more] investors and tourists to the province” (136). However, whilst the coastal tourism sector brings in many economic benefits for Cambodia, it has also engendered “serious social and environmental problems” in coastal sites because of inadequate investment to improve and maintain the beach environment and its facilities (137). The lack of regulatory guidelines has caused “haphazard proliferation of tourist facilities, activities, and waste disposal that compromised environmental quality, increased user conflicts and threatened the beach’s attraction to tourists” (137).

Marine Fisheries and aquaculture: As of 2016, the marine fisheries sector employed over 2.4 million Cambodians (90), and 88% of the coastal population rely on fish as their primary protein source whilst some 30% depend directly on small-scale fisheries to make a living (56,35). Not only do marine fisheries and aquaculture generate marine plastic pollution, the accumulation of marine plastic pollution and other forms of marine litter greatly undermines resource production by these sectors by damaging marine ecosystems.

A number of large, multi-national donors have expressed interest in developing Cambodia’s blue economies, including market strengthening for mariculture and fisheries. This represents a vital opportunity for the Kingdom, however, it is crucial that these interventions are managed sustainably with communities and ecosystems in mind. There is scope for regulation of plastic use and disposal, especially fisheries waste, along these value chains to ensure they do not undermine the ecosystems upon which they depend.

In Cambodia, fishing gear (e.g., nets, monofilament lines, ropes and buoys) is predominantly made of plastic and typically purchased from neighbouring countries of Thailand and Vietnam (49). A recent study by FFI conducted in Koh Sdach Village (KSV) found that the polymer used for fishing net manufacture was not high-quality, and fishers included the study reported a lifespan of their nets to last between one to three months before the nets degrade and become unusable, with 52% of all fishing HHs reporting to dispose of their degraded nets directly into the ocean (49). This translates into an estimated 3,286-4,930 nets entering the ocean from the study village annually. The reported causes of fishing nets going into the ocean include: accidental loss of fishing gear (including due to snagging on reefs), direct disposal of used fishing gear (along with other waste) whilst out at sea, loss of fishing gear

[9] Khmer text retrieved from the official MoE website on June 25, 2021 and translated into English

(including nets) due to extreme weather, and disposal of illegal fishing gear into the ocean to evade enforcement activities (49).

Because many coastal communities rely on fishing as their primary source of income generation and for meeting their daily subsistence need, it is imperative to pay attention to abandoned, lost and discarded fishing gear (ALDFG), not least when these communities are vulnerable to ALDFG whilst also being the main generator of this kind of plastic waste.

Construction & property development sector: The construction sector has boomed in Cambodia, and between 2000 and 2018 the Ministry of Land Management, Urban Planning and Construction approved nearly 44,000 construction projects, representing an estimated investment capital exceeding US$43.3 billion (94). Along with the tourism, garment and agriculture sectors, construction is one of the key sectors supporting Cambodia's economic expansion, including at coastal and island sites (94). Whilst limited information exists, the construction sector is perceived to be a key waste generator in coastal zones, with development at Koh Kong and Sihanoukville presenting a particular threat to current and planned MPA sites. Sub-decree 113 describes how to sort and manage construction waste and outlines penalties for construction sites that fail to meet these requirements, however limited regulation and enforcement of these profitable and powerful actors takes place.

Informal waste sector: SWM practices in Cambodia include informal waste collection networks centerd on Etchay who pick waste to extract recyclables. Etchay are often represented by the urban poor, employing vulnerable individuals, including women and children. Little is known about these informal networks, though it is estimated some 3,000 individuals are active nationally (52,54,66). Etchay are also active at coastal sites, though in smaller numbers. One case study found that in coastal zones the Etchay focus on purchasing old nets and aluminium cans for resale in Thailand and Phnom Penh (other than nets, plastic recyclables were not typically purchased due to their low resale value) (49).

Though data collection regarding the informal waste sector is challenging, anecdotal evidence and KIIs suggest that Cambodia's informal SWM systems are characterised by networks of Etchay who collect waste for larger recycling centers. These larger centers transport recyclables to Thailand and Vietnam for sale, though some evidence suggests other nations are increasingly represented in these markets, including China and Korea. Despite the presence of transboundary waste trading networks, waste export is prohibited without the proper permissions (Article 9 of sub-decree 36); "*the export of the household waste from the Kingdom of Cambodia abroad cannot be conducted unless approved by the Ministry of Environment, and [holding an] export license from the Ministry of Trade and permit from the import country*". It is not known whether the existing informal networks have appropriate licenses, though anecdotal evidence suggests they do not. The Etchay are vulnerable due to their tenuous legal and socio-economic status, despite this they form a crucial part of Cambodia's SWM, especially the processing of recyclables. The global pandemic has only increased their vulnerability, including limiting their movements across borders (74). Adding to their vulnerability is the impending closure of the Thai and Vietnamese borders to the recyclables trade, which is expected to take place in 2021 (49). The result of this would be the collapse of Cambodia's informal waste sector; domestic solutions that empower these actors and support circular economies are therefore essential.

II.iii Third Sector

The World Bank (WB): The WB provides technical support to Cambodia's Ministry of Environment (MoE) and Ministry of Economy and Finance (MEF) through capacity building, data collection and policy development. The WB's ProBlue project in coastal regions of Cambodia focuses on developing a Blue Economy Roadmap that also includes a National Plastics Action Plan. To date, research conducted under the ProBlue project includes: 1) plastic imports and sellers survey and assessment of available alternatives to plastic products in Cambodia; 2) assessment of top 10 most common plastics using satellite images and drone survey; and 3) legislative review framed by lessons learned in the international context and feasibility in the Cambodian context (152). Planned and ongoing research activities include: quantification of waste leakage into river systems and expansion of pilot studies; assessment of socio-economic impacts of absent or deficient SWM in coastal and island communities; and waste characterization studies in these communities.

The United Nations Development Program (UNDP): The UNDP is also working with the RGC, including the MoE and the NCSD, to build their technical capacity and support action that addresses plastic use

and pollution in Cambodia. To date UNDP's work has included SBC campaigns targeting plastic disposal behaviours, educational forums focusing on addressing plastic pollution, and investigating innovative methods for waste management, such as waste-to-energy and circular economy approaches. With support from the Embassy of Japan, the UNDP launched their Marine Plastic Project in early 2021. This project aims to "*prevent and minimize plastic waste pollution on land and in the ocean through promotion of a 4R (Refuse, Reduce, Reuse, and Recycle) framework.*"

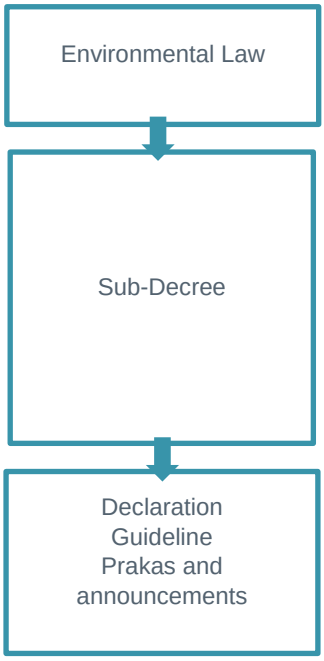
The United Nations Environment Programme (UNEP): The UNEP Regional Office for Asia and the Pacific is working to support prosperity, build resilience and boost resource efficiency across the region. The Coordinating Body on the Seas of East Asia (COBSEA) is a regional intergovernmental mechanism and one of 18 Regional Seas programmes. It is the decision-making body for the East Asian Seas Action Plan, bringing together nine countries, including Cambodia. COBSEA focuses on marine pollution, ecosystem-based marine and coastal planning and management, and ocean governance. The SEA circular project is implemented by the UNEP Regional Office for Asia and the Pacific and COBSEA, with support from the Government of Sweden. SEA circular aims to reduce and prevent plastic pollution and its impact in partnership with governments, businesses, civil society, academia, and international partners. The initiative promotes market-based solutions and enabling policies to transform plastic value-chain management, strengthens the science base for informed decision making, creates outreach and awareness, and leverages COBSEA's regional mechanism to tackle the transboundary challenge of marine litter. The project promotes a human rights-based approach to protect informal waste workers and coastal communities most vulnerable to the impacts of plastic pollution.

Fauna and Flora International (FFI): The FFI-Cambodia Programme, specifically the Coastal & Marine Conservation Programme (CMCP) has been operational for over 10 years. The CMCP supports the FiA and MoE to protect coastal and marine biodiversity, sustainably manage fisheries resources and improve the livelihoods of coastal communities. Focused on building community, Government and local partner capacity for biodiversity conservation the CMCP has supported the design and management of an MPA network, whilst tackling key threats such as IUU fishing and most recently, plastic pollution. In response to significant evidence gaps, FFI's Marine Plastic Project began scoping studies in 2018 to quantify and characterize marine plastic pollution in Cambodia. FFI's Marine Plastic Project now acts as the in-country technical partner for COBSEA's SEA circular initiative, engaging the MoE in capacity building, research and policy reform. In Cambodia the SEA circular initiative currently focuses on enabling the establishment of a marine litter monitoring programme, enhanced marine litter planning and supporting Cambodia's commitments under the 2019 Regional Action Plan on Marine Litter (RAP MALI).

Annex III. Governance and Management Systems

There are a number of international and regional conventions, agreements and strategies concerning the health of the marine environment to which Cambodia is a signatory or member party, in addition to its own national legislation, policy and regulatory frameworks. The legislation and policies of Cambodia outline the leading role of the MoE in the Kingdom's SWM systems, as well as other governance frameworks pertaining to marine plastic pollution, such as national strategies and governing bodies. More recent sub-decrees identify other ministries as key actors, including the Ministry of Interior (MoI), MEF and the MoT. In 2001 and 2008, two major phases of decentralisation of governance and institutional reform led to administrative power and responsibility for waste management to be shifted away from national Government and towards sub-national authorities (see Section 6.5). This means legislation dictates that responsibilities are highly decentralised, primarily to provincial level, with the option to further delegate to municipal, district and commune administrations. As a result, the Government actors expected to be involved in waste management can be unclear, and without clear and transparent channels for support and communication sub-national authorities may struggle to meet the commitments set out by the legislation.

Law and Regulation Framework



Law on Environmental Protection and Natural Resource Management (1996)

1. Sub-decree 113: Solid Waste Management (2015)
2. Sub-decree 16: Electrical Waste Management (2016)
3. Sub-decree 168: Plastic Management (2017)
4. Sub-decree 27 on the Control of Water Pollution
5. Sub-decree 36 on Solid Waste Management
6. Sub-decree 189: Establishment Enterprise for Transfer and Landfill Management (2020)
7. Sub-decree 25: Establishment Solid Waste Management Committee (2021)

1. Industrial and Factory Waste Management (2003)
2. Environmental Guideline for SWM (2006)
3. Solid Waste Management for Urban (2016)
4. Electrical Waste Management (2017)
5. Declaration on Maximum Tariff for SWM (2018)

The exiting legislation most relevant to marine plastic pollution is summarised below:

Sub-decree No.36 on Solid Waste Management:

- Governs the "*collection, storage, transportation, recycling and disposal of municipal waste*";
- The MoE is responsible for its enforcement, including monitoring SWM activities (Article 6) and establishing national standards and guidelines (Article 4);
- Crucially, the sub-decree devolves responsibility to provinces and cities, which are expected to develop *"short, medium and long-term waste management plans for their areas*" (Article 5). Provincial, municipal and local authorities have responded to this by contracting waste management to private companies, although in many areas waste management systems are absent;
- The sub-decree asserts that the MoE is responsible for approving any "*domestic investment in the construction of landfill, incinerator, storage sites or recycling plant for household waste*";
- The sub-decree also covers Hazardous Waste Management, which includes setting out responsibilities for the appropriate storage, transport and disposal of "*fibrous and clothing wastes from textile and garment industry; [and]… plastics waste from production or use of plasticizers*;" both of which are relevant to marine micro-plastic pollution.

Sub-decree No.27 on the Control of Water Pollution:

- This sub-decree "*applies to all sources of pollution and all activities that cause pollution of the public water areas*." (Article 2);
- "*Sources of pollution*" covers dwelling houses, public administrative buildings, transport facilities, business areas, premises or service places "*from which effluent, pollutants or hazardous substances are directly or indirectly discharged into public water areas or public drainage systems*.";
- Includes "*solid waste*," "*garbage*," and "*solid, liquid or gaseous substances or all kind of wastes*" within the scope (Article 3e & f), as well as "*any substances that cause danger to living organisms… or adversely impact and damage the environment*." (Article 3h), thereby covering plastic waste pollution of any kind;
- Declares "*the disposal of solid waste or any garbage or hazardous substances into public water areas or into public drainage system shall be strictly prohibited*," and "*the storage or disposal of solid waste or any garbage and hazardous substances that lead to the pollution of water… shall be strictly prohibited."* (Article 8);
- States that the monitoring and analysis of water pollution is the responsibility of the MoE (Chapter 4).

Sub-decree No.113 on the Management of Garbage and Solid Waste of Downtowns:

- Regulates SWM in urban areas with "*effectiveness, transparency and accountability*";
- Decrees how solid waste is to be sorted and managed and outlines penalties for non-compliant HHs, businesses and construction sites;
- Requires the municipality (or district) to provide enough bins and services in public places;
- Stipulates that a maximum service fee for waste collection is to be determined by the MoI, MoE and MEF (Article 33), and that "*Income generated by the management of garbage and solid waste of downtowns is personal income of municipal and district administrations*" (Article 34);
- Decrees that municipal and district administrations may utilize their budgets to support activities related to the management of solid waste.

Sub-decree No.168 on the Management of Plastic Bags:

- Addresses the "*reduction, import, production, distribution and use of plastic bags" to improve "public health, environment and aesthetics*";
- Outlines permissible dimensions (size, thickness of plastic) of plastic bags in Cambodia and penalties for non-compliance;
- Identifies the same responsible ministries, with the addition of the MoT (Article 8), which is responsible for public education and identifying indicators for "*aesthetics*".

III.i Governance instruments in development

Momentum surrounding marine plastic pollution, in particular SWM reform, plastic management and support for circular economies, is rapidly emerging in Cambodia and a number of governance pieces are currently in development that support the reduction of marine plastic pollution, including:

- **Cambodia's Law on Fisheries** is currently under review, with more recent drafts including provisions on inland aquaculture and mariculture management, water quality, and discharge of waste matter;
- **Environment and Natural Resource Code of Cambodia** is also under review, and more recent drafts include provisions to support an enabling landscape for sustainable consumption and production;
  Circular Economy Strategy and Action Plan aims to create an enabling environment to support the systemic transformation required to realise a circular economy in Cambodia;
  Sub-decree on Plastic Management which is likely to include provisions to manage and reduce SUP, reduce and management plastic imports and address micro-plastic pollution.

Credit: Andy Ball / FFI

Annex IV. Recommendations Framework in Detail

The findings set out in this report have been synthesized to develop recommendations targeted at reducing marine litter in the KRMNP. The below recommendation framework sets out a pathway to implement and maximise existing governance mechanisms and adopt locally viable solutions to reduce plastic use and mitigate marine litter will be identified taking into account the 3R (reduce, reuse, recycle) principle. Within each broad recommendation, site-based interventions have been identified, which detail context specific opportunities in the KRMNP. These are also linked to upstream interventions, that is, change that needs to take place upstream nationally or coast-wide to support the more site-specific actions. The following solutions identify key actors and stakeholders along plastic use and waste generation chains, aim to support leadership and foster action at a local level, including via private sector engagement. To avoid duplication and enable strategic, productive collaboration, the following recommendations take into consideration key national strategies and emerging governance pieces, including The World Bank's report 'Solid Waste Plastics Management: Improving Financial and Environmental Sustainability in Solid Waste Management and Plastics' (draft, 2020).

7.1 SWM System Establishment and Improvement Recommendations

SWM System Establishment and Improvement Recommendations		
Recommendation 7.1.1. Improved residuals management that is safer for people and the environment		
Evidence	**Upstream Interventions** (coast-wide or national) needed to support site-based action	**Site-Based Actions** for the Koh Rong Archipelago (KRA)
Currently **many island sites rely on incineration or open burning to manage their waste – an unsafe and unsustainable practice**. In the KRMNP incinerators are not always operational, and when operational, the ash/smoke is not properly managed or operation of the incinerator itself is sub-optimal leading to health & safety issues.	Development of national standards for incinerators and co-processors, including standards for emissions, operations, maintenance, air quality monitoring, health and safety, and shut down/decommissioning in the event of non-compliance; as well as training to support compliance with standards. **Key Actors:** National & sub-national government, most notably the MoE.	In the KRA improved incineration could take many forms, however the safest option available at this time would be to link communities with ChipMong InSee co-processing facilities in the coastal province of Kampot. Further details are set out in Section 7.5.2 of this report. **Key Actors:** • ChipMong InSee; • HHs & businesses of the KRMNP; • Informal waste collectors; • Local authorities.
Waste is rarely stored securely and leakage from piers, temporary dumpsites, waste transport vessels (boats), businesses and HHs is likely. **Proper waste storage prior to & during transport is essential to prevent waste leakage on land and into the ocean.**	Not applicable	In the KRA improved waste packaging and storage could take many forms along the waste cycle, as detailed in Section 7.5.2 (including Key Actors).
KRA does not currently have formally designed	Support national standards for landfill design and management,	Ensure landfills are properly designed and able to meet the needs of the area

landfills, but instead has some uncontrolled dumping areas and otherwise disposes of waste in the mainland landfill. If co-processing or safe incineration are not possible, then non-recovered waste should be disposed of at sanitary landfills.	including monitoring and enforcement. **Key Actors:** National & sub-national government, most notably the MoE.	they service, regardless if they are located on the mainland or on the island. This would be the responsibility of local authorities, though support from provincial government would likely be required. **Key Actors:** Local authorities & sub-national government, most notably the MoE.

Recommendation 7.1.2: Investment in infrastructure, equipment & locally-led innovations that enable improved waste management, stemming marine plastic pollution in the KRMNP		
Evidence	**Upstream Interventions** (coast-wide or national) needed to support site-based action	**Site-Based Actions** for the KRA
Collection systems in the KRA are poor overall due to poor or absent associated infrastructure. For example, the lack of roads make collection difficult and the lack of, or poor placement of, bins renders them unused.	Collaboration between the MoE and Ministry of Economy and Finance (MEF) is essential to increase the environmental funds provided to local authorities to meet regulations under existing Cambodian sub-decrees. To support transparency this would need to include monitoring and reporting requirements, which can connect directly to SDGs. **Key Actors:** National & sub-national government, most notably the MoE & MEF.	Investment in infrastructure to improve SWM should prioritise: • *Investment in roads* that are accessible during rainy season to enable waste transport to management facilities. It is noted that the Royal Group of Companies has invested USD35M to build a 70km road around Koh Rong, which is expected to complete by first quarter of 2022; • *Working with local authorities to identify types and locations for bins* (which local authorities must provide per sub-decree 113), particularly those useful for the separation of waste; • *Investment in improved water supply to reduce reliance on bottled water and their plastic.* This is estimated to cost US$907,740 to improve water supply by 2030 (full costings set out in Koh Rong Marine National Park: Market Analysis and Demand Assessment for Sustainable Island Tourism (187)). **Key Actors:** • Local authorities of the KRMNP; • Sub-national and national government; and

		• Development partners supporting infrastructure development.
Small scale, limited markets and high overhead costs greatly reduce profitability of and incentives for improved recycling activities and other innovations. In addition to plastics, it is important to consider management of organic waste, which makes up about ~50% of the total waste produced in the KRMNP.	National promotion of organic composting at HH and community level, and the development of a small grants scheme and/or subsidies, ideally (at least) co-funded by local or national authorities. **Key Actors:** • Local authorities of the KRMNP; • National & sub-national government, including the MoE.	• *Community innovation & capacity development grant scheme* to provide subsidies for recycling activities, for example composting, waste banks, plastic recycling and resource recovery businesses (EcoBrick, for example). Subsidies are necessary because cost recovery of infrastructure investment is unlikely at small scale. • Provide tools, small infrastructure, awareness raising, and capacity development for *HH, community, or business-based composting*. Composting provides opportunities for managing small gardens, reducing the need to import some produce. It can also help guesthouse/restaurants to promote sustainable tourism, by composting and growing vegetables on the property. • *Subsidies or funding* for small carts, waste compactors and related equipment to support the recovery of recyclable waste by the informal sector. • *Subsidize or fund simple, low cost collection solutions for water bodies*, such as those used by Plastic Fisher (an organisation working on removing plastics from waterways in Asia). **Key Actors:** • Development partners to support grant schemes & innovation; • Local communities, including HHs and businesses, notably tourism businesses; • Informal waste collection actors; • Local authorities.

Recommendation 7.1.3: Foster and empower local leadership collaboration and planning between local leadership and formal private sector collection services		
Evidence	**Upstream Interventions** (coast-wide or national) needed to support site-based action)	**Site-Based Actions** for the KRA

There are no formal collection services in the KRMNP, though private boat operators do collect solid waste from ports for transport to the mainland, which is then taken to the landfill by the formal collector contracted by Sihanouk city (KSWM).	Ensure that the private waste manager in Sihanoukville, KSWM, adopts safe & sustainable practices at their facilities; and that new SWM facilities are also safely and sustainably managed with oversight from the local authorities to ensure compliance with national legislation. Longer term projections of waste generation in Sihanoukville should also be developed to ensure that waste management systems can meet growing waste generation to ensure improper disposal & waste leakage are reduced from the mainland into the waters of the KRMNP. **Key Actors:** • KSWM; and • National & sub-national government working in Sihanoukville, including the MoE and MEF.	To improve and maintain SWM services in the KRMNP the following actions are recommended: • Improve working conditions and incentives to support, attract and maintain a skilled work force; • Implement targeted training on work health and safety and the 3R's, to support skill development of SWM workers; • Facilitate official contracts with the municipality (usually 10 years) in order to incentivize investment in, and improvement of, services; • Collaborate with local authorities to set and publicize collection schedules; and • Identify and implement formally recognized waste collection points and storage (elaborated further below). **Key Actors:** • Informal waste collectors; and • Sub-national government and local authorities.
Without formal collection services, **SWM service and collection fees are not recovered**, resulting in poor funding for adequate SWM services.	Work with the MoE and other relevant authorities to have nationwide mandates on the collection and use of SWM funds, such as business or land taxes, national fees associated with tourism, or combining SWM collection fees at local level with other services (like water or electricity supply). AFD and the World Bank are funding the study of similar policies for sanitation services; it is recommended to collaborate closely with the associated consultants to promote opportunities for SWM. **Key Actors:** National & sub-national government working in	To improve fee collection for SWM services in the KRMNP, it is recommended that SWM service providers engage with local water and electricity service providers to explore collecting waste fees with these services. These stakeholders may also be willing to provide SWM services in parallel; the policy and legal licensing implications must also be considered if this is the case. Such a model is already in use in Phnom Penh, where SWM fees are combined with sanitation as part of the water bill. **Key Actors:** • Sub-national government and local authorities; and • local service providers.

	Sihanoukville, including the MoE and MEF.	

Recommendation 7.1.4: Engage and empower informal waste collection actors		
Evidence	**Upstream Interventions** (coast-wide or national) needed to support site-based action:	**Site-Based Actions** for the KRA:
The informal waste collectors, including the Etchay, currently play a crucial role in collecting and recycling certain materials, which at coastal sites. Not only are these informal networks important to Cambodia's emerging recycling sector but they are highly vulnerable due to border closures, the legality of their actions, the COVID-19 pandemic, the unstable and unsafe nature of their work and the enactment of their rights as workers. **Collection and sale of plastic waste is rare due to the low value and high overhead costs for waste pickers**.	National engagement with MoE for recognition and monitoring of informal waste collection sector, including junk shops and import/export of plastics. Engagement with key associations, such as IDEA, who are creating formal channels for informal workers to gain a voice and rights. They are currently engaging on a project to gain NSSF health care benefits for informal Tuk Tuk drivers in Phnom Penh and they are actively recruiting members of the informal sector to their association, which can enable access to the same benefits in the future. **Key Actors:** • National & sub-national government, including the MoE; • Informal waste sector (national); • Development partners and NGOs focusing on engagement of vulnerable waste sector actors, including the Etchay.	In the KRA support of the informal sector could efficiently improve SWM outcomes and reduce waste leakage from land. This could include: • *Awareness raising* to encourage HHs and businesses to separate waste, and elevate the status of waste pickers, framing them as a vital actor who protect community wellbeing; • *Subsidising or investing in waste compactors* for use by waste pickers to support the mass export of bulky plastic items for sale on the mainland, enabling efficiencies of scale and supporting the sale of low value plastics; • *Establishing recyclables banks,* where separated waste could be compacted and stored until a sufficient volume is amassed for export and sale on the mainland. Again, this would support economies of scale and profitability as well as ensuring secure storage of recyclables thereby reducing waste leakage. In particular, they could be placed and promoted near key tourism points (like piers) to encourage tourists to also deliver waste; • *Subsidising transport of recyclables to the mainland* to reduce overhead costs and increase profitability; • *Establishing contracts and work safety standards* to formalise the roles of waste pickers and protect these vulnerable actors, including to ensure that children are not employed by this sector; and • Per Recommendation 7.1.5, *establishing domestic Circular*

		Economy (CE) MSME's that work with the informal sector, including setting fair prices for recyclables that enable CE MSMEs to be profitable whilst also protecting the livelihoods of waste pickers. **Key Actors:** • Informal waste sector actors; • Community members, including HHs and businesses, especially the tourism and fisheries sectors; • Development partners and NGO's working on CE solution in mainland Cambodia; and • Local authorities.

Recommendation 7.1.5: Trialling & supporting Circular Economy (CE) MSMEs at coastal and island sites		
Evidence	**Upstream Interventions** (coast-wide or national) needed to support site-based action:	**Site-Based Actions** for the KRA:
The findings highlight that **a large proportion of HH and business waste is recyclable or compostable,** which presents an opportunity for the KRMNP to move away from linear resource use, and develop initiatives or businesses that adopt CE approaches.	Solid Waste Management reform, that is, systematic waste collection and separation, presents avenues to adopt novel CE approaches that benefit people, planet and economy. The above recommendations can support circular-centric MSME's to thrive, overcoming barriers that have hindered their profitability in the past, including limited waste collection and high costs associated with waste cleaning, separation and transport. Nationally and coast-wide, continued support of the Circular Economy Strategy, Plastic Road Map and Plastic Management Sub-decree will support island-based action in the KRA. **Key Actors:** • National & sub-national government, including the MoE; and • Development partners and NGOs focusing on circular economy solutions in Cambodia.	Steps to enable resource cycling and support CE MSMEs is set out in Section 7.5.2 (above, including key actors).

7.2 Institutional & Governance Recommendations

Institutional & Governance Recommendation Framework		
Recommendation 7.2.1: Utilise existing governance instruments by articulating and addressing barriers to their implementation, including lack of capacity and enforcement		
Evidence	**Upstream Interventions** (coast-wide or national) needed to support site-based action	**Site-Based Actions** for the KRA
A number of enabling governance instruments exist in Cambodia that would support improved waste management thereby addressing a primary driver of marine plastic pollution in the KRA. Sub-decrees 27, 36, 168 and 113 are all critical to establishing SWM systems but to date they remain largely unutilised, especially at coastal and island sites (see Annex III). **Lack of understanding & awareness of legislation also undermines the rudimentary SWM systems that currently exist in the KRMNP leading to increased waste leakage from land and at sea.**	Build awareness and understanding of governance instruments among the relevant provincial and municipal authorities to support successful operationalisation. Capacity development of authorities should encourage collaboration with and support of local authorities, such as commune and village chiefs, in the KRA. This particularly crucial step given Cambodia's decentralised governance landscape. **Key Actors:** • National & sub-national government, as mandated in existing legislation; and • Development partners and NGOs focusing on governance strengthening.	To increase adoption of existing governance instruments in the KRMNP, it is recommended that *local leaders be supported through targeted training & technical support* with a focus on municipal and commune authorities, relevant private sector actors and key waste sector actors on relevant legislation. This would include building understanding of the legislation itself, roles and responsibilities, fee collection and management, restrictions, and penalties. *Representation of women* is crucial, and women should be supported to join local government to improve representation & agency in decision making. **Key Actors:** • Sub-national and local authorities; • Female community members and government authorities.
Sub-decree 113 clearly stipulates the fees and penalties for non-compliance, however, these are rarely (if ever) enforced. At this time the SWM systems in place in the KRA are either absent or deficient. People should not be fined for non-compliance with systems that do not exist, that is, SWM systems need to be created or improved	It is necessary to develop transparent, national enforcement mechanism which includes: • Clearly defined roles and responsibilities for and between each relevant authority; • Means of tracking non-compliance complaints; • Mechanisms for issuing official warnings and fines; • means of fee collection; and	*Strengthened enforcement of legislation is needed in the KRMNP.* Existing community organisations could be leveraged including, local governing bodies, CFis or CPA's. Other mechanisms to support enforcement include: • Training and resourcing of enforcement officers to ensure they are able to take on this new remit; • Fostering collaboration between MAFF and MoE. This is crucial because, per the legislation, MoE have the leading legal mandate for the enforcement of SWM laws. However, they do not have a strong

before enforcement activates are intensified.	• appropriate allocation of funds collected. The entity collecting the fees should be specified in the law, and the fees should be regarded as an environmental fee/tax. To discourage non-compliant behaviour, *the level of the penalty should de-incentivize non-compliance whilst remaining proportionate*, that is, penalties are not intended to harvest money or to harm HHs or businesses, but rather to motivate behavioural change and build awareness. Moreover, enforcement activities and penalties should be designed in a way as *not to incentivize corruption and a consistent approach should be taken coast wide* given the mandate and reach of the framing legislation. **Key Actors:** • National & sub-national government, including MAFF, MoE and MEF; and • Development partners and NGOs focusing on governance strengthening.	presence in the KRMNP, whereas the FiA and CFis are well provisioned and could support the MoE enforcement activities; and • Couple enforcement and systemic improvements with awareness raising and social and behavioural change campaigns to support habitual change of damaging behaviours. **Key Actors:** • Enforcement officers and community bodies that support enforcement, including CPA. CFis, MoE and MAFF officers; • Local communities, including HHs and businesses.

Recommendation 7.2.2: Develop new governance instruments that bridge gaps and target the most prolific and problematic plastics and hotspots		
Evidence	**Upstream Interventions** (coast-wide or national) needed to support site-based action	**Site-Based Actions** for the KRA
The most common types of plastic found in business and HH waste in the KRMNP, was plastic bags and plastic packaging.	Looking nationally, continued support of *new governance frameworks already in development is needed to* reduce plastic use (especially SUPs) and support plastic waste management. This includes, the Plastic Management Sub-decree and the National Circular Economy Strategy (both currently in development). This is critical because the governance instruments will	Novel governance to target problem plastics in the KRA should include: • *Bans, restrictions, or import taxes* on the most certain single-use plastic (SUP) products especially non-essential SUPs or where alternatives are readily available. Specifically for the KRA this would include straws, drink holders and small plastic bags (small plastic bags are banned under sub-decree 168); • • *Incentives for businesses* developing sustainable, local alternatives to single-use plastic or adopting Circular Economy

	empower locally led action in the KRMNP. **Key Actors:** • National & sub-national government, including MAFF, MoE and MEF; and • Development partners and NGOs focusing on governance strengthening.	(CE) approaches (currently part of the new 'Plastic Management Sub-Decree'); • *Subsidies or incentives for the tourism sector* to reduce plastic use or adopt sustainable practices. For example, offering visitors water refill stations with filtered water. • *Embedding new marine plastic pollution reduction strategies into existing governance frameworks* e.g. MPA and protected area management frameworks and community action plans. **Key Actors:** • Enforcement officers and community bodies that support enforcement, including CPAs, CFis, MoE and MAFF officers; • Local communities, including HHs and businesses, notably tourism businesses.

7.3 Private Sector and Citizen Engagement Recommendations

Private Sector and Citizen Engagement Recommendation Framework		
Recommendation 7.3.1: Engagement of private sector to foster accountability, with a focus on sectors that are most polluting of and/or reliant on coastal and marine ecosystems		
Evidence	**Upstream Interventions** (coast-wide or national) needed to support site-based action	**Site-Based Actions** for the KRA
Many of the smaller and/or locally-run tourism-centric businesses of the KRMNP are well aware of their dependence on healthy coastal and marine ecosystems and have initiated their own practices to reduce their environmental impact. However, the larger and/or international businesses leading large-scale tourism-dependant projects are challenging to engage and their impacts are not fully understood. Further, **awareness raising among tourists & training for the staff of tourism businesses to improve disposal behaviours** would complement the	Per Recommendation 7.2.1, it is crucial to ensure that private sector meets the regulations set out in the current legislation. Tourism-related coastal development in Sihanoukville also impacts marine debris in the KRMNP and ensuring regulations are enforced on the mainland coast will reduce waste leakage & debris that threaten the KRMNP. **Key Actors:** Private sector, especially key resource users and waste generators, including the tourism sectors both in the KRMNP and Sihanoukville.	Strategies to reduce waste generation and marine litter stemming from tourism activities are set out in Section 7.5.3.

establishment of SWM systems at coastal and island sites.		
Cambodia's current legislation sets out regulations and standards for the construction and development sectors, yet construction and development sectors are powerful actors, resulting in **poor management and enforcement of construction waste.** Ensuring legislation is enforced is crucial to reduce to reduce marine plastic pollution and safeguard the wellbeing of communities and ecosystems. As highlighted in the report, the construction and development sector is particularly active on KRA, yet many **do not manage their waste appropriately**.	Ensuring that large-scale investment and development projects utilize urban planning, adopt waste management strategies and support wider infrastructure development is key to ensure these large projects are developed sustainably. Similar to the recommendations for overall SWM above, collaboration between MOE and the Ministry of Land Management, Urban Planning, and Construction (MLMUPC) is necessary to develop enforcement mechanisms. MLMUPC decides how construction permits are managed, issued, and revoked, at times delegating responsibilities to provincial, municipal, and district authorities. Whilst a top-down management approach from the Ministry level is essential for improved management, engagement with the private sector is also ideal **Key Actors:** • Private sector, notably the construction sector; and • National & sub-national government, including MoE and MLMUPC.	Depending on the size of the development and the actor in question, this is complex and sensitive recommendation, however enforcement activities abide by the law, which specifically set out penalties for the construction and development sector where they improperly dispose of waste (sub-decree 113), thus enforcement activities in the KRMNP should address non-compliance by construction projects. **Key Actors:** • Private sector, especially construction sector in the KRMNP; and • Enforcement officers and community bodies that support enforcement, including CPAs, CFis, MoE and MAFF officers.
When piped water is poor in quality, people resort to bottled water, leading to more plastic waste. The research findings suggest that suggest that KRMNP communities and the tourism sector **rely on bottled water as their main potable water source**, with Cambodian brands being most popular.	Looking upstream, the "**Polluters Pay" Principle** presents opportunities for coastal sites, for example, EPR schemes. Engage with the brands found to be providing bottled water to island sites, such as Cambodia Water brand, Samphois and Vital, as well as other popular brands, including Brown Coffee and Starbucks could work to role model corporate accountability nationally, inspiring engagement by smaller, local businesses. EPR programs could include subsequent promotion of brands to encourage engagement.	*Engagement with the piped water supplier and the local authorities* to improve management of piped water will reduced reliance on bottled water in the KRMNP (links to Recommendation 7.1.2 above). **Key Actors:** • The local piped water supplier; and • Local authorities.

	Key Actors: • Cambodian and international brands active in Cambodia, who are known polluters; & • Authorities responsible for management of piped and bottled water (Ministry of Industry, Science, Technology, and Innovation), both at national and provincial levels.	

Recommendation 7.3.2: Engagement of citizens to promote awareness and tools for improved waste management.		
Evidence	**Upstream Interventions** (coast-wide or national) needed to support site-based action	**Site-Based Actions** for the KRA
Similar to local authorities, awareness of SWM laws, impacts of poor waste management, and opportunities for improvement among citizens is low. Findings suggest that specific behaviours to target are: • Fee payment for waste collection services; • Waste cleaning & separation; • Re-use and plastic reduction behaviours; • Knowledge of legislation, rules & regulations.	Not applicable	*Awareness raising & education* for community members is crucial to ensure they understand key components of legislation and the outcomes of not abiding by the law. Due to low literacy levels in the KRMNP multiple channels of dissemination would be needed as well as both visual and verbal content. Social and behavioural change, education and awareness raising campaigns in the KRMNP should focus on: • How to reduce plastic use & the impacts of marine plastic pollution; • Education & awareness raising of legislation, including penalties for non-compliance with the law; • How to appropriately dispose of waste & what the impacts are of improper disposal; • Why and how to pay fees for waste collection services; • Long term SBC to foster habit formation that supports positive storage and disposal behaviours, such as waste separation and use of bins. Additionally, bins should be designed with behavioural nudges that encourage waste separation; • Education campaigns to set out the impacts of open burning, waste dumping

		and littering, including interconnected impacts on health, economy and environment. **Key Actors:** • KRMNP community members and businesses; • Local authorities and NGOs working to improve SWM outcomes and change disposal behaviours, for example, KRECA.
Due to social and cultural norms and gender roles in Cambodia, **women are key plastic consumers and dispersers**; as well as the primary managers of HHs. As such they have an important role to play in how SWM systems and plastics are used by HHs. Ensuring women receive training & support to reduce the use of plastic in their HH and appropriately manage waste is essential to reducing land-based waste leakage that contributes to marine plastic pollution.	Not applicable	To support women to reduce plastic use the following is recommended: • Targeted capacity development should be designed for women, taking into account their unique roles, health & hygiene needs and distinct education outcomes; and • Women should be engaged in training of trainers to position them as leaders of community level interventions. **Key Actors:** Female community members who are enthusiastic about improved SWM and community outcomes.

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