RAPID ASSESSMENT ON PLASTIC WASTE GENERATION & MANAGEMENT PRACTICES ON ST. MARTIN'S ISLAND

MAY 2025

PREPARED BY

Kewkradong® earth+adventure

COLLABORATING ORGANIZATION

Unilever

Disclaimer

Kewkradong Bangladesh advises that the information contained in this publication comprises general statements based on environmental research and practices. Readers are advised to note that such information may be incomplete or may not be applicable to specific situations. Therefore, no actions or decisions should be made based solely on the information provided in this publication without seeking prior expert, professional, or technical advice.

To the extent permitted by law, Kewkradong Bangladesh (including its members, employees, and collaborators) excludes all liability for any consequences, including but not limited to losses, damages, costs, or expenses, arising directly or indirectly from the use of this publication, either in part or in whole, and any information or material contained within it.

Kewkradong Bangladesh is committed to ensuring accessible and inclusive content. Further we are committed to providing web accessible content wherever possible. If you experience any difficulties accessing this document, please contact us for assistance through kewkradong@gmail.com.

Limitations of the Study

Despite offering critical insights into the solid waste management landscape of Saint Martin's Island, this rapid assessment was subject to several methodological and contextual limitations:

Lack of Sectoral Attribution of Waste Generation
The assessment did not include quantifiable data on the sector-wise contribution to total waste generation. As such, it was not possible to determine the relative inputs from households, hospitality establishments, retail shops, food vendors, and other commercial actors. This gap limits the ability to perform targeted interventions and establish polluter-responsibility linkages.

Insufficient Temporal Coverage to Assess Seasonal Variability
Although the assessment was conducted during the peak and closing phases of the tourist season, it did not encompass a full annual cycle, including the off-peak and monsoon periods. As a result, the study could not fully capture year-round trends in waste generation and accumulation, which are essential for infrastructure planning and load forecasting. Understanding seasonal variability—especially in a tourism-dependent context like Saint Martin's Island—requires longitudinal data collection across multiple climatic and tourist activity phases.

Limited Access to Institutional and Administrative Data
Relevant documents—such as existing waste management plans, operational budgets, service contracts, and previous monitoring records—were not made accessible during the assessment period. This prevented data triangulation and hindered validation of observed practices against formal institutional mandates.

Potential Human Error and Data Variability Due to Access Constraints
Given the rapid nature of the assessment and the island's dispersed settlement pattern, there is a possibility that some properties or establishments may have been unintentionally missed during data collection. Factors such as limited accessibility, logistical constraints, and unavailability of respondents at certain locations contributed to variations in data completeness. While efforts were made to ensure broad coverage and consistency, the potential for human error and sampling omissions should be acknowledged when interpreting the quantitative estimates presented in this report.

TABLE OF CONTENTS

Acknowledgments / I
Executive Summary / III

1. INTRODUCTION 01
2. FINDINGS 04

2.1 Sources Of Inland Plastic Waste 08
2.2 Local Population And Commercial Establishments.....08
2.3 Household Plastic Waste And Dumping Patterns.....11
2.4 Beach Survey And Categorization Of Plastic Waste.....15
2.5 Restaurant Survey.....17
2.6 Accommodation Survey.....19
2.7 Banning Only Works When Enforcement Is Strict: The Case Of St. Martin's Island.....20
2.8 Summary Of Findings.....21

3. OBJECTIVES...01

3.1 KEY HOTSPOTS FOR PLASTIC WASTE GENERATION ACROSS THE ISLAND 24

3.1.1 Identifying Hotspots.....25
3.1.2 Findings.....27
3.1.3 Composition Analysis.....27
3.1.4 Categorization.....28
3.1.5 Comparative Insights.....33
3.1.6 Spatial Trends In Plastic Waster Distribution.....34
3.1.7 Waste Collection And Management Challenges.....39
3.1.8 Data Collection Process.....40
3.1.9 Key Takeaways.....41

3.2 WASTE MANAGEMENT ON ST. MARTIN'S ISLAND: THE GROWING PLASTIC CRISIS 42

3.2.1 Historical Perspective On Environmental Degradation.....43
3.2.2 The Plastic Waste Crisis.....45
3.2.3 Present Waste Collection, Segregation, Disposal And Recycling Mechanisms.....46
3.2.4 Waste Segregation And Recycling Initiatives.....46
3.2.5 Disposal And Waste Transportation.....47
3.2.6 Recycling And Commercial Waste Handling.....47

3.3 ASSESSING STAKEHOLDER CAPACITIES AND OPPORTUNITIES FOR ENHANCED COLLABORATION 48

3.3.1 Limitation In Current Stakeholder Capacities.....49
3.3.2 Gaps In The Management System.....49
3.3.3 Opportunities For Enhanced Collaboration 50

3.4 PAST AND ONGOING INITIATIVES 51

3.4.1 Behavior Change Campaigns.....52
3.4.2 Solid Waste Management.....54
3.4.3 Cleanup Efforts.....56

4. OVERALL GAPS AND CHALLENGES 58
5. RECOMMENDATIONS 60
6. METHODOLOGY 63
7. CONCLUSION 66

STATISTICAL ESTIMATION 69
GRID MAP 79
ORTHOPHOTO MAP 91

MAPS

M1 Inland Carry Bag Trash Distribution.....30
M2 Inland Plastic Sheet Trash Distribution.....31
M3 Inland Food Wrapper Trash Distribution.....32
M4 Inland Hard Plastic Trash Distribution.....35
M5 Inland Hard Plastic Cup Trash Distribution.....36
M6 Inland Hard Plastic PET Trash Distribution.....37
M7 Village name of St. Martin's Island.....44
M8 Shop Distribution.....10
M9 House Distribution.....12
M10 Adult Population.....13
M11 Child Population.....14
M12 BeachTrash Distribution.....16
M13 Restaurent Capacity Distribution.....18
M14 Grid and Zone map of SMI.....79

ACKNOWLEDGMENT

This report has been prepared by **Muntasir Mamun**, Marine Debris Specialist and Country coordinator, Ocean Conservency's International Coastal Cleanup; **Dr. Mohammad Sorowar Hossain**, Associate Professor of Environmental Science and Management (IUB); **Dr. Enayetur Raheem** is a data scientist with over 20 years of experience in statistical analysis and machine learning (ML). Proficient in Python (10+ years) and R (22+ years), he specializes in applying data-driven solutions across diverse domains. Currently an Adjunct Faculty Associate at Columbia University, he supports the Machine Learning course. His prior roles include teaching advanced statistical methods and analytics at UNC Charlotte, the University of Northern Colorado, the University of Wisconsin Green Bay, and the University of Dhaka; **Mustafiz Mamun**, an award-winning Bangladeshi photojournalist and Adjunct Faculty Member in the Department of Television, Film, and Photography at the University of Dhaka; and **Shakhawat Chowdhury and Morshed Alam**, seasoned activist with nearly two decades of experience in environmental protection, research, and policy advising.

The team extends its sincere gratitude to the field assessment team: **Mirza Niaz, Antar Shafiulla, Md. Manirul Islam Shamim, Syed Ahmed Siyam, Md. Niaj Makdum, Salma Khatun, Shirajul Islam, Nilay Ahmed Nayan, Baizid Sarkar, Joynal Sakar, Joshim Uddin, Md. Faisal, Abir Ahmed Labib**. Their dedication and hard work were invaluable in conducting this assessment.

We express our heartfelt appreciation to **Lieutenant Commander Muhtadin Islam**, Station Commander of Saint Martin's, Bangladesh Coast Guard. His accommodating cooperation significantly facilitated our work, ensuring the smooth execution of the assessment.

A special acknowledgment goes to **Shamima Akhter** of Unilever Bangladesh, whose vision and insight on waste management as well as dedication to protecting St. Martin's Island played a pivotal role in making this rapid assessment possible.. We also extend our gratitude to **Unilever Bangladesh Limited (UBL)** for their invaluable support and financial contribution, as well as to **S. M. Faysal from Unilever** for his cooperation throughout the process.

We extend our deepest gratitude to the **Bangladesh Ministry of Environment, Forest and Climate Change**, particularly **the Department of Environmental Pollution Control - 1**, for their support and access to critical environmental data.

A sincere thanks to **Bangladesh Sustainability Alliance (BSA)** for their efforts in environmental sustainability, particularly in waste management initiatives on **St. Martin's Island**. Special appreciation is extended to **Unilever Bangladesh Limited (UBL)** and **CordAid Bangladesh** for their contributions to the joint assessment and research on waste production and management.

A special acknowledgment goes to **Biswajit Shankar Dutta**, *Deputy Secretary*, for facilitating access to official documentation and reports. Our gratitude also extends to the **Deputy Commissioner of Cox's Bazar**, the **Director of the Department of Environment (Cox's Bazar District Office)**, and the **Upazila Executive Officer of Teknaf**, for their cooperation in data collection and fieldwork coordination.

Our sincere thanks also go to **Kewkradong Bangladesh** and its well-wishers for their unwavering support, we extend our heartfelt appreciation to **Dr. Sarah Carr,** coordinator of the Coastal-Marine EBM Tools Network and **Dr. Acacia Warren** from ESRAG for her encouragement and support, which helped strengthen our efforts.

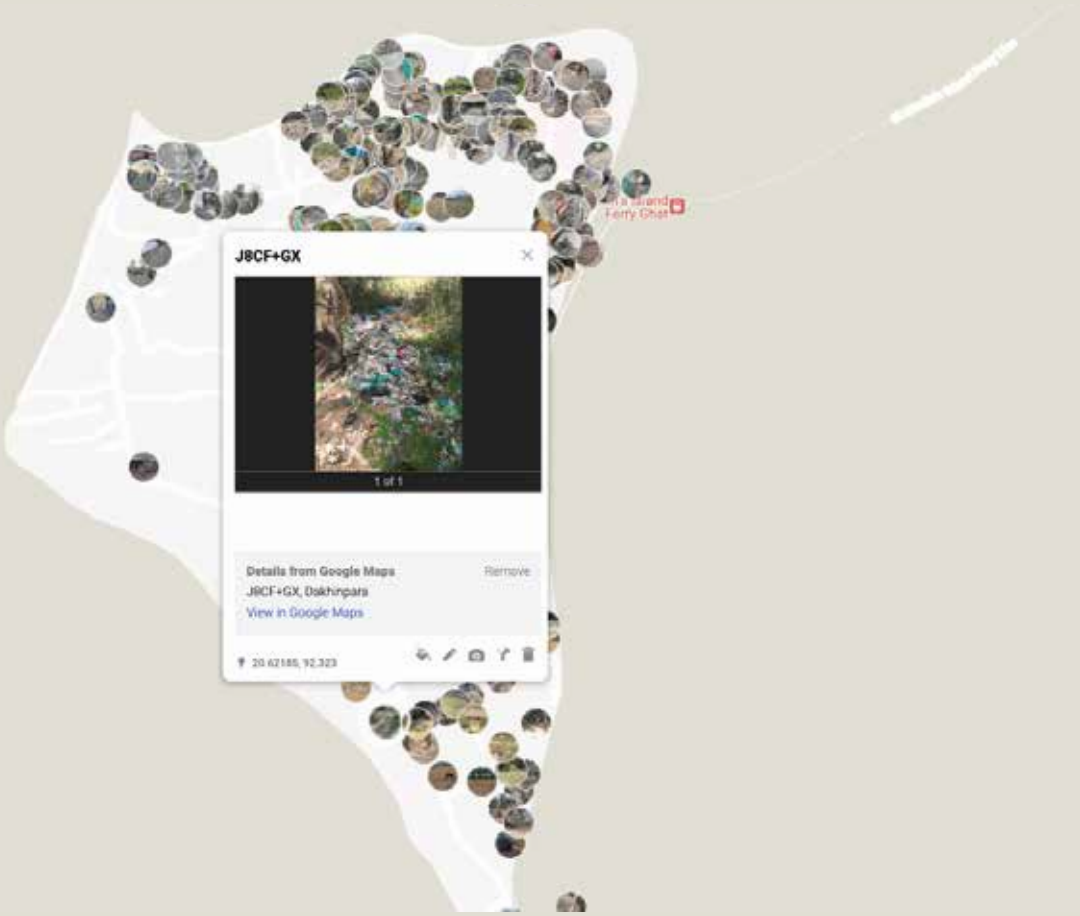
This report is a testament to the collective efforts of numerous individuals and organizations, whose contributions have been instrumental in advancing sustainable management and conservation strategies for St. Martin's Island.

EXECUTIVE SUMMARY

Saint Martin's Island, the only coral-bearing island in Bangladesh, is experiencing acute environmental stress due to systemic inadequacies in waste management and the pervasive use of plastic-based products, which now represent the principal source of plastic pollution. This rapid assessment quantifies current waste generation, identifies infrastructural and regulatory gaps, and proposes data-driven, actionable interventions for sustainable waste governance.

Plastic Pollution Crisis:

Single-use plastics, largely driven by tourism and local inhabitants, are the primary contributors to single use plastic pollution, with waste generation hotspots identified in tourist areas concentrated with accommodation facilities, shops, restaurants and local households. While awareness campaigns have been implemented, sustainable waste disposal practices are yet to gain widespread acceptance among locals and tourists.



CRITICAL GAPS

Poor Disposal Infrastructure: Absence of proper waste disposal sites causing environmental harm.

Waste Segregation: Absence of infrastructure and guidelines for separating plastics.

Insufficient Collection: Current waste collection mechanisms inadequate in coverage and logistics.

Household Collection Absence: No structured household waste services, causing informal dumping and burning.

Data Deficiency: Lack of systematic plastic waste data hampers effective policy planning.

Limited Coordination: Fragmented efforts among stakeholders lead to inefficiencies.

Poor Enforcement: Existing regulations suffer from weak implementation and insufficient resources.

Unregulated Inflow of Plastic Products: : The continuous arrival of plastic-based items—such as bottles, multi layer food wrappers and packaging materials—from the mainland occurs without any local control or restriction, leading to unchecked distribution and excessive accumulation on the island.

Marine Pollution Neglect: Insufficient measures addressing plastic leakage into marine environments.

Lack of Economic Incentives: No financial incentives encouraging reduction and recycling of plastics.

Weak Public Awareness: Limited initiatives promoting behavioral change and responsible disposal.

Seasonal Challenges: Tourist influx overwhelms existing waste management systems during peak seasons.

Initiatives: Sustainable waste management initiatives on the island remain very limited or not present.

Dependence on Mainland: Reliance on mainland for waste processing is inefficient and unregulated.

RECOMMENDATIONS

Improve Infrastructure: Create official, regulated disposal sites and prevent open dumping.
Enhance Coordination: Establish multi-stakeholder governance frameworks.
Strengthen Collection: Expand island-wide waste collection and introduce household collection services.
Control Inflow of Plastic Products: Establish strict oversight on the entry and distribution of plastic-based items to the island, encouraging responsible use and reducing environmental burden.
Waste Segregation: Implement color-coded bins and awareness campaigns.
Strengthen Enforcement: Boost monitoring capabilities and reward policy compliance.
Develop Comprehensive Data: Regularly track plastic waste generation, composition, and disposal.
Marine Pollution Measures: Deploy ocean waste traps and collaborate with local fishers.
Context-Specific Economic Measures: Special directives can be introduced for ecologically sensitive areas like Saint Martin's Island, including targeted taxes, subsidies, or incentive-based schemes to promote recycling, responsible consumption, and waste recovery.
Raise Public Awareness: Launch education programs targeting schools, businesses, and tourists.
Seasonal Planning: Develop contingency plans for waste management during high tourist seasons.
Promote Circular Economy: Encourage community-led reuse and waste repurposing initiatives.
Mandatory Mainland Transfer: Collect, segregate, and transport all plastic waste to controlled mainland facilities, prohibiting on-island recycling.

THIS REPORT CALLS FOR AN URGENT, COORDINATED RESPONSE TO ADDRESS THE IDENTIFIED CHALLENGES AND SAFEGUARD THE ISLAND'S UNIQUE BIODIVERSITY. BY BUILDING ON PAST SUCCESSES AND FOSTERING COLLECTIVE ACTION, SAINT MARTIN'S ISLAND CAN BE A MODEL FOR SUSTAINABLE WASTE MANAGEMENT IN FRAGILE ECOSYSTEMS.

ST. MARTIN'S ISLAND, WITH A PERMANENT POPULATION OF APPROXIMATELY 12,000 AND A DAILY INFLUX OF 8,000 TOURISTS DURING PEAK SEASON, GENERATES A SIGNIFICANT VOLUME OF PLASTIC WASTE. IF NOT EFFECTIVELY MANAGED, THESE PLASTIC MATERIALS DEGRADE OVER TIME, FRAGMENTING INTO MICROPLASTICS. GIVEN THE SCALE OF ANTHROPOGENIC DEBRIS ALREADY ACCUMULATED ON THE ISLAND, ST. MARTIN'S IS INADVERTENTLY RELEASING A SUBSTANTIAL AMOUNT OF PLASTIC PARTICLES AND MICROPLASTICS INTO THE OCEAN, POSING A SERIOUS THREAT TO MARINE ECOSYSTEMS.

HOWEVER, ADDRESSING THIS ISSUE IS NOT INSURMOUNTABLE. THE ADVANTAGE LIES IN THE ISLAND'S SMALL SIZE—JUST 3.5 SQUARE KILOMETERS—WHERE PLASTIC WASTE REMAINS HIGHLY CONCENTRATED. THIS PRESENTS AN OPPORTUNITY FOR TARGETED AND EFFECTIVE INTERVENTIONS TO SYSTEMATICALLY REMOVE BOTH NEWLY GENERATED WASTE AND THE LEGACY PLASTIC DEBRIS THAT HAS ACCUMULATED OVER TIME. IMPLEMENTING STRATEGIC WASTE MANAGEMENT MEASURES CAN SIGNIFICANTLY REDUCE THE ENVIRONMENTAL IMPACT AND PREVENT FURTHER DEGRADATION OF PLASTIC INTO MICROPLASTICS.

1.

INTRODUCTION

Saint Martin’s Island, the only coral-bearing island in Bangladesh, faces escalating environmental challenges, primarily due to plastic pollution. Increased tourism, inadequate waste management infrastructure, and unsustainable consumption practices have severely impacted marine biodiversity, degraded coral ecosystems, and threatened the livelihoods of local communities dependent on fishing and eco-tourism.

This assessment report, titled "Rapid Assessment on Plastic Waste Generation and Management Practices on St. Martin’s Island" builds upon the initial findings of the inception report and presents a comprehensive evaluation of plastic waste generation, existing waste management practices, and their broader plastic waste implications. The assessment synthesizes primary data collected through field research and analysis, while also reviewing past and ongoing mitigation efforts by the Government of Bangladesh (GoB), NGOs, INGOs, and private stakeholders. By identifying best practices and critical gaps, this report provides actionable recommendations for establishing a sustainable waste management framework.

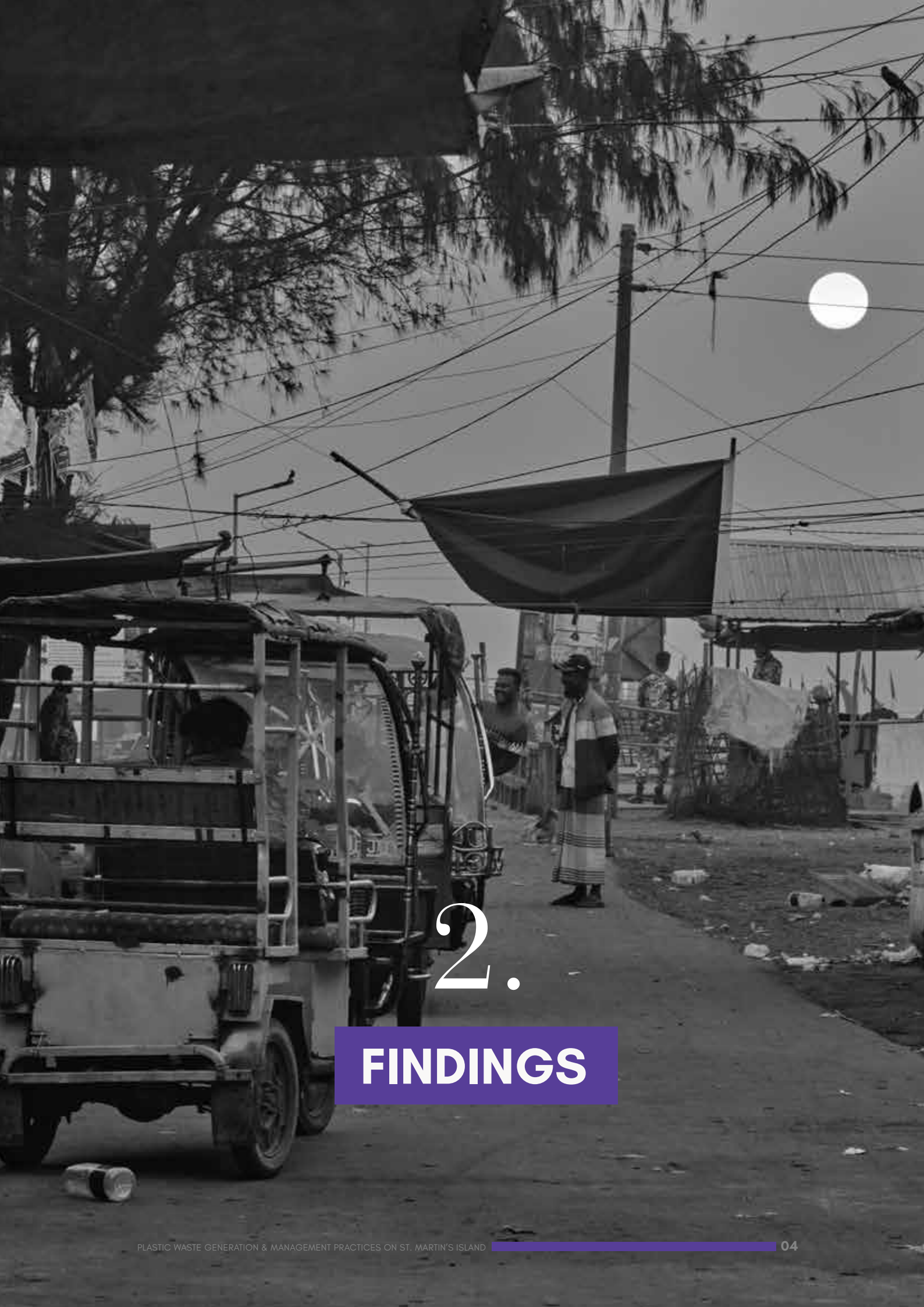
Beyond its ecological significance, Saint Martin’s Island holds strategic geopolitical importance for Bangladesh, contributing to the country’s exclusive economic zone under the United Nations Convention on the Law of the Sea. The island is home to globally threatened marine turtle species and serves as a critical habitat for migratory birds. However, unchecked tourism and insufficient conservation measures have led to severe environmental degradation over the past two decades.

Key policy interventions, such as the Ecological Critical Area (ECA) declaration (1999), the Marine Protected Area designation (2022), and the recent ban on single-use plastics (2024), have aimed to mitigate these challenges. Additionally, community-driven programs—including the International Coastal Cleanup, the Plastic Exchange Store, and the upcoming Waste-to-Energy Project (2025)—have played an important role in conservation efforts. Despite these initiatives, significant challenges remain in policy enforcement, infrastructure development, and multi-stakeholder coordination.

This final report underscores the urgency of implementing a data-driven, long-term waste management strategy to protect the ecological integrity of Saint Martin's Island. While past initiatives, such as the Coastal and Wetland Biodiversity Management Project (CWBMP), have contributed to conservation efforts, research gaps persist in areas such as marine ecosystem health, biodiversity monitoring, and sustainable waste management solutions. Through an evidence-based approach, this assessment consolidates existing knowledge, presents key research findings, and proposes strategic interventions to balance environmental conservation with the socioeconomic needs of local communities. The findings presented in this report are based on extensive field research, stakeholder engagement, and policy analysis conducted over the course of the assessment period. By fostering collaboration among government agencies, conservation organizations, and local communities, this report aims to support the development of an integrated waste management system that aligns with both ecological preservation and long-term sustainable development goals for Saint Martin's Island.

STRUCTURAL NOTE:

In deviation from conventional reporting formats where findings typically follow the methodology, this report presents the **Findings** section immediately after the Introduction. This arrangement is intended to enhance accessibility and facilitate prompt reference for decision-makers and stakeholders. The methodology and supporting data are detailed in the subsequent sections.



2.

FINDINGS

While the national Single-Use Plastic (SUP) SRO outlines certain materials for phase-out, in practice, blanket bans have proven difficult to enforce in Bangladesh—particularly in remote and tourism-dependent areas like Saint Martin's Island. Given the informal nature of the supply chain and limited regulatory capacity, a more effective and context-appropriate strategy is to strengthen the segregation, collection, and safe storage systems for plastic waste. Prioritizing post-consumer recovery—especially of high volume plastic waste such as multilayer food wrappers, mini sachets, and polystyrene containers—can significantly reduce environmental leakage. Investments in source segregation, vendor-level collection hubs, and temporary storage infrastructure offer a practical path toward managing plastic waste, while also preparing the ground for future regulatory compliance.

The Solid Waste Management Rules, 2021, framed under the Environment Conservation Act, 1995, lay out clear directives for the management of municipal and institutional waste across Bangladesh. However, during the assessment conducted on Saint Martin's Island, it was found that most of these provisions have not been operationalized.

RULE 6(1) Waste must be segregated at source into biodegradable, recyclable, and hazardous components

OBSERVED PRACTICE Although segregation of waste at source is not practiced across household, commercial, or institutional levels, an even more concerning trend was observed: plastic waste is often burned openly. This practice was noted from individual households to hotels and shops, posing serious environmental and health risks. Such open burning not only violates the principles outlined in Rule 6(1) of the Solid Waste Management Rules, 2021, but also contributes to air pollution, threatens public health, and undermines the broader goals of safe and sustainable waste management on the island.

Rule 6(2)	Local authorities to provide color-coded bins and promote awareness.

OBSERVED PRACTICE

While some waste bins were observed during the assessment, these were not color-coded. as mandated under Rule 6(2) of the Solid Waste Management Rules, 2021. The color coding is essential for promoting source-level segregation between biodegradable, recyclable, and hazardous waste. Additionally, public awareness campaigns appeared limited and sporadic, with no consistent messaging or signage visible in key tourist or residential areas.

Rule 7(1–5)	Local bodies must ensure door-to-door collection, transfer stations, and sanitary landfills.

OBSERVED PRACTICE

While a basic waste collection system was found to be in place on Saint Martin's Island's Jetty/ Bazar area, it remains highly inadequate relative to the volume of waste generated, the resident and tourist population, and the density of commercial activity. Notably, no door-to-door collection was observed at the household level, which contradicts the operational standards set by Rule 7(1) of the Solid Waste Management Rules, 2021. The limited collection infrastructure fails to ensure timely and area-wide coverage, resulting in overflowing trash, accumulated waste in public spaces, and the continuation of open dumping. The absence of a transfer station or a formally designated disposal site further undermines the prospects for effective and compliant waste management on the island.

Rule 10	Waste collectors and handlers must be registered and provided with protective equipment.
OBSERVED PRACTICE	Collection appears informal and unregulated.
Rule 15	Local authorities must prepare and maintain a 10-year solid waste management plan.
OBSERVED PRACTICE	The current state of waste management on the island—characterized by unsegregated disposal, open dumping, inadequate collection, and absence of designated disposal sites—does not reflect the existence of any strategic or structured planning process. Even if such a plan were in place, the on-ground situation offers little evidence of its implementation or impact, suggesting a significant gap between planning and execution. The absence of a visible and functional plan further points to weaknesses in institutional coordination, accountability, and long-term sustainability planning in this ecologically critical area.
Rule 27	Single-use plastics must be prohibited in Ecologically Critical Areas (ECA).
OBSERVED PRACTICE	SUPs such as multi layer food wrappers and packaging materials, polythene bags are openly sold and discarded.

2.1 SOURCES OF INLAND PLASTIC WASTE

Plastic waste presence on the island is primarily influenced by behavioral habits, particularly during the peak tourist influx. The island experiences a significant rise in plastic waste generation, with packaged food products contributing the most. Among these, chip packets are the most commonly found plastic waste, followed closely by biscuit wrappers, which are widely available across almost all shops on the island.

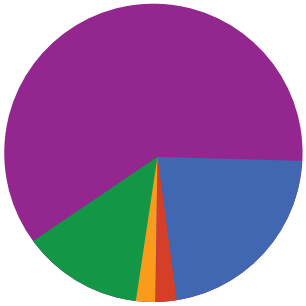
A notable observation is the prevalence of mini-packs and sachets, which are frequently discarded. Despite the scarcity and high price of green coconuts (daab), single-use plastic (SUP) straws remain remarkably common. This can be attributed to the widespread sale of beverages such as juices and soft drinks, which are often packaged in tetra packs or plastic containers with a straw attached to the main packaging using shrink-wrapped plastic. This finding is significant as it challenges the common assumption that straws are primarily associated with green coconut consumption. Instead, they are extensively used due to the packaging practices of commercially sold drinks.

Beyond food-related plastics, a considerable amount of fragmented plastic sheets has been documented. These originate primarily from construction activities and household use. Many houses on the island incorporate plastic sheets as roofing or wall reinforcements. Over time, due to weathering and degradation, these plastic sheets become brittle, resulting in the formation of microplastic fragments. These small particles eventually mix with soil and sand, contributing to environmental contamination.

2.2 LOCAL POPULATION AND COMMERCIAL ESTABLISHMENTS

According to locally available data, the island hosts an approximate population of 12,000 residents. Additionally, the island contains approximately 376 commercial establishments. This distribution highlights that local consumption of plastic is substantial and contributes significantly to plastic waste generation. Plastic waste from local commercial establishments is often found near households. A long-term practice observed in these settlements is the habitual burning of plastic waste, a method used for waste reduction, albeit one with severe environmental and health implications.

PERMANENT SHOPS	115
SEMI PERMANENT SHOPS	261
NON SUP CONTRIBUTING SHOPS	89
SUP CONTRIBUTING PERMANENT SHOPS	95
TOTAL NUMBER OF SHOPS	376



TYPE OF SHOPS

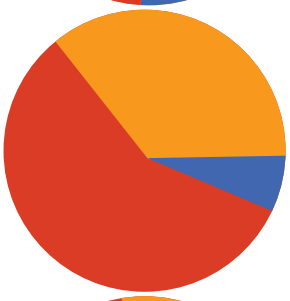
Grocery 23.2%
Pharmacy 2.1%
Hardware 2.1%
General 13%
Other 59.6%

STRUCTURE TYPE

Permanent 31.7%
Semi Permanent 68.3%

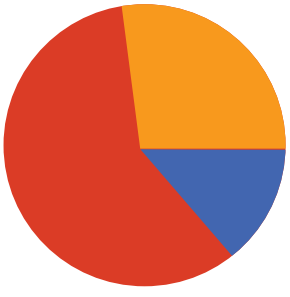
STRUCTURE MATERIALS

Brick 26.2%
Metal 16.4%
Other 57.5%



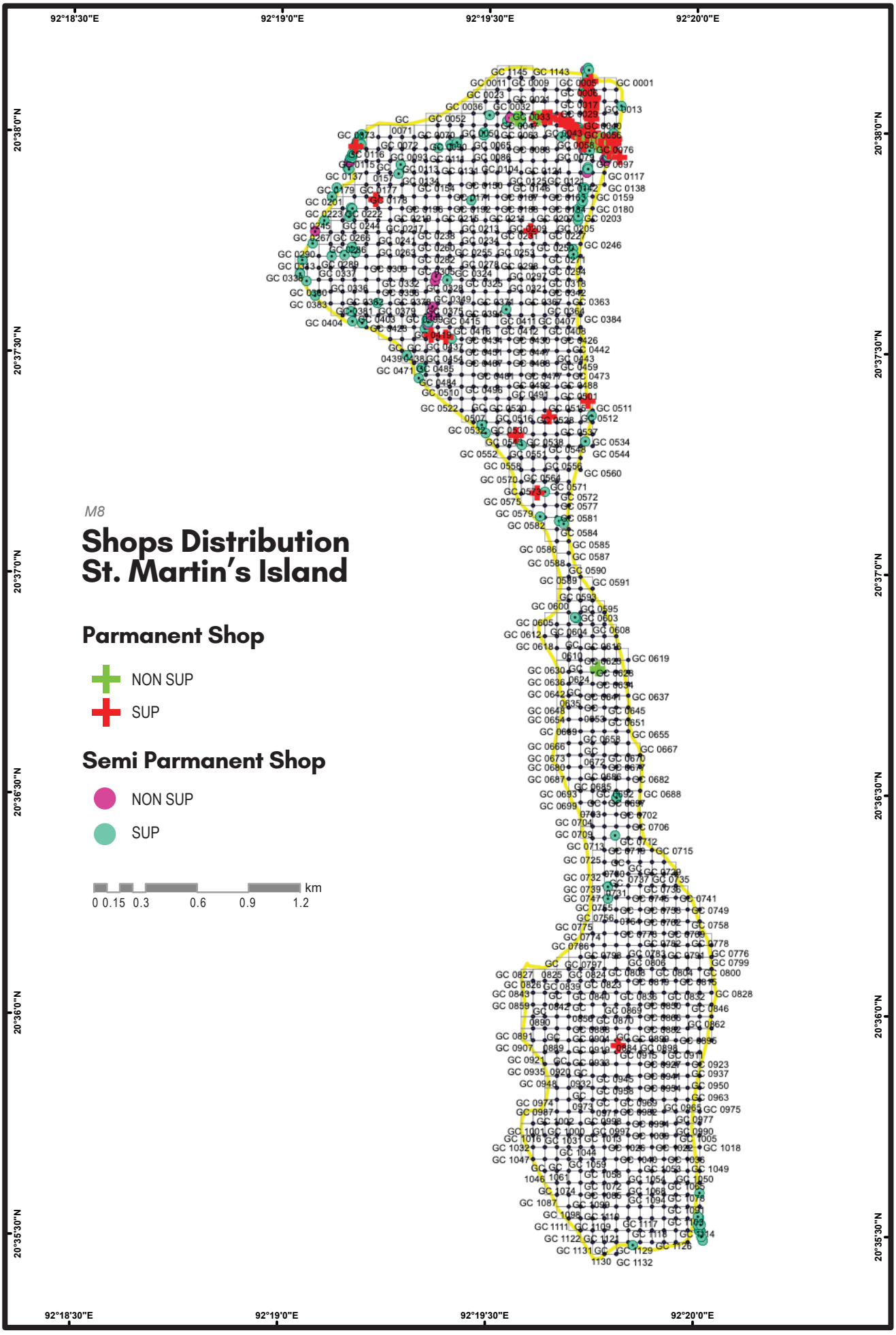
LENGTH OF THE SHOP (in foot)

2 TO 5 6.5%
6 TO 10 58 %
10+ 35.5%



WIDTH OF THE SHOP (in foot)

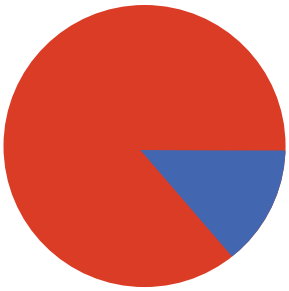
2 TO 5 13.8%
6 TO 10 59%
10+ 27.2%


92°18'30"E
92°19'0"E
92°19'30"E
92°20'0"E
20°38'0"N
20°37'30"N
20°37'0"N
20°36'30"N
20°36'0"N
20°35'30"N
M8
Shops Distribution
St. Martin's Island
Parmanent Shop
NON SUP
SUP
Semi Parmanent Shop
NON SUP
SUP
0 0.15 0.3 0.6 0.9 1.2
km

2.3 HOUSEHOLD PLASTIC WASTE AND DUMPING PATTERNS

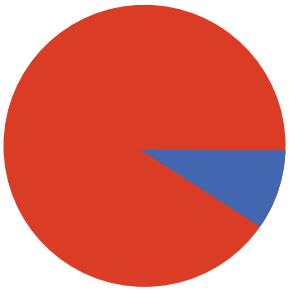
To quantify household-generated plastic waste, a comprehensive household survey was conducted. The survey assessed the approximate population distribution in terms of adults and children while also mapping the periphery of each household for signs of waste dumping. The extent of dumping was measured using a scale of 1 to 10, with 1 unit equivalent to 1 square foot. The largest recorded dumping area was classified as 10, indicating that household plastic waste accumulations exceeded 10 square feet in some instances.

PERMANENT	222
SEMI PERMANENT	1180
TOTAL NUMBER OF HOUSES	1402



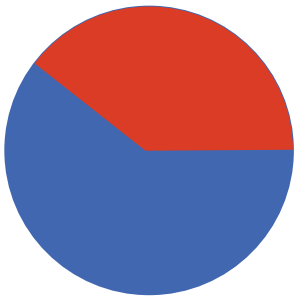
STRUCTURE TYPE

Permamnent 13%
Semi Permanent 87%



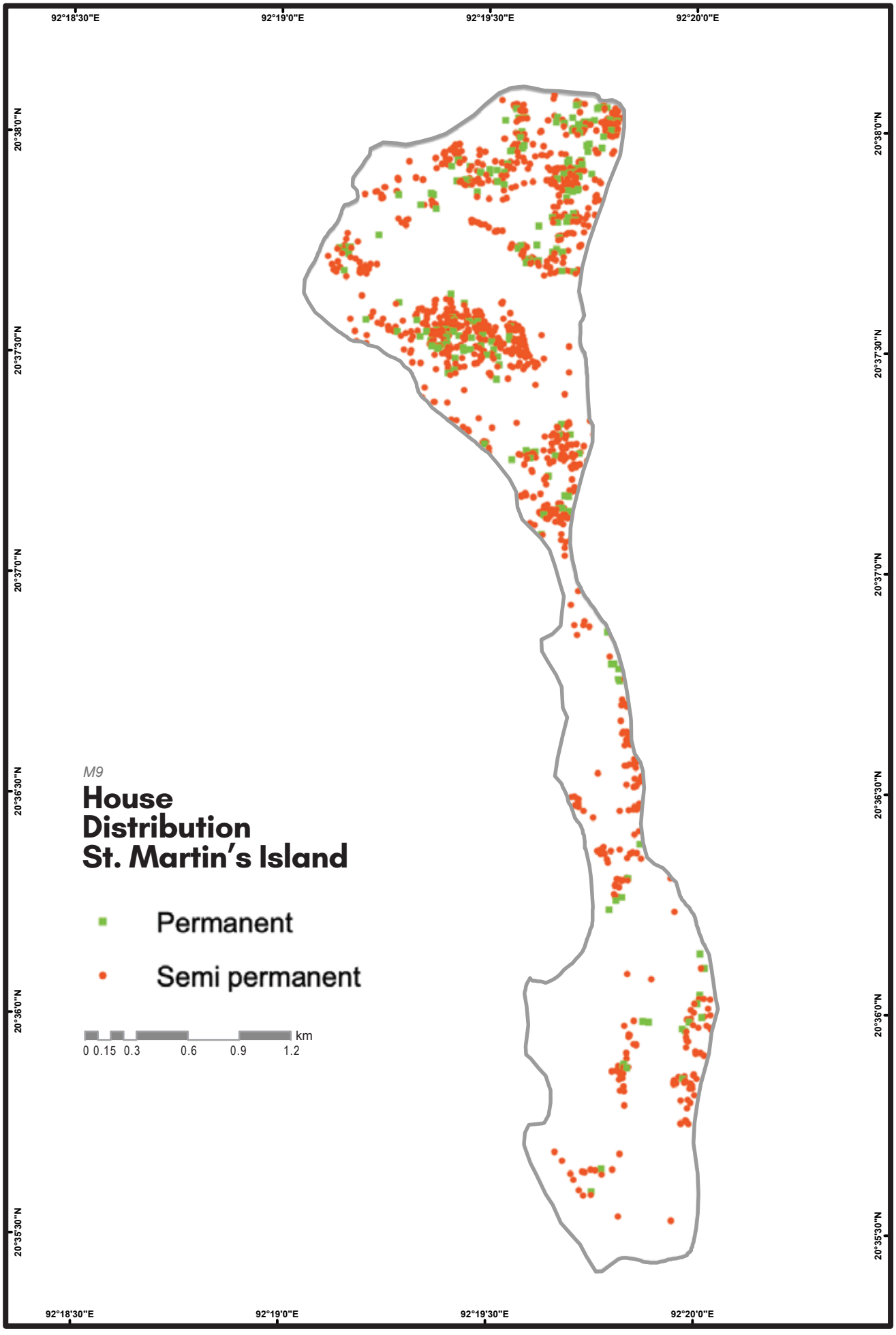
BIN

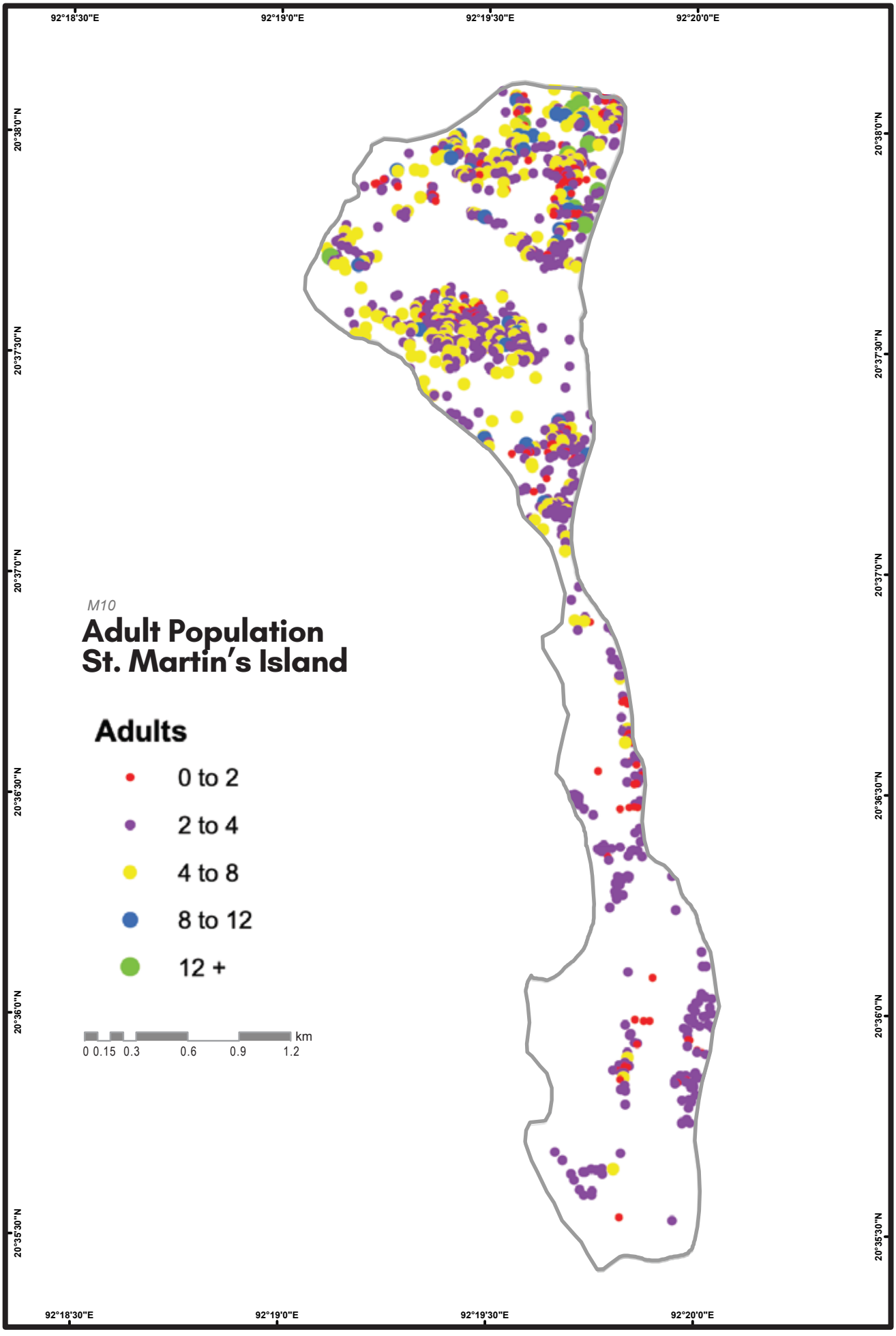
YES 9.3%
NO 90.7%

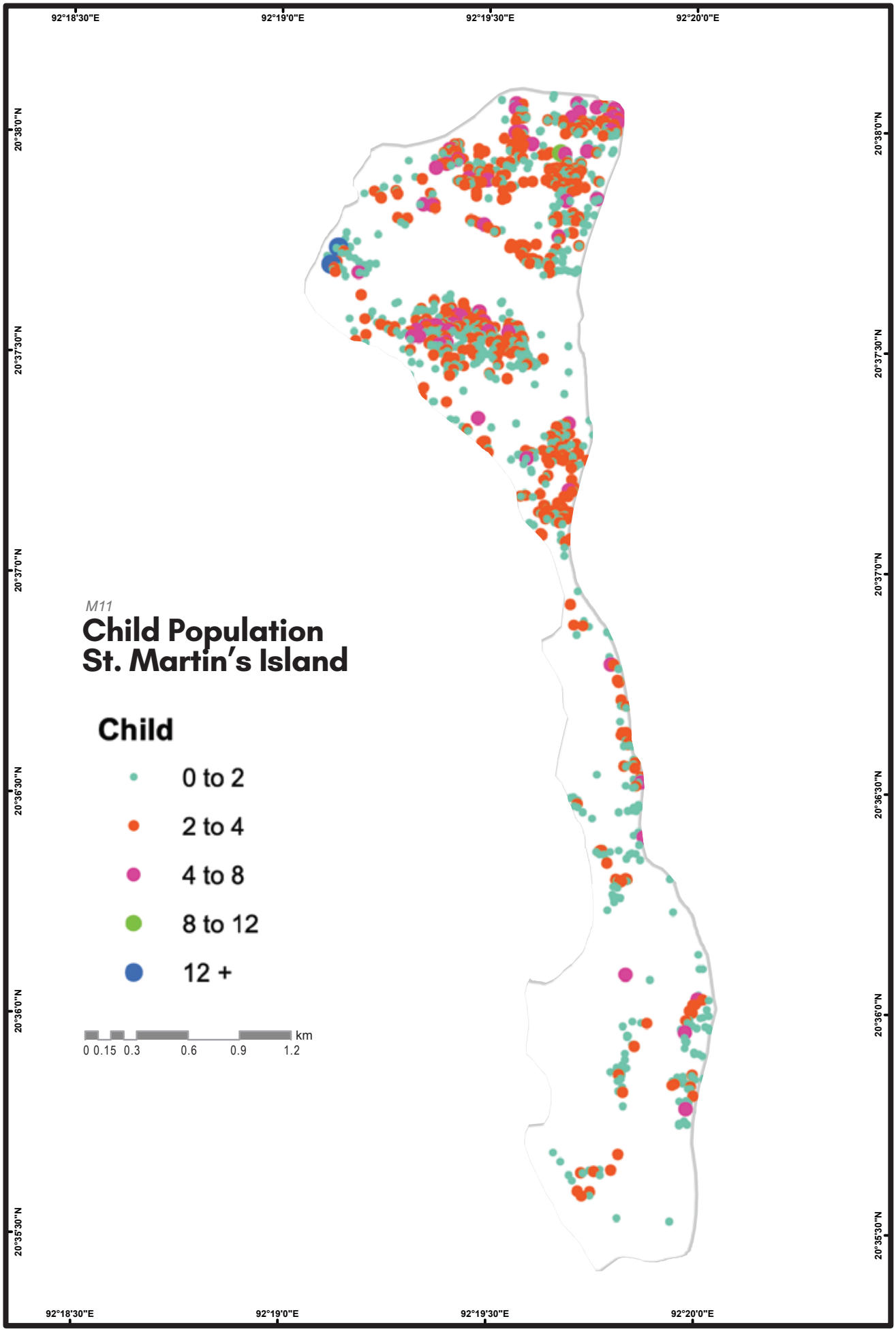


EXISTENCE OF DUMPING

YES 60.4%
NO 39.6%


92°18'30"E
92°19'0"E
92°19'30"E
92°20'0"E
20°38'0"N
20°37'30"N
20°37'0"N
20°36'30"N
20°36'0"N
20°35'30"N
M9
House Distribution St. Martin's Island
Permanent
Semi permanent
km
0 0.15 0.3 0.6 0.9 1.2


92°18'30"E
92°19'0"E
92°19'30"E
92°20'0"E
20°38'0"N
20°37'30"N
20°37'0"N
20°36'30"N
20°36'0"N
20°35'30"N
M10
Adult Population
St. Martin's Island
Adults
0 to 2
2 to 4
4 to 8
8 to 12
12 +
km
0 0.15 0.3 0.6 0.9 1.2

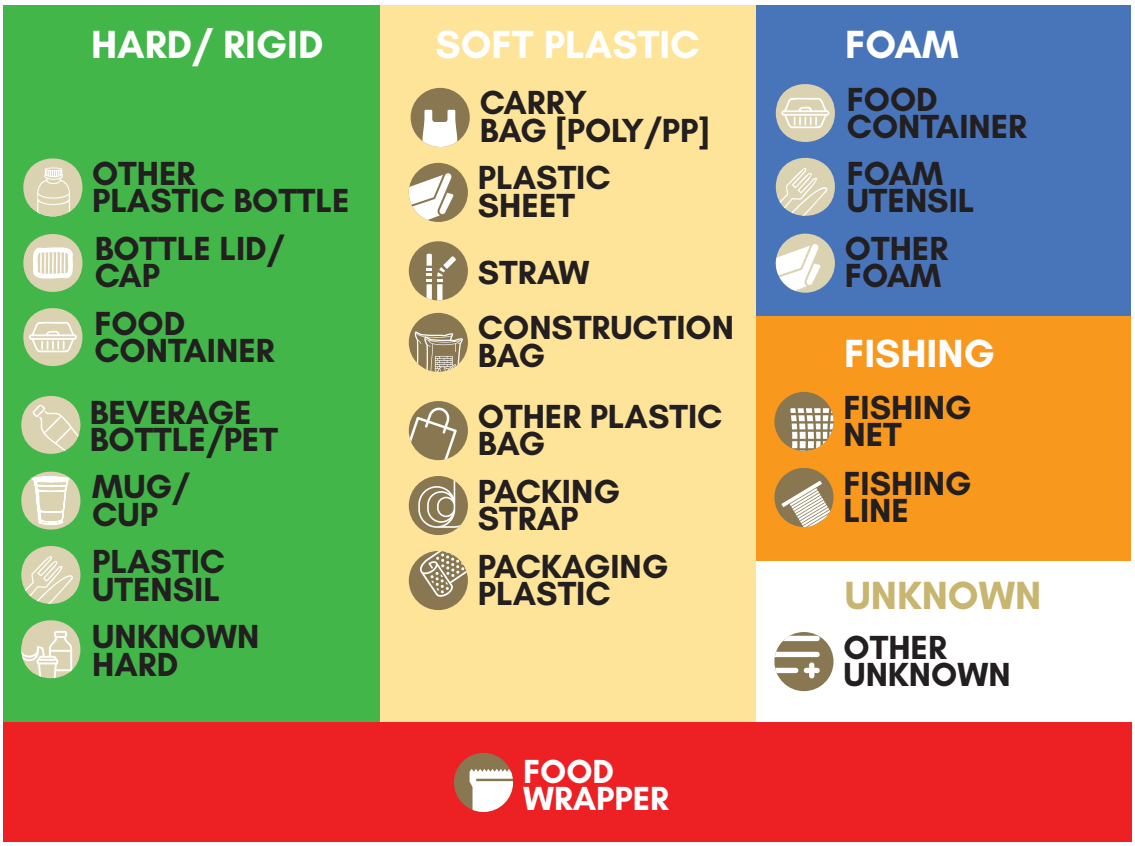

92°18'30"E
92°19'0"E
92°19'30"E
92°20'0"E
20°38'0"N
20°37'30"N
20°37'0"N
20°36'30"N
20°36'0"N
20°35'30"N
M11
Child Population
St. Martin's Island
Child
0 to 2
2 to 4
4 to 8
8 to 12
12 +
km
0 0.15 0.3 0.6 0.9 1.2

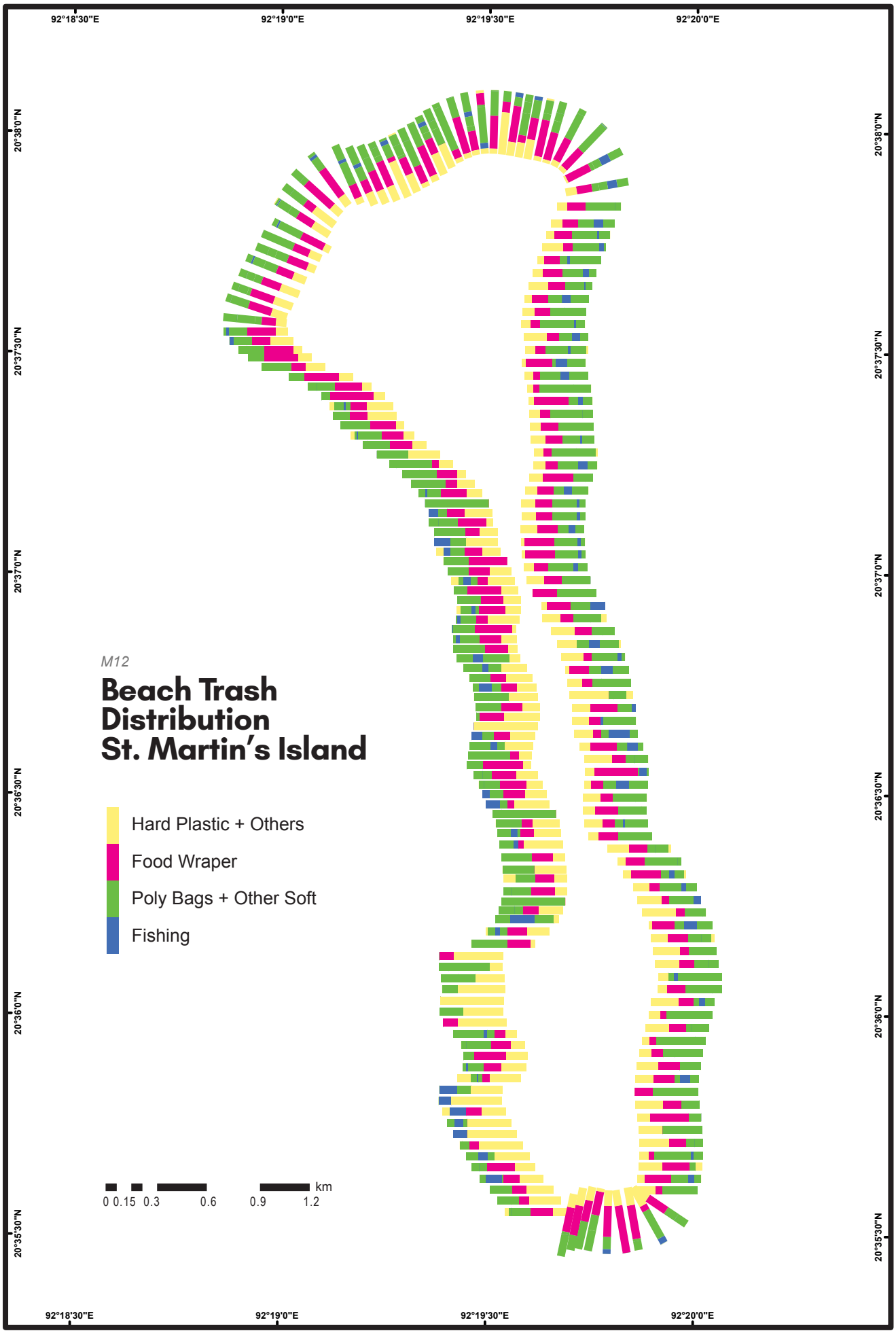
2.4 BEACH SURVEY AND CATEGORIZATION OF PLASTIC WASTE

A structured transect survey was conducted on the island's beach to quantify plastic waste accumulation. The methodology adhered to the guidelines outlined in the Methodology Handbook. The survey identified 24 distinct types of plastic waste, which were subsequently categorized into five broader classifications for better representation. The findings reaffirm that food wrappers remain the most predominant type of plastic waste on the beach.

Additionally, a significant quantity of hard plastic fragments was observed. Poly bags and other non-rigid plastics were categorized under soft plastics, encompassing all flexible plastic materials

TYPE OF PLASTICS




92°18'30"E
92°19'0"E
92°19'30"E
92°20'0"E
20°38'0"N
20°37'30"N
20°37'0"N
20°36'30"N
20°36'0"N
20°35'30"N
M12
Beach Trash Distribution St. Martin's Island
Hard Plastic + Others
Food Wraper
Poly Bags + Other Soft
Fishing
0 0.15 0.3 0.6 0.9 1.2
km

2.5 RESTAURANT SURVEY

During our survey, we identified 62 operational restaurants. However, a few restaurants could not be accessed due to their location within accommodation facilities. We aimed to determine the seating capacity per restaurant as well as the total capacity.

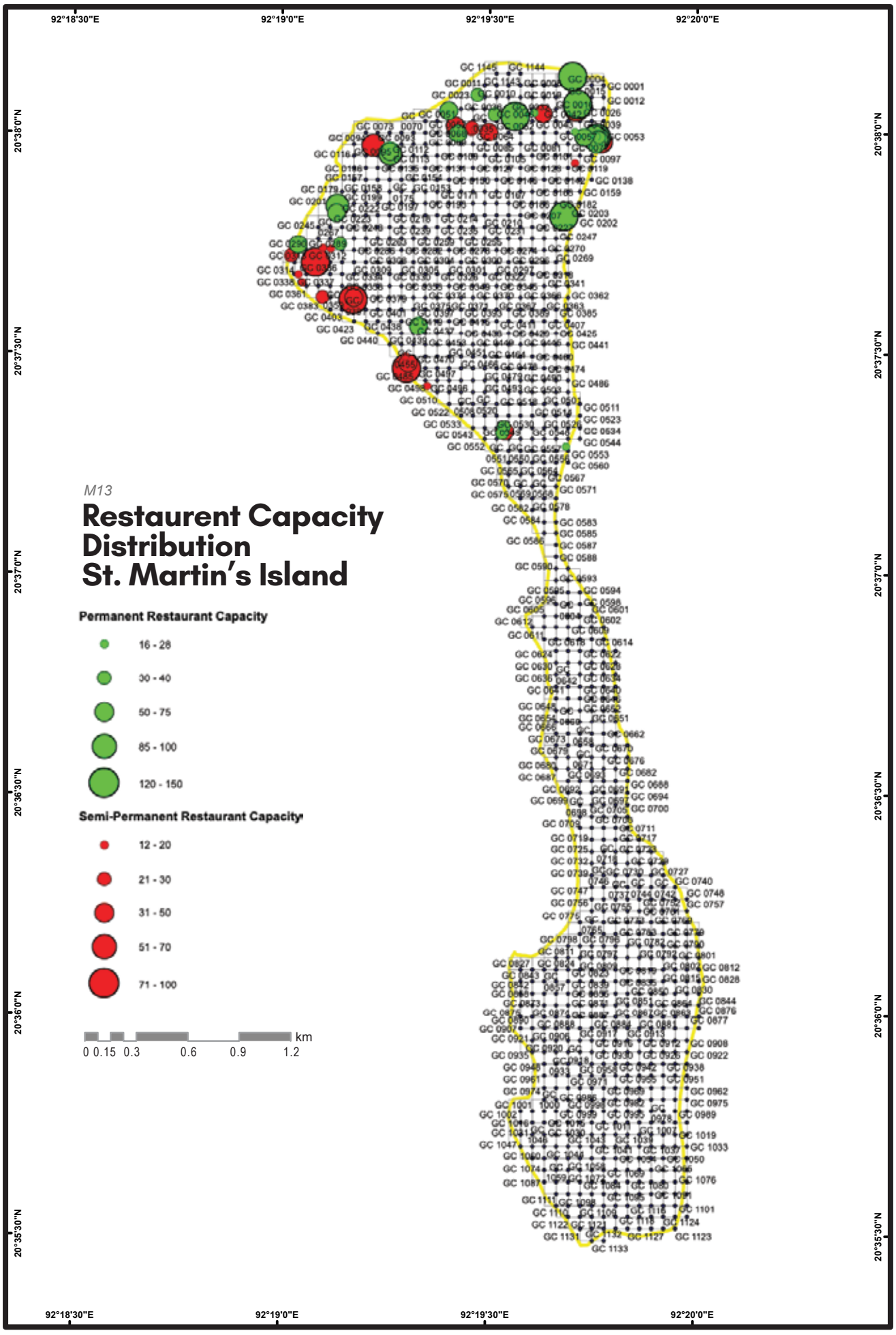
Our findings indicate that, at full capacity, all restaurants combined can accommodate 3,200 people simultaneously. This suggests that during peak tourist seasons, when the island receives more than 8,000 visitors per day, restaurant seating limitations may lead to increased consumption of packaged food and cooked meals, particularly at lunchtime. Dinner, however, is somewhat more accommodating due to the absence of strict time limitations.

This analysis indicates that restaurant capacity constraints can directly impact plastic waste generation. When seating is insufficient, tourists may opt for packaged food alternatives, significantly increasing single-use plastic (SUP) waste. Additionally, the increased demand for takeout meals escalates the usage of disposable plastic utensils, containers, and wrappers.

Furthermore, the distribution of meal demand throughout the day plays a crucial role in waste production. While lunch sees higher congestion due to time constraints, dinner service is more flexible, potentially allowing better waste management strategies. This suggests the need for staggered meal service, extended restaurant hours, or mobile food services to mitigate pressure during peak hours and reduce the reliance on SUPs.

Another critical consideration is waste disposal capacity on the island. Given the influx of visitors, a substantial amount of food and plastic waste is generated, which, if not managed effectively, can lead to environmental degradation.

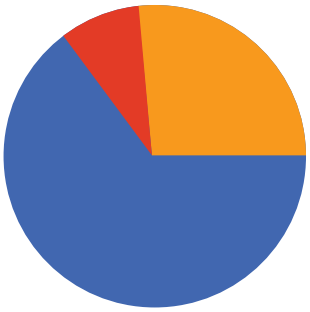
PERMANENT	31
SEMI PERMANENT	31
TOTAL NUMBER OF RESTAURANT	62
ACCOMMODATION CAPACITY	3266


92°18'30"E
92°19'0"E
92°19'30"E
92°20'0"E
20°38'0"N
20°37'30"N
20°37'0"N
20°36'30"N
20°36'0"N
20°35'30"N
M13
Restaurent Capacity Distribution St. Martin's Island
Permanent Restaurant Capacity
16 - 28
30 - 40
50 - 75
85 - 100
120 - 150
Semi-Permanent Restaurant Capacity
12 - 20
21 - 30
31 - 50
51 - 70
71 - 100
km
0 0.15 0.3 0.6 0.9 1.2

2.6 ACCOMMODATION SURVEY

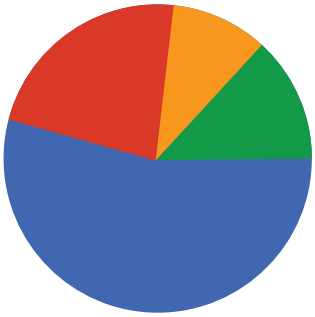
Our survey identified 175 accommodation facilities of various types on the island. Additionally, we discovered several businesses that do not exist on Google Maps or other internet platforms. At full capacity, the surveyed accommodations can host approximately 7,000 tourists. If visitor numbers exceed this capacity, additional tourists are likely to rely on alternative arrangements such as homestays or shared room accommodations.

PERMANENT	68%
SEMI PERMANENT	32%
TOTAL NUMBER OF ACCOMMODATIONS	175
ACCOMMODATION CAPACITY	7141



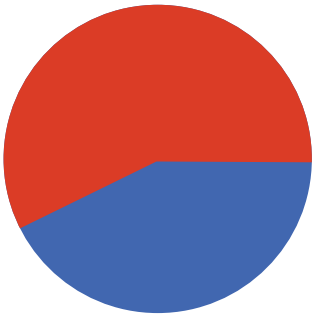
STRUCTURE MATERIALS

BRICK 64.9%
METAL 8.6%
OTHER 26.4%



NUMBER OF FLOORS

1 54.3%
2 22.5%
3 9.8%
4 13.3%



OPEN DUMPING

YES 43%
NO 57%

2.7 BANNING ONLY WORKS WHEN ENFORCEMENT IS STRICT: THE CASE OF ST. MARTIN'S ISLAND

Banning a practice, substance, or behavior may seem like a straightforward solution to environmental and societal issues, but its effectiveness depends entirely on enforcement. Without a strict monitoring system and the willingness to penalize violations, bans often turn into symbolic gestures rather than meaningful deterrents.

Saint Martin's Island, Bangladesh's only coral-bearing island, exemplifies this challenge. Over the years, various bans have been placed on harmful activities, such as coral extraction, turtle poaching, and plastic waste dumping. However, due to lax enforcement, these destructive practices continue. Tourists still litter the beaches with plastic, unauthorized boats operate beyond permitted capacities, and commercial establishments function without proper waste management. Despite government orders to limit tourist numbers, enforcement remains weak, and the environmental degradation persists.

In contrast, effective bans require three essential pillars: detection, deterrence, and punishment. Countries that have successfully implemented environmental bans, such as the Galápagos Islands in Ecuador, rely on a combination of strict entry limits, heavy fines, and rigorous monitoring. The presence of trained enforcement personnel, well-defined tourist regulations, and local community involvement ensures that the bans are not just policies on paper but real protective measures for the ecosystem.

For Saint Martin's Island, a ban on excessive tourism or single-use plastics will only work if enforcement is consistent, strict, and resource-backed. Without proper surveillance, penalties, and local compliance, bans risk becoming empty declarations, allowing environmental destruction to continue unchecked. If enforcement is not feasible, the government should consider regulated tourism models rather than outright prohibitions. Only through a well-structured enforcement mechanism can SMI be preserved for future generations.

2.8 SUMMARY OF FINDINGS

FOOD PACKAGING WASTE, ESPECIALLY FROM CHIPS AND BISCUITS, IS THE LEADING CONTRIBUTOR TO PLASTIC POLLUTION.

SUP STRAWS ARE PREVALENT DESPITE THE HIGH COST AND SCARCITY OF GREEN COCONUTS, LARGELY DUE TO COMMERCIALLY SOLD DRINKS.

PLASTIC SHEET FRAGMENTATION FROM HOUSEHOLD AND CONSTRUCTION MATERIALS CONTRIBUTES SIGNIFICANTLY TO MICROPLASTIC FORMATION.

LOCAL COMMERCIAL ACTIVITIES GENERATE SUBSTANTIAL PLASTIC WASTE, WITH A SIGNIFICANT PORTION ACCUMULATING AROUND HOUSEHOLDS.

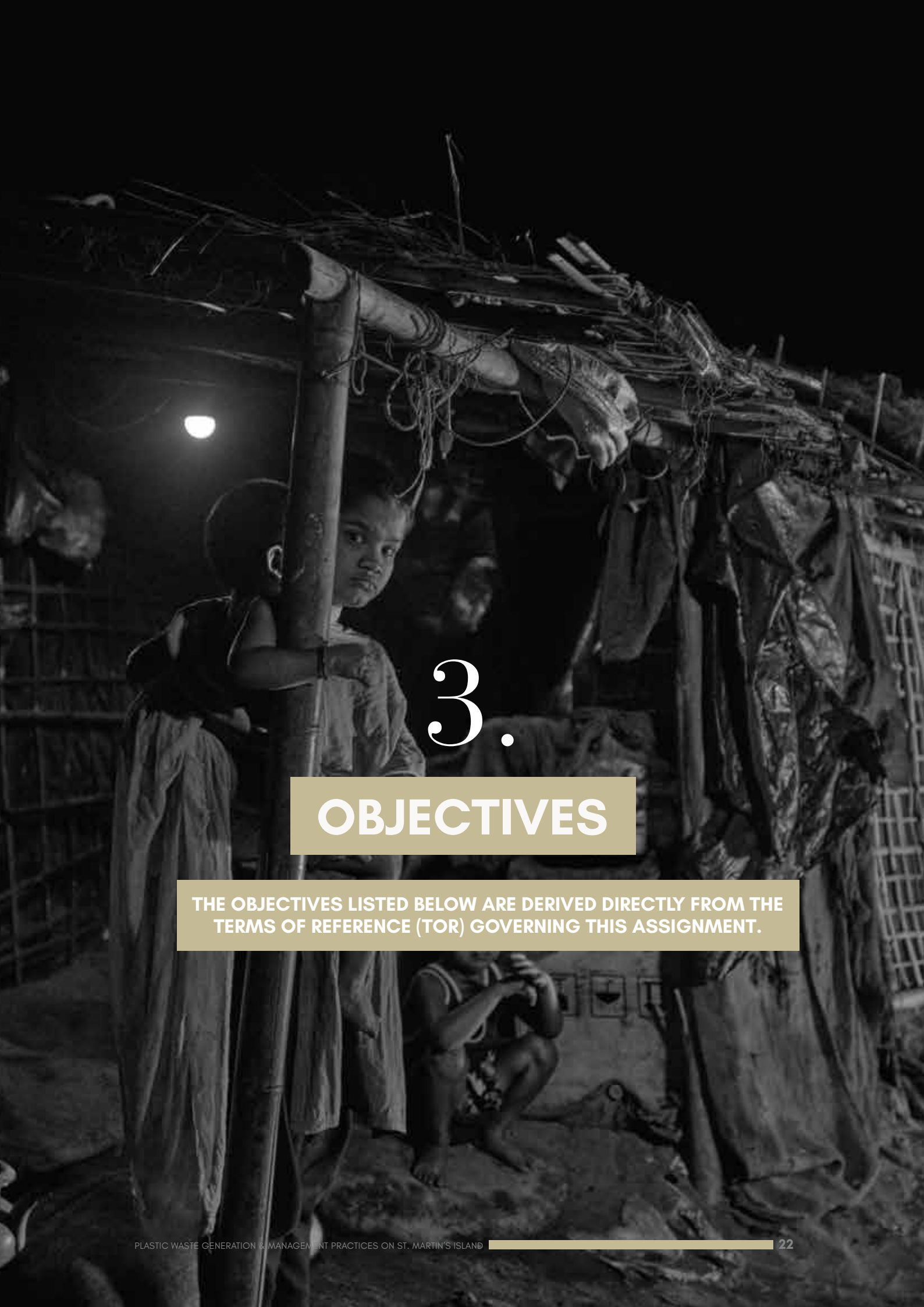
LONG-TERM PLASTIC BURNING PRACTICES ARE A PREVALENT, ENVIRONMENTALLY HARMFUL WASTE MANAGEMENT METHOD.

HOUSEHOLD WASTE DUMPING AREAS RANGE IN SIZE, WITH THE MOST SIGNIFICANT ACCUMULATIONS EXCEEDING 10 SQUARE FEET.

BEACH PLASTIC WASTE PRIMARILY CONSISTS OF FOOD WRAPPERS, FOLLOWED BY HARD PLASTIC FRAGMENTS AND SOFT PLASTIC MATERIALS, INCLUDING POLY BAGS.

RESTAURANT CAPACITY IS LIMITED TO 3,200 PERSONS, MAKING PACKAGED FOOD CONSUMPTION MORE LIKELY WHEN VISITOR NUMBERS EXCEED 8,000 PER DAY.

ACCOMMODATION FACILITIES CAN HOUSE UP TO 7,000 TOURISTS, WITH EXCESS VISITORS RESORTING TO HOMESTAYS OR SHARED-ROOM ARRANGEMENTS.



3.

OBJECTIVES

THE OBJECTIVES LISTED BELOW ARE DERIVED DIRECTLY FROM THE TERMS OF REFERENCE (TOR) GOVERNING THIS ASSIGNMENT.

1 TO IDENTIFY PLASTIC GENERATION HOTSPOTS, TYPES OF PLASTICS USED, AND KEY DRIVERS OF CONSUMPTION.

2 TO EVALUATE EXISTING WASTE MANAGEMENT PRACTICES, INCLUDING COLLECTION, SEGREGATION, DISPOSAL, AND RECYCLING.

3 TO ASSESS STAKEHOLDER CAPACITIES AND HIGHLIGHT OPPORTUNITIES FOR ENHANCED COLLABORATION.

4 TO PROPOSE RECOMMENDATIONS THAT BALANCE ENVIRONMENTAL PRESERVATION WITH THE SOCIOECONOMIC NEEDS OF THE LOCAL COMMUNITY.

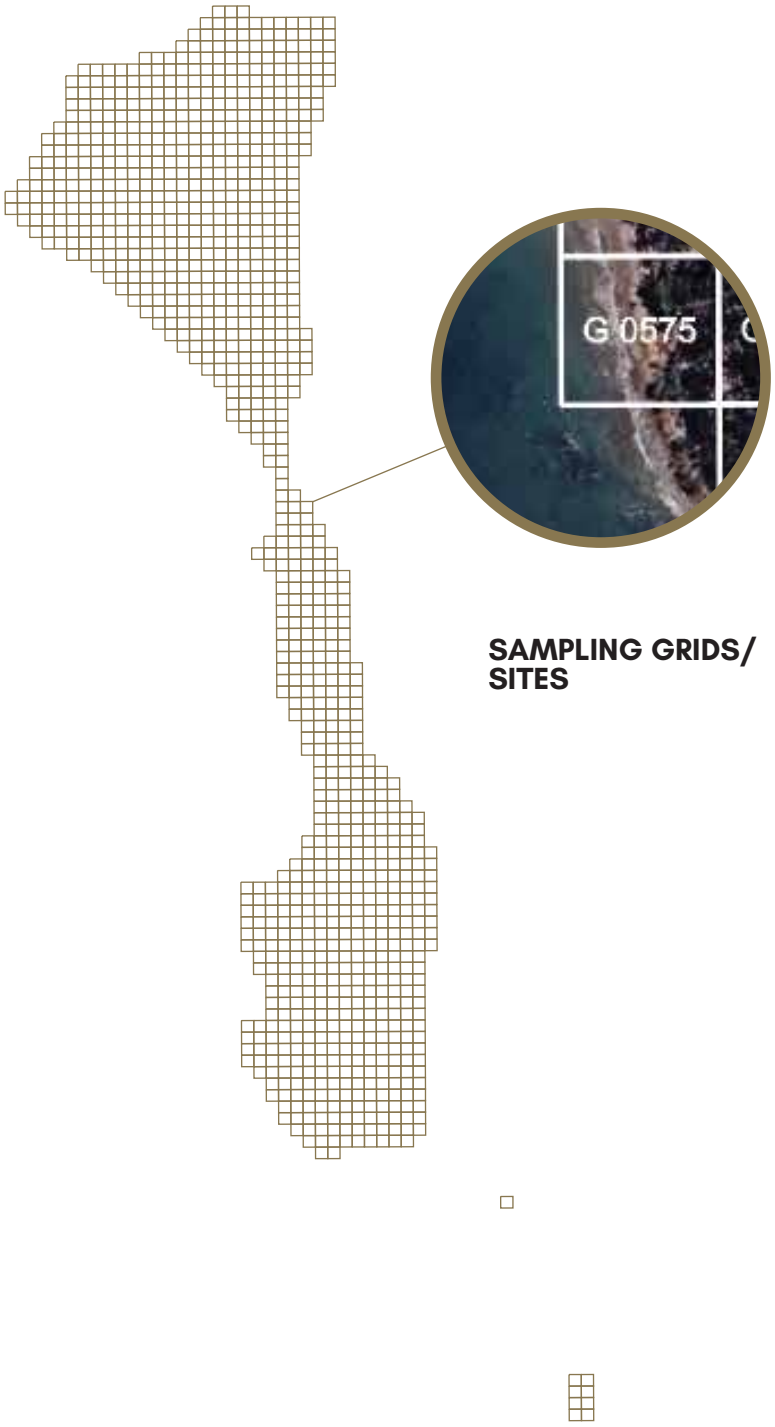
3.1 FROM THE TERMS OF REFERENCE (TOR)

KEY HOTSPOTS FOR PLASTIC WASTE GENERATION ACROSS THE ISLAND

This rapid assessment aims to provide a comprehensive evaluation of plastic waste generation and management practices on St. Martin's Island, with the ultimate goal of informing effective and sustainable waste management interventions. Plastic pollution on St. Martin's Island originates from multiple sources, primarily driven by human activities such as tourism, commercial enterprises, accommodation facilities, and household waste. Understanding the distribution and intensity of plastic waste generation is essential for designing effective waste management strategies.

3.1.1 IDENTIFYING HOTSPOTS

To systematic ally analyze waste distribution, the total area of Saint Martin's Island has been divided into 1,145 quads/grids, each measuring 50m x 50m. These grids encompass the entire inland area, including residential and commercial zones, as well as the island's beach areas. The beach zones are specifically measured from the vegetation line extending towards open water bodies or the ocean, ensuring a comprehensive assessment of coastal waste accumulation.

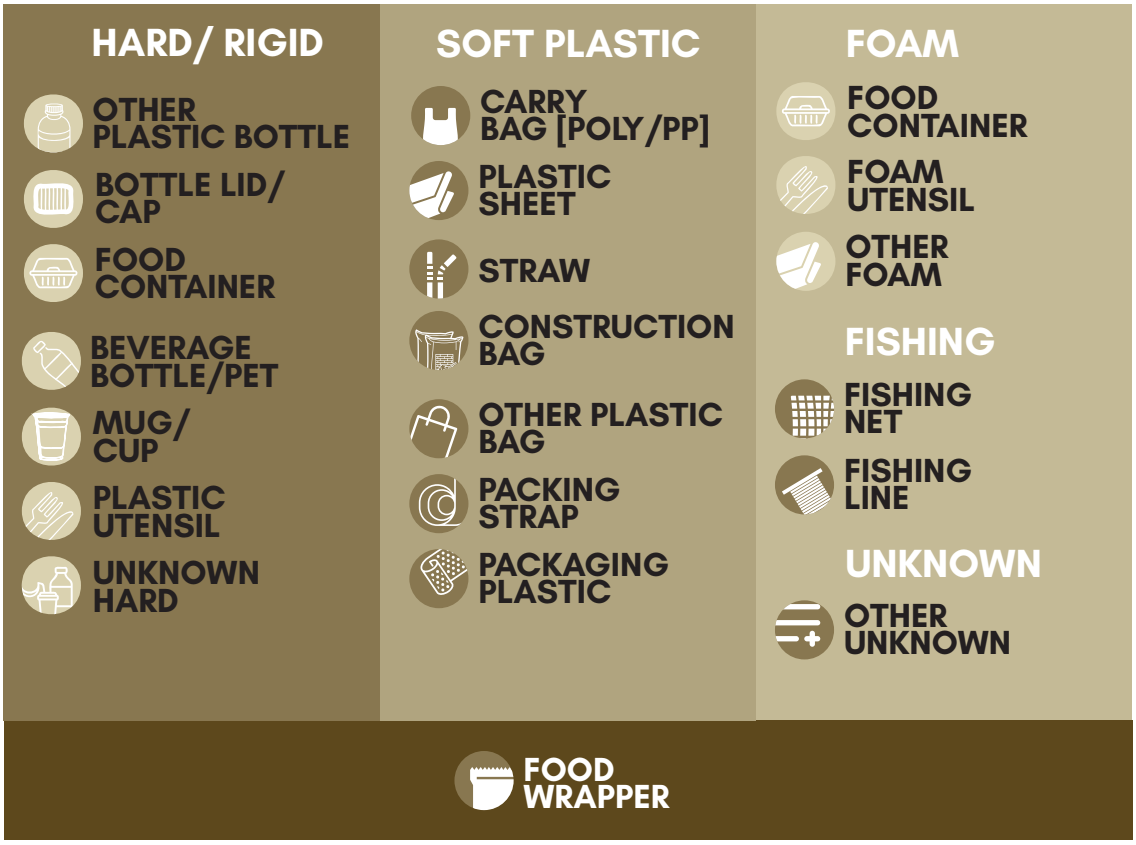


To pinpoint the areas with the highest concentrations of plastic waste, all six data layers (structured establishments and waste surveys) were overlaid on a geographic map. By analyzing the density of data points across the 1,145 grids, the hotspot grids were identified based on the highest concentration of plastic waste generation.

This geospatial approach enables a targeted intervention strategy, allowing authorities and environmental organizations to prioritize cleanup efforts, implement waste management solutions, and introduce sustainable policies for reducing plastic pollution on Saint Martin's Island.

3.1.2 FINDINGS

A Quantitative Summary – Key figures, such as the number of plastic waste items recorded in inland and beach areas per grid.



3.1.3 COMPOSITION ANALYSIS

From the collected datasets, it was observed that soft plastics are the predominant category of plastic waste on Saint Martin's Island, accounting for the highest recorded volume among all waste types. However, food wrappers, despite being a type of soft plastic, were analyzed separately due to their significant individual contribution. The data reveals that food wrappers are nearly as prevalent as other types of waste, reinforcing their role as a major pollutant.

As an independent category, soft plastics encompass a variety of lightweight, flexible materials such as shopping poly bags, general packaging, and other non-food-related plastics. Although poly bags were commonly found, their numbers were lower than food wrappers when considered individually. Additionally, a significant amount of foam-based packaging and food carriers was recorded, which adds to the waste burden, especially in areas associated with tourism and food services.

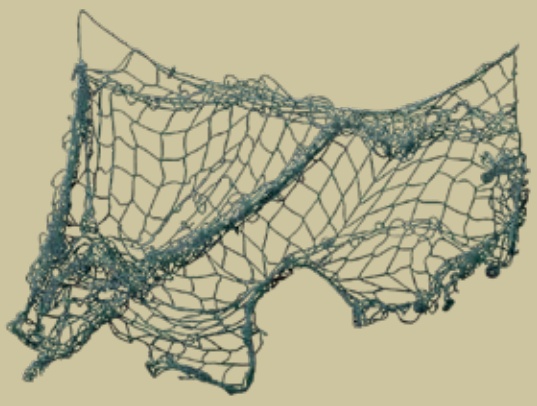
3.1.4 CATEGORIZATION

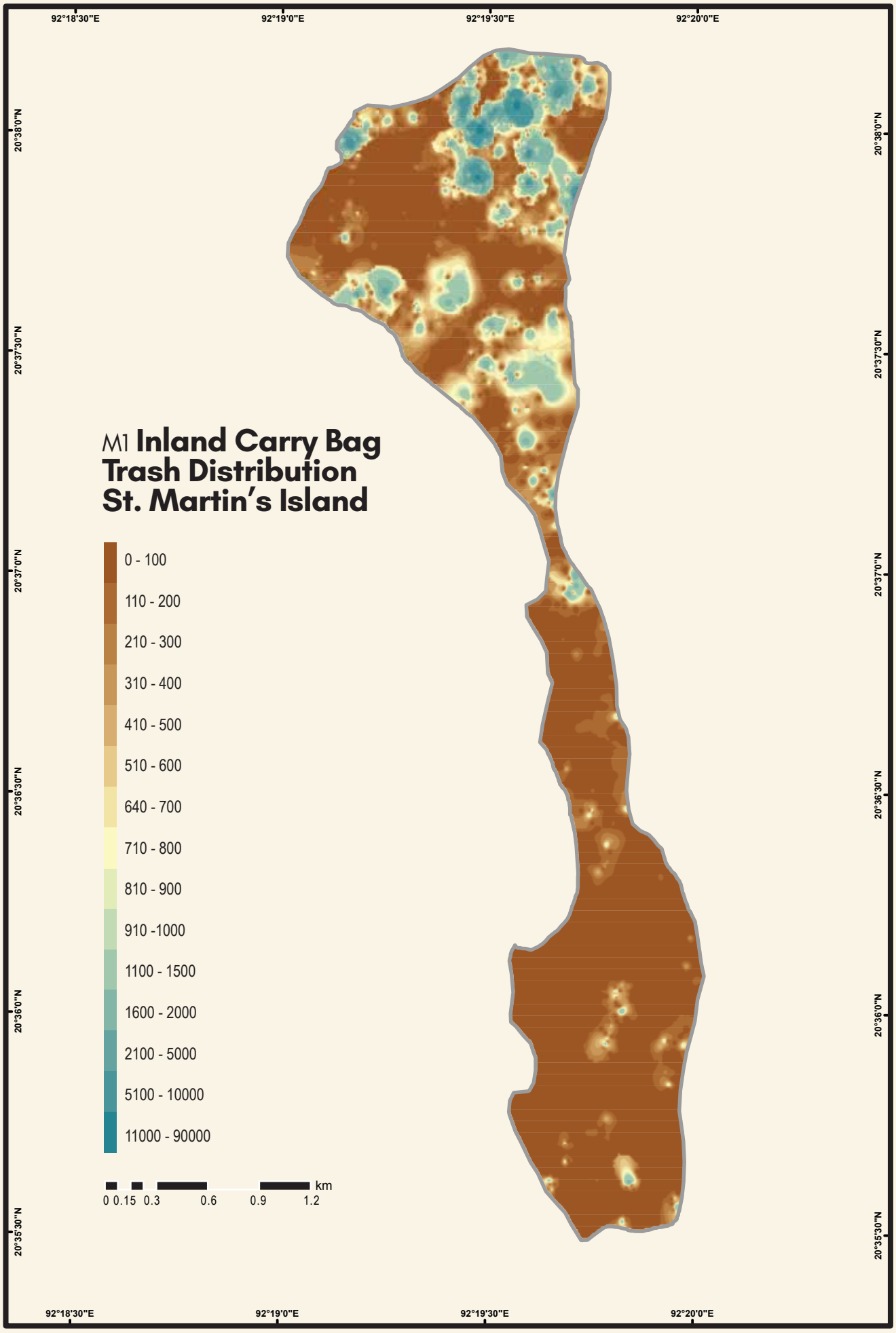
Food Wrappers: Treated as a standalone category due to their overwhelming presence compared to other types of plastic waste. These wrappers are commonly associated with tourism and food consumption on the island and contribute significantly to pollution.

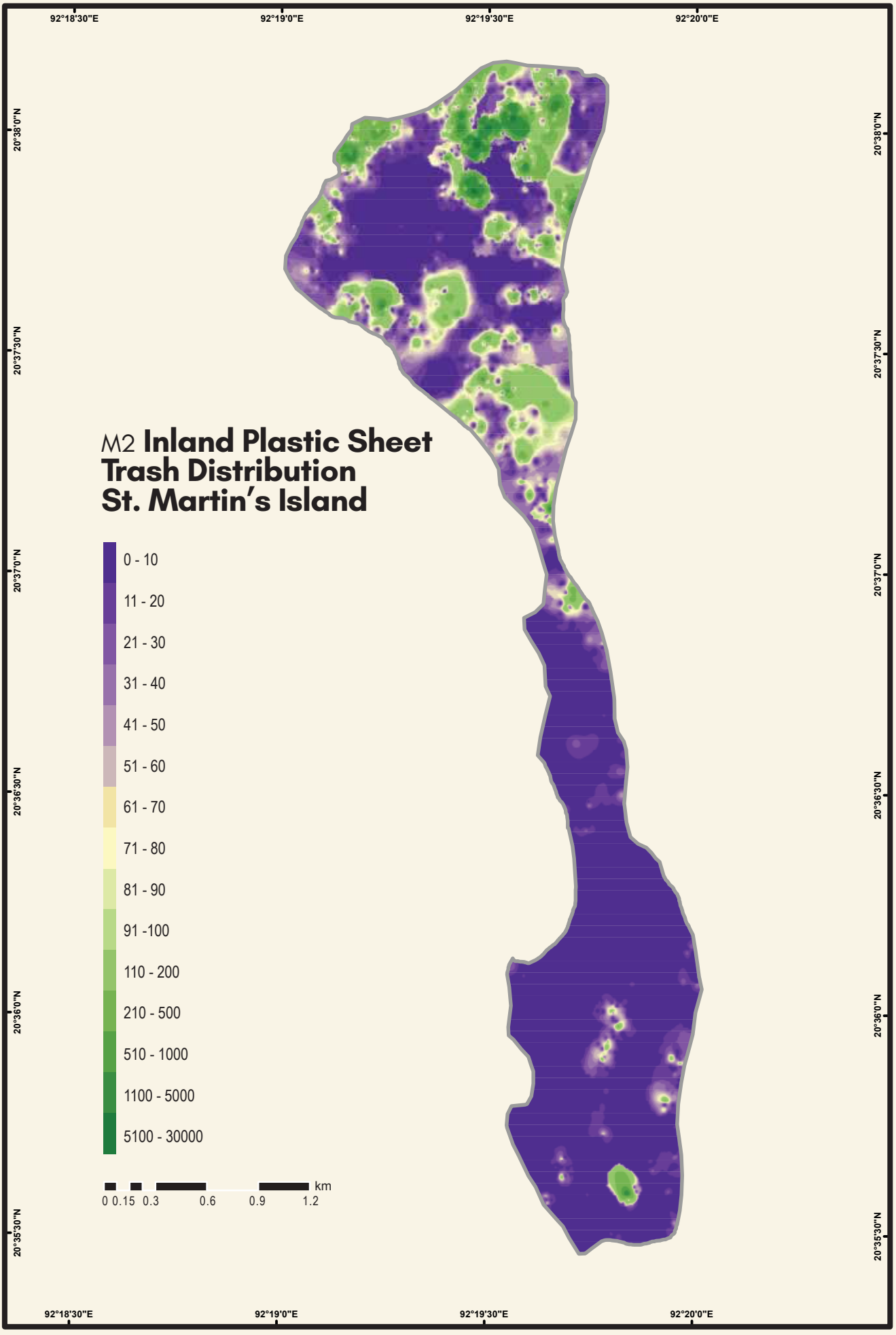
Soft Plastics: This category includes lightweight, flexible plastic materials like shopping poly bags and general packaging. Soft plastics dominate the plastic waste composition on the island and are more challenging to manage due to their lightweight nature and tendency to disperse.

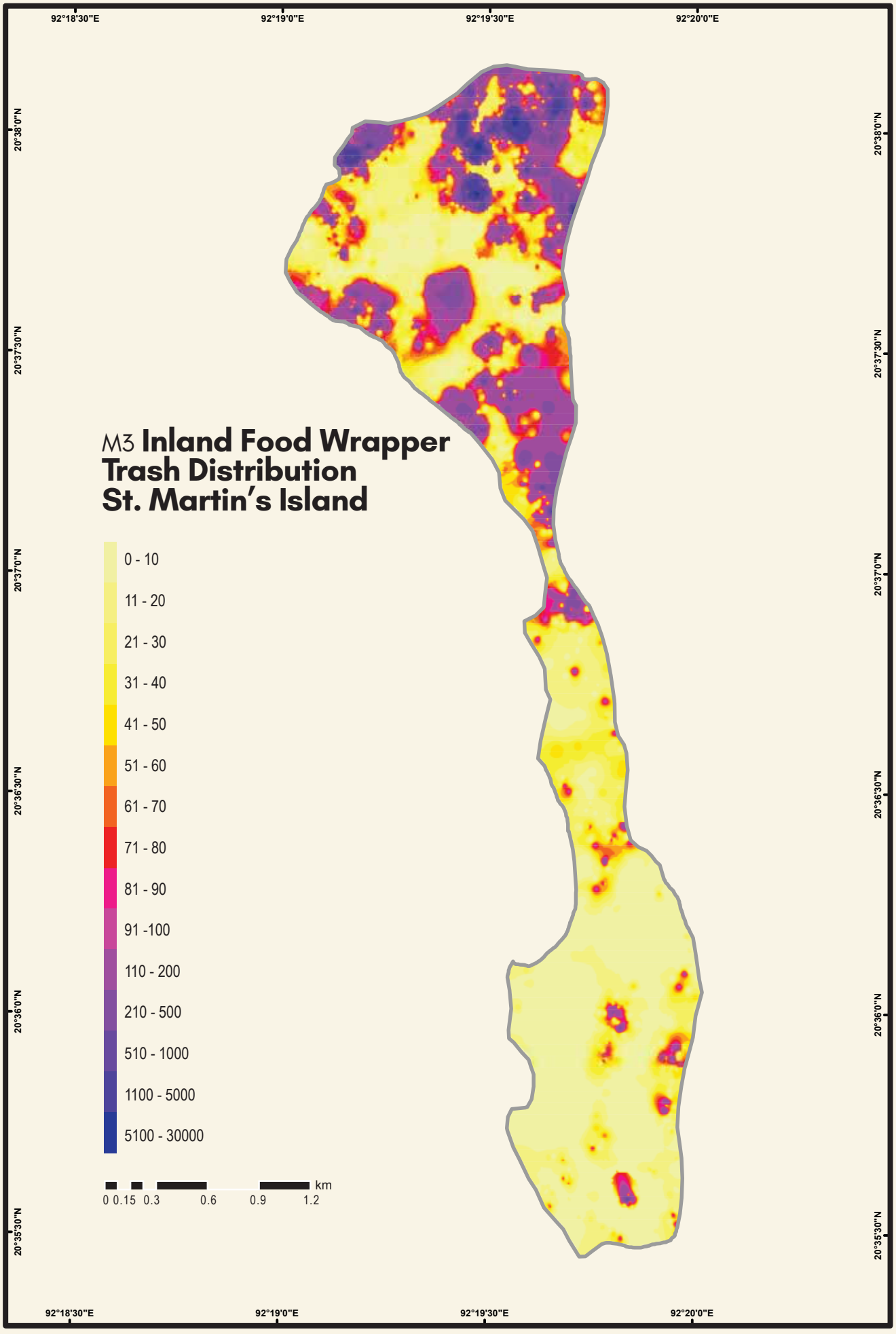
Rigid or hard plastics, such as beverage and liquid containers, are present, they are comparatively easier to collect and recycle. Due to their structured form and higher post-consumption value, they are more frequently collected than soft plastics. However, their accumulation still poses a waste management challenge, particularly in areas with inadequate collection infrastructure.

Additionally, **foam-based** plastics and **fishing nets** were identified in smaller amounts. Foam plastics, primarily used in food packaging and carriers, have a significantly lower presence than soft plastics but still contribute to localized waste accumulation. Fishing nets and other unlisted plastic waste items, though less frequent, pose an environmental risk due to their persistence and potential impact on marine life.




92°18'30"E
92°19'0"E
92°19'30"E
92°20'0"E
20°38'0"N
20°37'30"N
20°37'0"N
20°36'30"N
20°36'0"N
20°35'30"N
M1 Inland Carry Bag
Trash Distribution
St. Martin's Island
0 - 100
110 - 200
210 - 300
310 - 400
410 - 500
510 - 600
640 - 700
710 - 800
810 - 900
910 -1000
1100 - 1500
1600 - 2000
2100 - 5000
5100 - 10000
11000 - 90000
km
0 0.15 0.3 0.6 0.9 1.2


92°18'30"E
92°19'0"E
92°19'30"E
92°20'0"E
20°38'0"N
20°37'30"N
20°37'0"N
20°36'30"N
20°36'0"N
20°35'30"N
M2 Inland Plastic Sheet Trash Distribution St. Martin's Island
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
81 - 90
91 -100
110 - 200
210 - 500
510 - 1000
1100 - 5000
5100 - 30000
km
0 0.15 0.3 0.6 0.9 1.2


92°18'30"E
92°19'0"E
92°19'30"E
92°20'0"E
20°38'0"N
20°37'30"N
20°37'0"N
20°36'30"N
20°36'0"N
20°35'30"N
M3 Inland Food Wrapper Trash Distribution St. Martin's Island
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
81 - 90
91 -100
110 - 200
210 - 500
510 - 1000
1100 - 5000
5100 - 30000
km
0 0.15 0.3 0.6 0.9 1.2

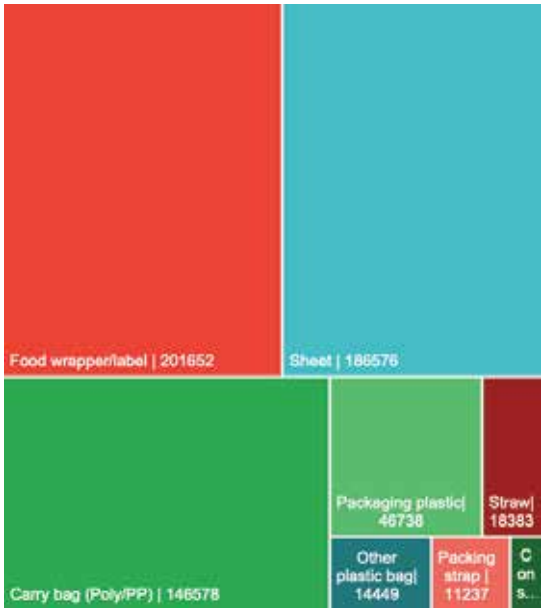
3.1.5 COMPARATIVE INSIGHTS

The analysis of plastic waste composition on Saint Martin's Island reveals distinct patterns in waste prevalence, collection feasibility, and environmental impact. These insights are crucial for shaping waste management strategies.

Soft Plastics Dominate the Waste Stream

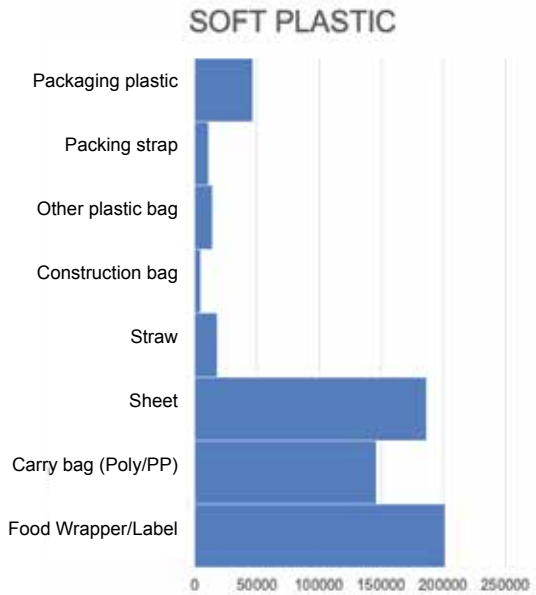
Soft plastics are the most abundant waste category, significantly surpassing other types in volume. Their lightweight nature and tendency to disperse make them particularly challenging to collect and manage.

Shopping poly bags and general packaging materials contribute heavily, reinforcing the need for policies aimed at reducing single-use plastic consumption.



Food Wrappers: A Primary Contributor

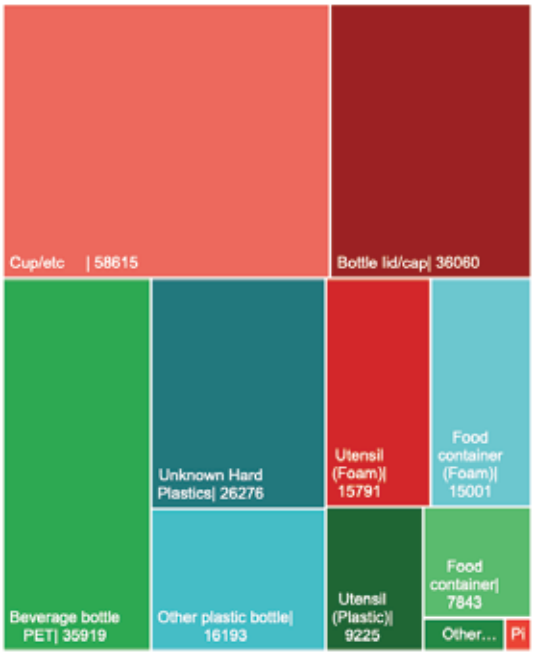
Despite being a subset of soft plastics, food wrappers were treated as a separate category due to their overwhelming presence. Their high numbers are directly linked to tourism and food services, indicating that efforts to reduce waste in these sectors could significantly impact overall plastic pollution.



Hard Plastics:

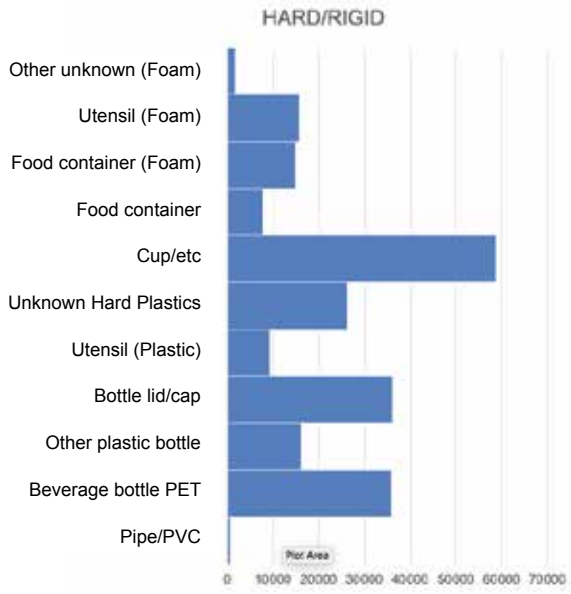
Collected More Frequently Due to Value. While rigid plastics, such as PET and HDPE containers, account for a notable portion of waste, they are more frequently collected due to their post-consumption value.

Unlike soft plastics, rigid plastics have established recycling channels, making them less persistent in the environment.



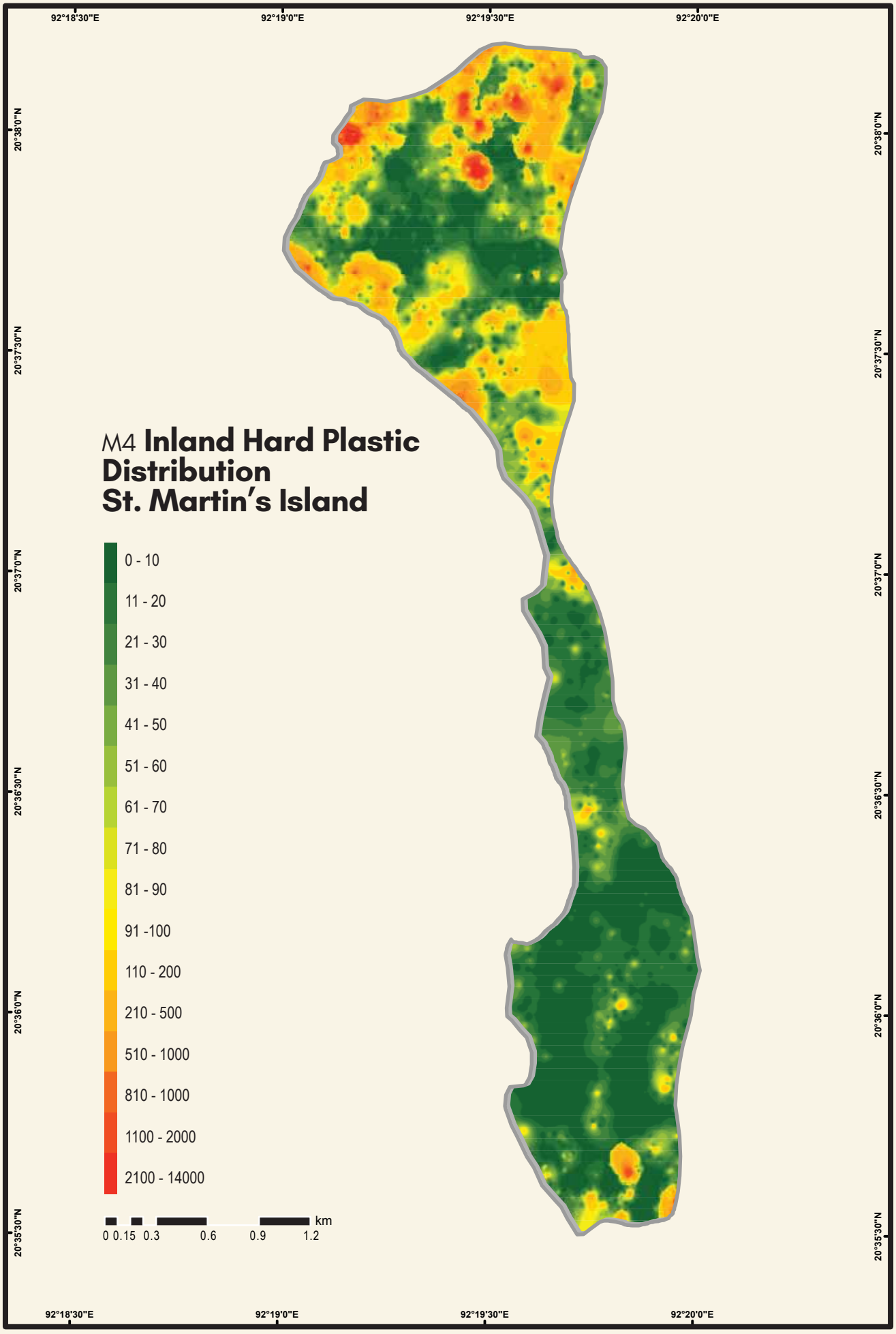
Foam-Based Plastics and Fishing Nets: A Smaller but Persistent Issue

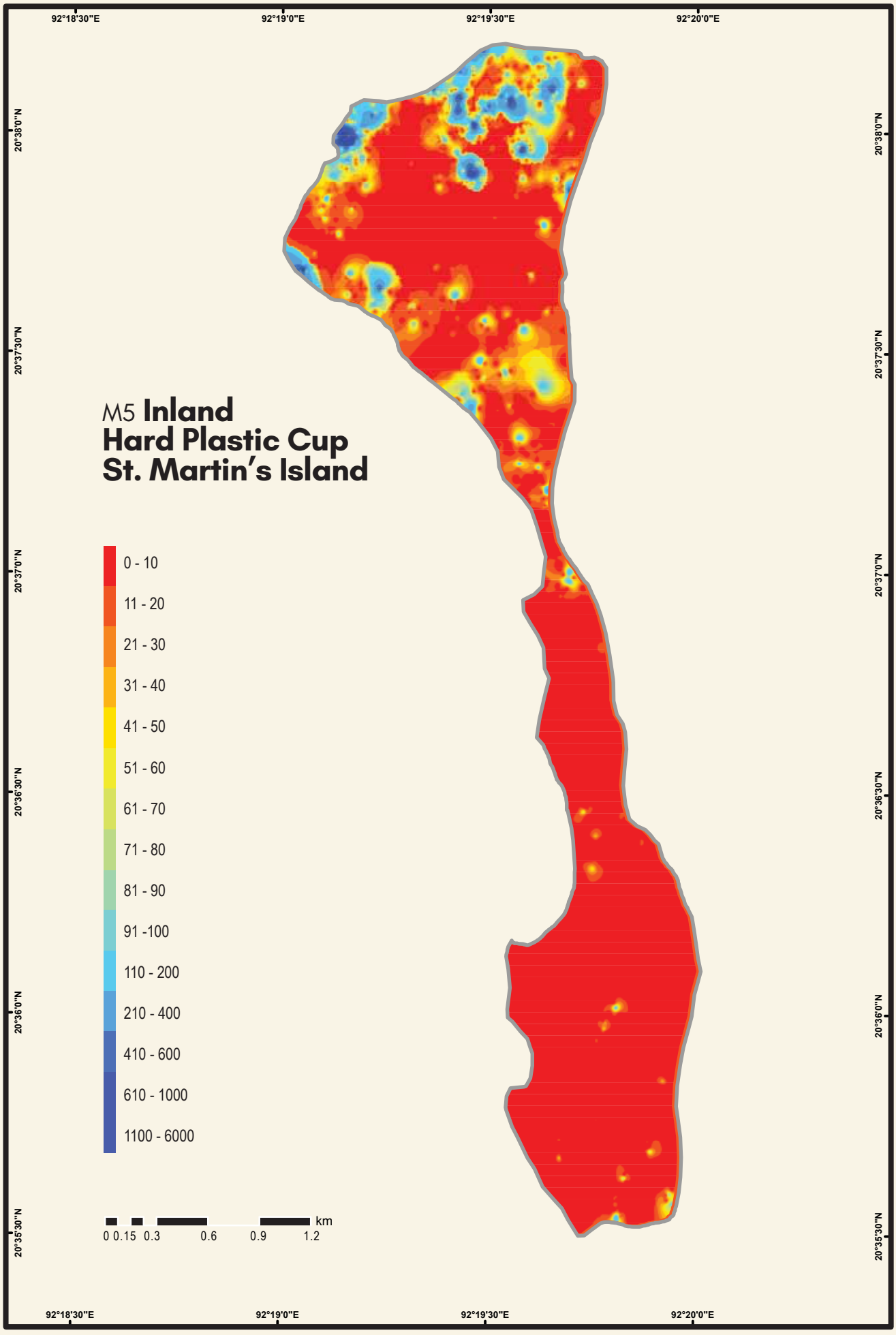
Foam packaging and food carriers, though present in smaller quantities, contribute to localized waste accumulation due to their fragility and tendency to break into microplastics. Discarded fishing nets, though not as prevalent, pose significant ecological threats, particularly to marine life.

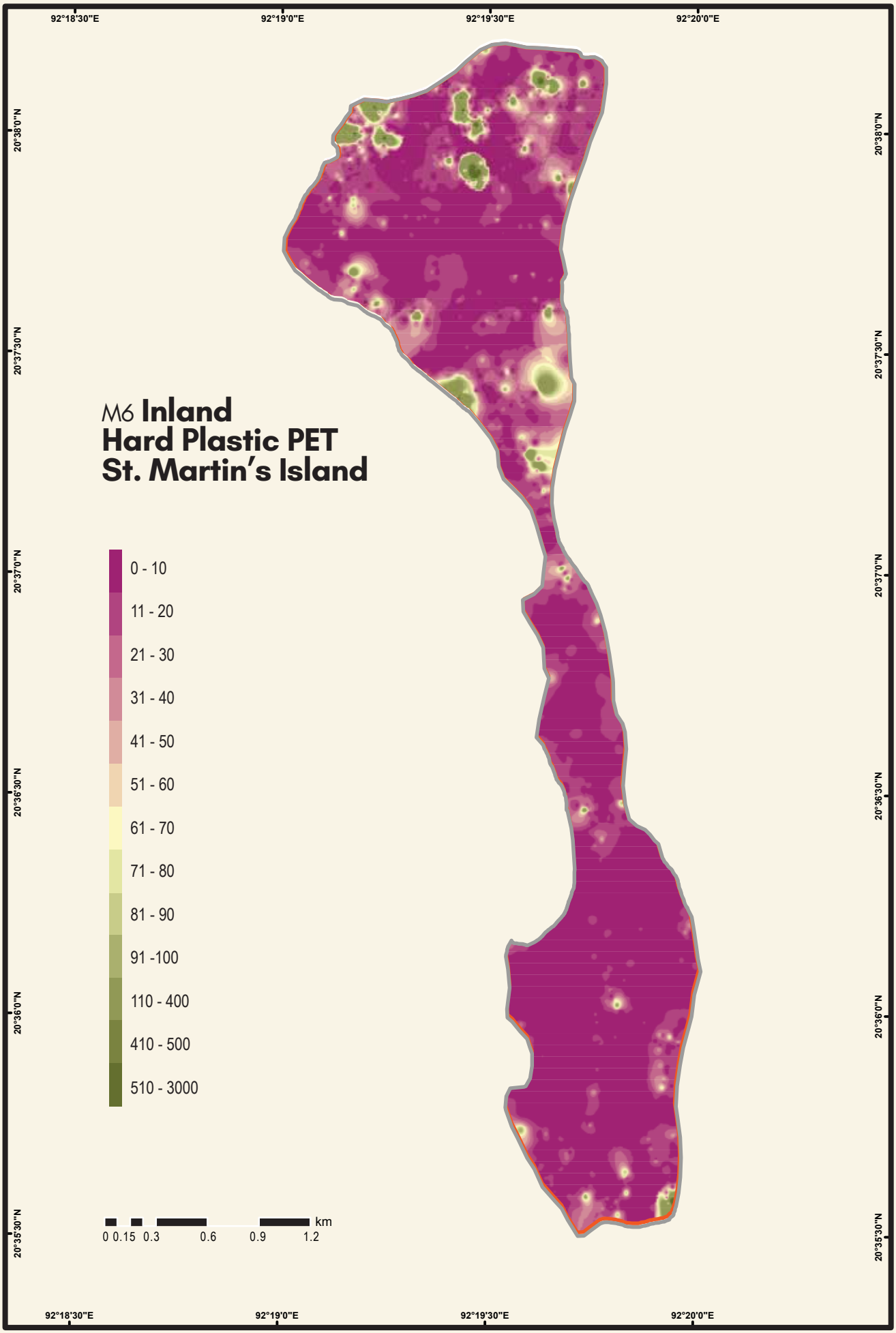


3.1.6 SPATIAL TRENDS IN PLASTIC WASTE DISTRIBUTION

The GIS analysis of plastic waste distribution on Saint Martin's Island highlights key spatial trends influenced by residential, commercial, and tourism-related activities. Understanding these trends is crucial for effective waste management interventions.


92°18'30"E
92°19'0"E
92°19'30"E
92°20'0"E
20°38'0"N
20°37'30"N
20°37'0"N
20°36'30"N
20°36'0"N
20°35'30"N
M4 Inland Hard Plastic Distribution St. Martin's Island
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
81 - 90
91 -100
110 - 200
210 - 500
510 - 1000
810 - 1000
1100 - 2000
2100 - 14000
km
0 0.15 0.3 0.6 0.9 1.2


92°18'30"E
92°19'0"E
92°19'30"E
92°20'0"E
20°38'0"N
20°37'30"N
20°37'0"N
20°36'30"N
20°36'0"N
20°35'30"N
M5 Inland
Hard Plastic Cup
St. Martin's Island
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
81 - 90
91 -100
110 - 200
210 - 400
410 - 600
610 - 1000
1100 - 6000
km
0 0.15 0.3 0.6 0.9 1.2


92°18'30"E
92°19'0"E
92°19'30"E
92°20'0"E
20°38'0"N
20°37'30"N
20°37'0"N
20°36'30"N
20°36'0"N
20°35'30"N
M6 Inland
Hard Plastic PET
St. Martin's Island
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
81 - 90
91 -100
110 - 400
410 - 500
510 - 3000
km
0 0.15 0.3 0.6 0.9 1.2

WASTE CONCENTRATION IN COMMERCIAL AND TOURISM HUBS

The highest density of waste accumulation is observed in areas where shops and restaurantsare clustered.

Commercial zones generate significant amounts of plastic waste, particularly from packaging, food wrappers, and beverage containers.

Tourist-heavy areas see higher waste generation due to increased consumption and improper disposal practices.

BEACH AND PERIPHERY WASTE

The outer edges and beach-adjacent grids show notable waste presence, even in areas with fewer structured establishments.

This suggests marine and wind-driven waste deposition, where inland and external waste accumulates along the shoreline.

These areas require targeted cleanup efforts to prevent further marine pollution.

RESIDENTIAL INFLUENCE ON WASTE SPREAD

Households are widely dispersed across the island, leading to varied waste distribution.

High-density residential areas contribute to plastic waste but at a lower concentration compared to commercial zones.

Household waste disposal appears more decentralized, reducing visible waste hotspots but still contributing to overall waste volume.

RELATIONSHIP BETWEEN HARD AND SOFT PLASTICS

Shops and restaurants contribute the most to food packaging and wrappers (soft plastics), aligning with high trash density in their vicinity.

Residential areas are more likely linked to hard plastic waste (e.g., water and beverage containers), which are easier to collect and recycle, explaining their lower visibility in unmanaged waste zones.

3.1.7 WASTE COLLECTION AND MANAGEMENT CHALLENGES

The waste management system on Saint Martin's Island exhibits significant structural and operational shortcomings. No formal, government-led waste collection initiative was observed during the study period. Instead, a limited and fragmented system operates, driven primarily by the informal efforts of international NGOs, local non-profits, and private actors. While these efforts contribute to partial waste handling, they remain uncoordinated, under-resourced, and lack regulatory oversight, leading to inconsistent service coverage across the island.

Public waste bins are limited in number, and those present are often poorly placed, irregularly emptied, and not designed for source segregation, which is mandated under the Solid Waste Management Rules, 2021. Door-to-door household collection is entirely absent. As a result, waste accumulation is clearly visible, even in commercial and residential hubs, indicating a lack of equitable spatial coverage in current waste management operations.

Even where waste is collected, the island suffers from a critical absence of infrastructure for sorting, processing, and safe disposal. There are only an inadequate number of confirmed, officially designated waste disposal zones was identified during the study, and no transfer stations, while recovery facilities are insufficient or nonexistent. Whether any disposal site is regulated or not could not be verified during the assessment. Additionally, no formal system exists to transport waste to the mainland, resulting in frequent open dumping, burning, or informal landfilling. These practices significantly increase the risks of air, soil, and marine pollution, particularly during the tourist season when waste volumes surge.

In this context, Saint Martin's Island lacks a functioning end-of-life pathway for waste, in clear divergence from both national regulatory standards and international good practices. Without immediate policy attention, infrastructure investment, and local governance reform, these challenges are likely to intensify.

3.1.8 DATA COLLECTION PROCESS

To determine the most significant contributors to plastic waste generation, the field assessment team gathered four layers of data on structured establishments, which include:

Houses – Residential areas where household-generated plastic waste accumulates.

Shops – Retail outlets and markets that contribute to plastic packaging waste.

Restaurants – Food service establishments that generate disposable plastic items, such as bottles, straws, and wrappers.

Accommodation Facilities – Hotels, resorts, and guesthouses that contribute to plastic waste through tourist activities and daily operations.

Additionally, the team conducted plastic waste surveys in two distinct environmental settings:

Inland Areas – Covering non-coastal parts of the island, where plastic waste accumulates from residential, commercial, and tourism-related activities.

Beach Areas – Monitoring plastic debris along the shoreline, where both local and external sources (e.g., marine litter) contribute to pollution.

3.1.9 KEY TAKEWAYS

ADDRESSING SOFT PLASTICS AND FOOD WRAPPERS SHOULD BE A TOP PRIORITY, GIVEN THEIR DOMINANCE AND DIFFICULTY IN COLLECTION.

TOURISM AND FOOD-RELATED ACTIVITIES ARE MAJOR DRIVERS OF PLASTIC WASTE, INDICATING THAT TARGETED POLICIES IN THESE SECTORS COULD YIELD SIGNIFICANT IMPROVEMENTS.

PRIORITIZE WASTE COLLECTION EFFORTS IN COMMERCIAL HUBS (SHOPS & RESTAURANTS) TO TARGET THE PRIMARY SOURCES OF PLASTIC POLLUTION.

ENHANCE WASTE CONTAINMENT NEAR BEACH PERIPHERIES TO MITIGATE WIND AND MARINE-DRIVEN WASTE SPREAD.

EXPAND WASTE COLLECTION POINTS IN HIGH-DENSITY RESIDENTIAL ZONES TO PREVENT DECENTRALIZED WASTE ACCUMULATION.

IMPLEMENT AWARENESS CAMPAIGNS IN TOURIST-HEAVY AREAS TO ENCOURAGE RESPONSIBLE WASTE DISPOSAL PRACTICES.

IMPROVE RECYCLING INCENTIVES IN COMMERCIAL ZONES, AS BUSINESSES CONTRIBUTE THE MOST TO SOFT PLASTIC WASTE (FOOD WRAPPERS, POLY BAGS).

3.2 FROM THE TERMS OF REFERENCE (TOR)

WASTE MANAGEMENT ON SAINT MARTIN'S ISLAND: THE GROWING PLASTIC CRISIS

Saint Martin's Island, Bangladesh's only coral island, faces an escalating environmental crisis, primarily driven by plastic waste pollution. While the island's ecological degradation has been well documented through historical waves of deforestation and habitat loss, contemporary issues—particularly plastic trash—have emerged as a pressing concern. This report examines the current state of plastic waste on the island, integrating historical perspectives on environmental degradation to provide a comprehensive understanding of its transformation.

3.2.1 HISTORICAL PERSPECTIVE ON ENVIRONMENTAL DEGRADATION

Saint Martin's Island was once covered with lush rainforests, coconut trees, and abundant teak forests. Before the 1980s, the island boasted vibrant biodiversity and dense forest cover (Tomascik, 1997). However, human intervention, primarily through deforestation and unregulated activities, has led to a near-total loss of its original ecosystem.

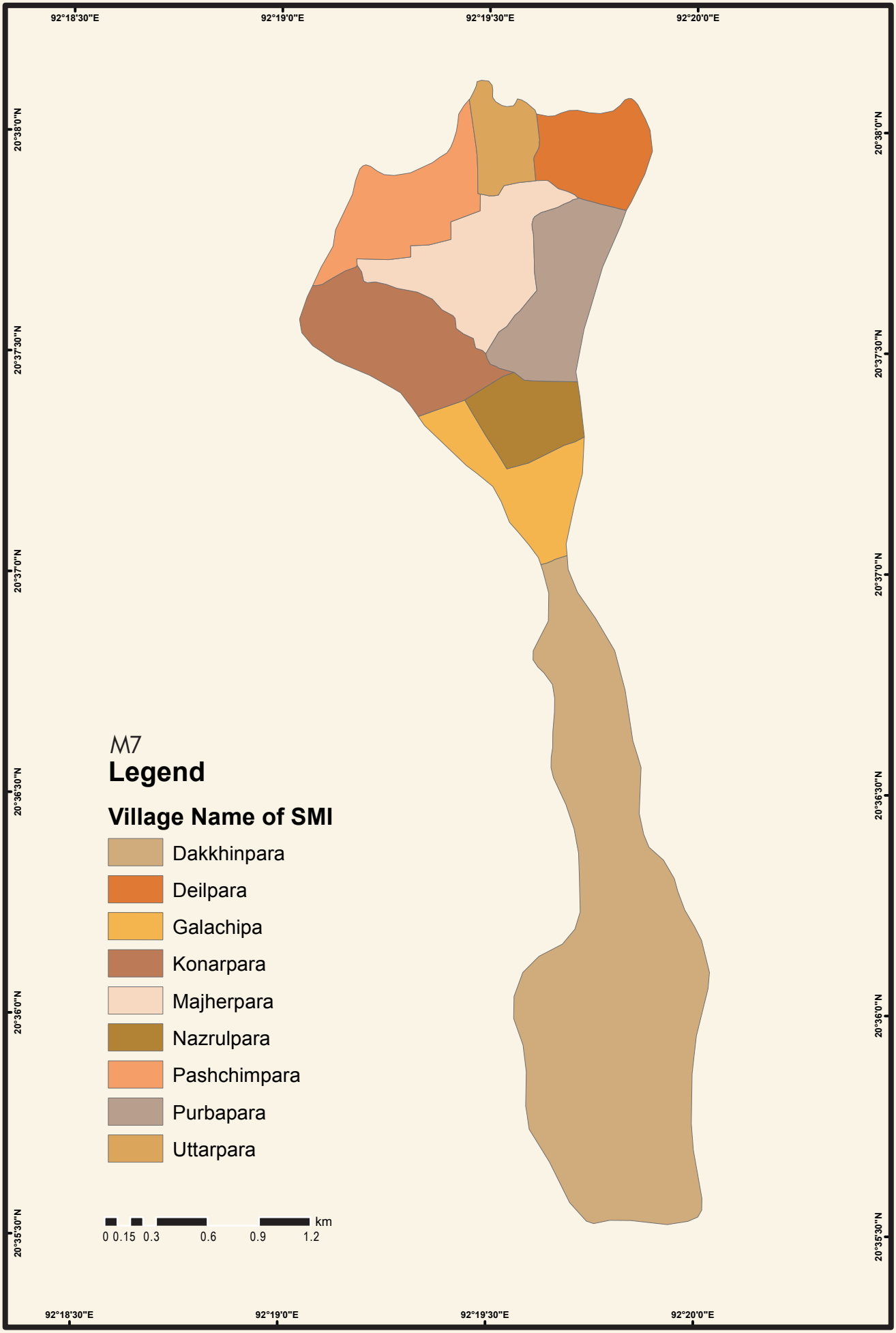
Waves of Deforestation

The first major ecological disruption began in the 1920s when local communities extracted teak timber extensively, much of which was exported to Myanmar for house and boat construction *(Rashid and Rob, 1997)*. Over the decades, deforestation intensified:
1920s: Large-scale extraction of teak and other trees for commercial purposes *(Rashid and Rob, 1997; Tomascik, 1997).*
1940s: Conversion of forested lands into agricultural fields, leading to further tree loss.
1980s: The final wave of deforestation occurred as settlers cleared remaining forests for habitation and farming *(Rashid and Rob, 1997).*

The destruction of these forests disrupted the island's biodiversity, impacting both terrestrial and marine ecosystems, including shallow-water benthic communities such as coral reefs (Alam & Hassan, 1998; Hossain et al., 2007).

Human Settlements and Economic Activities

The 1980s saw a significant influx of settlers to Saint Martin's Island. The rapid increase in human habitation led to large-scale forest clearance, overfishing, and agricultural expansion, causing irreversible damage to the island's fragile ecosystem (Tomascik, 1997). The reliance on marine resources further exacerbated ecological stress, as unregulated fishing practices contributed to the depletion of marine life.


92°18'30"E
92°19'0"E
92°19'30"E
92°20'0"E
20°38'0"N
20°37'30"N
20°37'0"N
20°36'30"N
20°36'0"N
20°35'30"N
M7
Legend
Village Name of SMI
Dakkhinpara
Deilpara
Galachipa
Konarpara
Majherpara
Nazrulpara
Pashchimpara
Purbapara
Uttarpara
km
0 0.15 0.3 0.6 0.9 1.2

3.2.2 THE PLASTIC WASTE CRISIS

While deforestation and settlement were the primary environmental concerns in the past, today, plastic pollution poses the greatest threat to the island's sustainability. The tourism boom of the last two decades has drastically increased plastic waste, with single-use plastics accumulating on beaches, in surrounding waters, and within local settlements.

Sources of Plastic Waste

Tourism Activities: Visitors frequently dispose of plastic bottles, wrappers, and packaging, which remain uncollected due to inadequate waste management infrastructure.
Fishing Industry: The widespread use of plastic fishing gear, including nets and containers, contributes to oceanic plastic debris.
Local Consumption: With increasing commercialization, plastic bags, food packaging, and household waste have surged, further polluting the environment.

Challenges in Waste Management

Lack of Infrastructure: The island has no systematic waste collection or recycling facilities, leading to open dumping and burning of plastic waste.
Limited Awareness: Tourists and local communities lack awareness of sustainable waste disposal practices.
Policy Gaps: There is insufficient regulatory enforcement to control plastic usage and disposal.

Inadequate Public Data on Governance and Environment

The Bangladesh National Portal (*https://saintmartinup.coxsbazar.gov.bd/*) indeed lacks detailed and up-to-date information about Saint Martin's Island, particularly about its current governance, environmental conditions, and socio-economic challenges. While the portal provides basic details about the island, it does not extensively cover its administrative structure, ecological concerns, or recent developments such as the tourist restrictions or the island's designation as an Ecologically Critical Area (ECA). The absence of comprehensive documentation hinders informed decision-making and policy interventions required to mitigate ongoing environmental threats.

3.2.3 PRESENT WASTE SEGREGATION, COLLECTION, DISPOSAL, AND RECYCLING MECHANISMS

The waste collection system in the area does not include door-to-door collection. Instead, waste is gathered daily from the dustbins located in and around the marketplace.

A team of four workers is responsible for collecting waste from the market. They use a van to transport the waste and dispose of it in a pond near the house of Dil Mohammad in Majher Para, Ward No. 2. On average, the surrounding market area generates approximately 8 to 10 vehicle loads of waste daily. Each vehicle carries an estimated 80 to 90 kilograms of waste.

This information has been verified by Mohammad Elias, one of the workers involved in the waste collection process.

3.2.4 WASTE SEGREGATION AND RECYCLING INITIATIVES

During the time of the study, the marketplace and its surrounding roads had around 40 bins placed in front of shops. Additionally, 60 bins were provided in Galachipa and along the western beach near various hotels. Recently, the Teknaf Upazila Executive Officer (UNO) had installed approximately 50 more bins, while Pran and RFL contributed 30 bins. The remaining bins had been previously available in the area.

The waste collection system includes all types of waste, including plastic. However, in Dakshinpara, Galachipa, and the western beach area, designated dustbins are used to collect only bottles twice a week from the nearby hotels.
Under the supervision of UNDP, four workers are employed for waste collection daily. They receive a monthly salary of 15,000 BDT each. On average, they collect approximately 960 kilograms of waste per day. This information has been confirmed by Mohammad Kamal Hossain, the UNDP Supervisor for Saint Martin's Island.

Bidyanondo Foundation operates a shop near the beach adjacent to the marketplace. They provide food items such as lentils, rice, semolina, salt, noodles, and oil in exchange for plastic bottles. For example, two kilograms of bottles can be exchanged for one kilogram of rice, while four kilograms of bottles can be exchanged for one kilogram of lentils. Over the past 20 days, Bidyanondo Foundation has collected approximately 4,000 kilograms of plastic bottles. The shop is managed by Mehdi Hasan, an office assistant.

Additionally, two scrap shops are located south of the Saint Martin marketplace, owned by Manjur and Mohammad Elias. These shops purchase metal, tin, broken household furniture, plastic juice bottles, and sellable leather shoes. On average, they collect around 10 tons of scrap materials per month, although this decreases outside the peak tourist season. Abdul Gafur, a local shopkeeper, has verified this information.

2.2.5 DISPOSAL AND WASTE TRANSPORTATION

A total of six workers operate under the supervision of UNDP, with four of them directly involved in waste collection. They work on a monthly basis with support from RFL and Pran.

The UNDP office operates from a room on the second floor of the Saint Martin Union Parishad building.
Since the beginning, the Union Parishad has collaborated with UNDP in waste management efforts.

Berger Paints Company supports six workers who work for two hours daily, earning 200 BDT per day. They primarily clean waste from the beach and place it in dustbins.

Occasionally, local youths organize cleanup drives around the marketplace and jetty area.

Organic waste is disposed of in a pond near the house of Dil Mohammad in Majher Para, Ward No. 2. Some waste is stored in an enclosed area on the southern side of the eastern beach of Saint Martin. Six vans are available for waste transportation, but due to a labor shortage, only one is currently in operation.

2.2.6 INFORMAL WASTE RECOVERY AND COMMERCIAL PRACTICES

Two shops in the eastern part of Saint Martin purchase scrap materials such as metal, tin, broken furniture, plastic juice bottles, and sellable leather shoes. These materials are sold by weight and transported to Teknaf for resale.

3.3 FROM THE TERMS OF REFERENCE (TOR)

ASSESSING STAKEHOLDER CAPACITIES AND OPPORTUNITIES FOR ENHANCED COLLABORATION

Saint Martin's Island, with a resident population of approximately 12,000 and an influx of nearly 8,000 to 10,000 people traveled to St. Martin's Island daily during the peak season (TBSNews, 2024), faces a severe waste management challenge. The existing system, despite contributions from local authorities, NGOs, and private entities, remains insufficient in handling the sheer volume of plastic and other waste generated daily.

3.3.1 CURRENT STAKEHOLDER CAPACITIES

Local Authorities: While the Union Parishad provides logistical support and office space for UNDP's waste management efforts, its direct involvement in waste management remains limited. There is no structured monitoring or enforcement mechanism to ensure waste segregation and efficient disposal.

NGOs: UNDP employs six workers for waste collection, with four directly engaged in daily operations. However, their collective effort in managing a portion of waste per day falls significantly short when compared to the estimated waste output from both locals and tourists.

Private Sector: Businesses such as scrap shops contribute to recycling efforts but operate independently without a streamlined integration into the broader waste management system. Bidyanondo Foundation's plastic-for-food exchange program, though innovative, remains focused on specific waste types and lacks scalability. Kewkradong' International coastal cleanup is a voluntary program and runs once a year.

Hotels, Shops, and Accommodation Facilities: There is no evidence that these businesses have launched or are operating any structured trash disposal system or a plan to relocate waste to the mainland. Given their significant contribution to waste generation, their inaction exacerbates the crisis.

3.3.2 THE MANAGEMENT SYSTEM

Underdeveloped Infrastructure: With only six active waste collection workers, one operational van, and limited disposal sites, the system is not equipped to handle peak-season waste surges.

Lack of Comprehensive Recycling Mechanisms: While scrap shops and NGOs collect recyclables, there is no unified recycling plan or processing facility to maximize waste repurposing.

Seasonal Pressure on Resources: The drastic increase in tourist numbers strains the already inadequate waste management system, leading to environmental degradation, especially on beaches and marine habitats.

Limited Community Participation: While informal youth-led cleanups occur, there is no systematic public awareness campaign to promote waste reduction, segregation, and responsible disposal.

Household Waste Accumulation: The high population density contributes significantly to waste generation. Without proper disposal mechanisms, households frequently resort to burning trash as a means of reducing waste volume and avoiding responsibility. This practice, however, poses serious environmental and health risks.

Business Negligence: Hotels, shops, and lodging facilities contribute heavily to waste but do not participate in its proper disposal. There is no clear system in place to ensure they collect, segregate, and transport their waste to a designated site or the mainland.

3.3.3 OPPORTUNITIES FOR ENHANCED COLLABORATION

Multi-Stakeholder Integration: A structured coalition among the Union Parishad, UNDP, NGOs, and private enterprises could streamline waste management operations, ensuring that efforts are not isolated but part of a cohesive strategy.

Investment in Workforce and Infrastructure: Expanding the number of waste collectors, increasing operational vehicles, and establishing additional disposal and recycling sites can significantly improve waste processing efficiency.

Tourism Industry Engagement: Hotels, tour operators, and tourism authorities should be mandated to contribute financially or logistically to waste management, given their role in increasing waste generation. A waste collection fee could be introduced as part of their licensing requirements.

Community Engagement Programs: Regular awareness drives and incentives for responsible waste disposal could foster greater community participation and long-term sustainability.

Strict Regulations on Waste Burning: Local authorities should implement and enforce regulations against burning trash while providing viable alternatives, such as community-managed waste disposal facilities.

WITHOUT SIGNIFICANT INTERVENTIONS, THE WASTE CRISIS ON SAINT MARTIN'S ISLAND WILL CONTINUE TO ESCALATE, THREATENING ITS ENVIRONMENTAL INTEGRITY AND TOURISM VIABILITY. COLLABORATIVE EFFORTS AND TARGETED INVESTMENTS ARE ESSENTIAL TO ESTABLISH A SUSTAINABLE AND EFFICIENT WASTE MANAGEMENT SYSTEM.

3.4 FROM THE TERMS OF REFERENCE (TOR)

PAST AND ONGOING INITIATIVES

Note: Data obtained from secondary sources. These references were used to support field findings and are subject to the limitations of publicly available information.

3.4.1 BEHAVIOR CHANGE CAMPAIGNS

Movement to Save St. Martin's Island (2010) Organized by the Coastal Area Resource Development and Management Association (CARDMA), this campaign included coastal cleanup activities and public awareness programs to highlight biodiversity conservation during the International Year of Biodiversity. The initiative aimed to engage local communities and tourists in protecting the island's unique ecosystem (IUCN, 2010).

Ecological Critical Area Declaration (1999) The government declared parts of Saint Martin's Island as an Ecologically Critical Area (ECA) to protect its fragile environment. This declaration was intended to curb harmful activities, including waste dumping, although enforcement has been challenging over the years.

International Coastal Cleanup (ICC) (Kewkradong Bangladesh and Coca-Cola Bangladesh, ongoing since 2011): This annual event mobilizes volunteers to clean up marine debris from the island's beaches, raising awareness about marine conservation and reducing plastic waste.

"No Plastic on Saint Martin's" Initiative (GoB, 2020): This campaign focused on raising awareness among tourists and locals to reduce single-use plastic.

Plastic-Free Tourism Campaign (NGOs, 2021): Designed to engage tourists through educational programs and visible signage about the detrimental impact of plastic pollution.

Plastic-Free Saint Martin Initiative (2021): Launched by The Earth in collaboration with Climate Parliament Bangladesh and the Bangladesh Tourism Board, this initiative aims to protect the island's environment by promoting responsible plastic management and encouraging sustainable alternatives.

Cleaning up of Saint Martin Coral Island (Manusher jonno foundation 2021): No data available.

Food for Plastic' Initiative (Bidyanondo Foundation, 2022): Encourages locals to collect plastic waste in exchange for food items and daily necessities, promoting environmental consciousness through incentivized action.

Saint Martin's Clean Sweep: Turning the Tide on Waste with a United Front. Transforming Saint Martin's: A Collective Approach to Waste Management.

Comprehensive Work Plan for Saint Martin's Island (2023): The government is developing a plan to regulate tourism, including a ban on single-use plastics, restrictions on overnight stays, and a cap on the number of tourists, to protect the island's ecosystem.

Reference

Movement to Save St. Martin's Island (2010)
Coastal Area Resource Development and Management Association (CARDMA). (2010). Movement to Save St. Martin's Island. International Union for Conservation of Nature (IUCN). Available at: https://iucn.org/content/st-martins-island-and-its-unique-biodiversity-face-serious-threats.

Ecological Critical Area Declaration (1999)
Ashik, T. M. (2023, May 22). All that ails St Martin's Island. The Daily Star. Available at: https://www.thedailystar.net/opinion/views/news/all-ails-st-martins-island-3326651.

International Coastal Cleanup (ICC) (Ongoing since 2011)
Kewkradong Bangladesh & Coca-Cola Bangladesh. (2011–Present). International Coastal Cleanup (ICC).

"No Plastic on Saint Martin's" Initiative (2020)
Government of Bangladesh (GoB). (2020). "No Plastic on Saint Martin's" Initiative.

Plastic-Free Tourism Campaign (2021)
Various NGOs. (2021). Plastic-Free Tourism Campaign.

'Food for Plastic' Initiative (2022)
Bidyanondo Foundation. (2022). Food for Plastic Initiative.

Saint Martin's Clean Sweep: Turning the Tide on Waste with a United Front
United Nations Development Programme (UNDP). (2023). Saint Martin's Clean Sweep: Turning the Tide on Waste with a United Front. Available at: https://www.undp.org/bangladesh/blog/saint-martins-clean-sweep-turning-tide-waste-united-front.

Plastic-Free Saint Martin Initiative (2021)
The Earth. (2021). Plastic-Free Saint Martin Initiative. Available at: https://theearthbd.org/plastic-free-saint-martin/.

Comprehensive Work Plan for Saint Martin's Island (2023)
The Financial Express. (2023). Comprehensive Work Plan for Saint Martin's Island.

Cleaning up of Saint Martin Coral Island (2021)
Manusher Jonno Foundation. (2021). Cleaning up of Saint Martin Coral Island. Available at: https://mrdibd.org/wp-content/uploads/2021/08/Cleaning-up-of-Saint-Martin-Coral-Island.pdf.

3.4.2 SOLID WASTE MANAGEMENT

Waste Segregation Pilot Project (INGO, 2019-2021): A system for waste sorting at source was implemented, engaging local businesses and households.

Marine Litter Management Program (GoB and private sector, 2022): This initiative introduced collection and transportation systems for plastic waste to recycling facilities on the mainland.

Saint Martin's Clean Sweep Initiative (UNDP Accelerator Lab Bangladesh, 2022): This collaborative effort involved on-site workshops with local stakeholders to identify and tackle waste management challenges. The initiative focused on systematic coordination, regular cleaning practices, and behavioral interventions through communication materials, resulting in visibly cleaner public spaces and reduced plastic pollution.

Plastic Exchange Store by Bidyanondo Foundation (2022): This initiative allows residents to exchange collected plastic waste for daily necessities like rice, pulses, and oil, incentivizing community participation in reducing plastic pollution.

'Saint Martin's: Environmental Conservation and Sustainable Economy' Initiative (PRAN-RFL and UNDP, 2024): This joint venture aimed at protecting the island's environment by establishing effective waste collection and recycling systems. Volunteers collect waste, which is then transported to designated dumping stations, compressed, and shipped to recycling plants on the mainland. The initiative also includes providing pure drinking water through rainwater harvesting and conducting tree plantation programs to enhance environmental sustainability.

Ministry of Environment's Waste-Free Initiative (MOEFCC, 2024): The Ministry of Environment, Forest and Climate Change, in collaboration with the Bangladesh Sustainability Alliance, launched a phased ban on single-use plastics on Saint Martin's Island. The program focuses on setting up effective waste management systems, engaging local residents, businesses, and fishermen, and conducting awareness activities to educate locals about plastic pollution. The goal is to implement a zero-waste concept by enhancing waste collection, sorting, and processing systems on the island. (Source : *https://thegreenpagebd.com/ministry-of-environment-bangladesh-to-make-st-martin-waste-free/)*

Community Involvement (EQMS 2020): Local participation is crucial for the success of waste management initiatives. Efforts have been made to engage local businesses and residents in sustainable practices, including proper waste disposal and reducing plastic usage.

Reference

Waste Segregation Pilot Project (2019-2021)
United Nations Development Programme (UNDP). (2023). Saint Martin's Clean Sweep: Turning the Tide on Waste with a United Front. Available at: https://www.undp.org/bangladesh/blog/saint-martins-clean-sweep-turning-tide-waste-united-front.
Tabassum, S. (2023). A Brief Review of Plastic Waste Management in Saint Martin Island, Bangladesh. ResearchGate. Available at: https://www.researchgate.net/publication/370301133_A_Brief_Review_of_Plastic_Waste_Management_in_Saint_Martin_Island_Bangladesh.

Marine Litter Management Program (2022)
Government of Bangladesh (GoB) & Private Sector. (2022). Marine Litter Management Program.

Saint Martin’s Clean Sweep Initiative (2022)
United Nations Development Programme (UNDP). (2022). Saint Martin’s Clean Sweep Initiative.

Saint Martin’s: Environmental Conservation and Sustainable Economy Initiative (2024)
PRAN-RFL & UNDP. (2024). Saint Martin’s: Environmental Conservation and Sustainable Economy Initiative. The Business Standard (TBS News).

Ministry of Environment’s Waste-Free Initiative (2024)
Ministry of Environment, Forest and Climate Change (MOEFCC). (2024). Waste-Free Initiative for Saint Martin’s Island. Green Page BD.

Community Involvement (2020)
EQMS Consulting Ltd. (2020). Plastic Waste Management at Saint Martin’s Island. Available at: https://eqms.com.bd/our-blogs/28/Plastic%20Waste%20Management%20at%20Saint%20Martin%20Island.

United Nations Development Programme (UNDP). (2023). Saint Martin's Clean Sweep: Turning the Tide on Waste with a United Front. Available at: https://www.undp.org/bangladesh/blog/saint-martins-clean-sweep-turning-tide-waste-united-front.

Plastic Exchange Store by Bidyanondo Foundation (2022)
Bidyanondo Foundation. (2022). Plastic Exchange Store Initiative.

A Brief Review of Plastic Waste Management in Saint Martin Island, Bangladesh
Tabassum, S. (2023). A Brief Review of Plastic Waste Management in Saint Martin Island, Bangladesh. ResearchGate. Available at: https://www.researchgate.net/publication/370301133_A_Brief_Review_of_Plastic_Waste_Management_in_Saint_Martin_Island_Bangladesh.

3.4.3

CLEANUP EFFORTS

The earliest documented intervention to address plastic pollution on Saint Martin's Island began in 2011 with the "International Coastal Cleanup (ICC)" initiative. This annual event, organized by **Kewkradong Bangladesh** in collaboration with Coca-Cola Bangladesh, mobilized volunteers to remove marine debris from the island's beaches, raising awareness about marine conservation and the need to reduce plastic waste.

Prior to this, while there were growing concerns about environmental degradation due to increasing tourism and plastic waste, no formalized intervention plans specifically targeting plastic pollution had been implemented on the island.

It's important to note that although the ICC initiative marked the beginning of organized cleanup efforts, comprehensive waste management systems and broader interventions have been more recent, particularly gaining momentum in the early 2020s. For instance, the "Saint Martin's Clean Sweep Initiative" by **UNDP Accelerator Lab Bangladesh** was launched towards the end of 2022 to tackle waste management challenges through community engagement and systematic coordination.

Additionally, the "Food for Plastic" initiative by **Bidyanondo Foundation**, introduced in December 2022, encouraged locals to collect plastic waste in exchange for food items, promoting environmental consciousness through incentivized action.

These recent initiatives reflect a growing recognition of the need for sustainable waste management practices on Saint Martin's Island, addressing both environmental concerns and community needs.

Save Our Sea (SOS), Save Our Sea (SOS), a non-profit marine conservation organization, had planned to organize the 'National Underwater & Beach Cleanup–2021' event at Saint Martin's Island, Cox's Bazar, on 21–22 March 2021. (No data or detailed information is currently available.)

MarineLife Alliance Underwater Cleanup (Scheduled for December and January 2013): The MarineLife Alliance is planning an underwater survey and cleanup to address the impact of tourism and plastic pollution on the island's coral habitats. This initiative aims to conserve marine biodiversity and mitigate damage caused by unsustainable practices. (No data or detailed information is currently available.)

4.

OVERALL GAPS AND CHALLENGES

Inadequate Infrastructure: Collection points and recycling facilities for plastic waste remain insufficient. Many areas of the island lack the necessary logistics and support systems to manage waste effectively, resulting in improper disposal or accumulation of waste in sensitive areas.

Limited Stakeholder Coordination: Overlap in responsibilities among GoB, NGOs, and private sector entities has led to inefficiencies, such as redundant efforts or conflicting priorities. Improved collaboration mechanisms are urgently needed to ensure streamlined operations.

Lack of Comprehensive Data: There is no integrated database capturing plastic waste generation and management on the island. This gap limits the ability to track progress, measure the effectiveness of initiatives, or plan data-driven interventions.

Lack Of Long Term And Sustainalbe Vision: Many initiatives are donor-dependent and lack plans for long-term sustainability. Without securing consistent funding or developing self-sustaining models, these programs risk discontinuation once external support is withdrawn.

Behavioral Resistance: Despite awareness campaigns, many locals and tourists still engage in unsustainable waste disposal practices, such as littering or using non-biodegradable plastics. Behavioral change remains slow and uneven.

Limited Community Engagement: Many initiatives lack sufficient participation from local communities, which is crucial for fostering ownership and ensuring long-term success. Programs need to prioritize capacity-building and empowerment of local stakeholders.

Marine Ecosystem Vulnerability: Plastic pollution poses severe risks to the marine ecosystem surrounding the island. Existing projects do not adequately address underwater waste management or mitigation of microplastics, which have long-term environmental consequences.

5.

RECOMMENDATIONS

The following recommendations are presented based on field-level observations, stakeholder interactions, and a review of relevant regulatory frameworks, including the Solid Waste Management Rules, 2021 and the Single-Use Plastic (SUP) SRO. These insights aim to inform ongoing discussions and inspire context-sensitive actions for improving waste governance on Saint Martin's Island. While not intended as binding directives, the points below highlight key areas where practical improvements may be pursued.

1. Strengthen Local Waste Governance
Encourage the development and implementation of a local solid waste management plan, in line with Rule 15, tailored to the island's spatial, seasonal, and ecological context.

Establish a coordination mechanism among local authorities, NGOs, tourism operators, and waste collectors to ensure shared responsibility and better service coverage.

2. Improve Segregation, Collection and Disposal Infrastructure. Expand door-to-door collection systems, particularly in underserved and inland areas.

Promote segregation of waste at source (biodegradable, recyclable, hazardous), as required under Rule 6(1), by supplying color-coded bins and clear instructions.

Identify and regulate designated waste disposal and storage zones, ensuring compliance with environmental safety standards.

Explore options for a transfer mechanism to the mainland for end-of-life waste that cannot be processed locally.

3. Address Plastic Inflow and SUP Regulation
In line with the SUP SRO, explore restrictions on the sale and distribution of high-impact plastic products (e.g., sachets, multilayer packaging, thin carry bags).

Introduce point-of-entry monitoring (e.g., ferry terminals) to reduce the unregulated inflow of plastic items onto the island.

4. Support Informal Waste Collectors and Promote Recycling
Recognize and engage existing informal waste handlers, and support their capacity through training, safety gear, and integration into local systems.

Pilot small-scale recycling or recovery initiatives, potentially linked to tourism businesses, to explore feasibility under a circular economy model.

5. Raise Public Awareness and Behavioral Change
Initiate locally relevant awareness campaigns, including visual materials and signage in tourist zones, to promote waste segregation and responsible disposal.

Collaborate with schools, hotels, and tour operators to embed education and accountability into the visitor and resident experience.

6. Introduce Economic and Policy Incentives
Consider location-specific directives or pilot programs (e.g., deposit-return systems, subsidized waste collection for hotels) for ecologically sensitive areas like Saint Martin's.

Explore public-private partnerships to mobilize resources for waste infrastructure and innovation.

6.

METHODOLOGY

This study follows a structured rapid assessment methodology to evaluate plastic waste generation and management practices on St. Martin's Island. The methodology incorporates beach and inland surveys, drone-based assessments, and business surveys to capture the extent, distribution, and sources of plastic pollution.

Survey Design and Data Collection Methods

A. Inland Quadrant Surveys

- Objective: Systematic sampling of visible plastic trash in inland areas.
- Method:
    - o Quadrant Size: 10m × 10m (100 m²).
    - o Sampling: 3-6 quadrants randomly selected per segment.
    - o Trash Count: Items categorized and recorded on standardized survey sheets.
    - o Documentation: Photographic evidence before and after sampling.

B. Beach Transect Surveys

- Objective: Assess plastic waste distribution along the shoreline.
- Method:
    - o Transect Size: 2m × 50m (100 m²).
    - o Spacing: 50m apart along the shoreline.
    - o Trash Count: All visible plastic is recorded, weighed, and categorized.
    - o Documentation: Observations include environmental factors influencing waste accumulation.

C. Drone Survey for Remote Sensing

- Objective: Identify plastic waste hotspots and assess distribution over large or inaccessible areas.
- Method:
    - o Flight Parameters: 30-50m altitude, 3-5 m/s speed, 70-80% image overlap.
    - o Data Collection: Georeferenced high-resolution images and video.
    - o Analysis: GIS-based heatmaps to identify high-density waste zones.

D. Business Surveys (Plastic Usage and Retail Practices)

- Objective: Map shops selling or using plastic-packaged products.
- Method:
    - o Survey Type: Census of all permanent and semi-permanent shops.
    - o Parameters: Shop type, plastic usage, disposal practices, geotagging of locations.
    - o Documentation: Direct observation and shopkeeper interviews.

Rationale for Methodology

• Standardized approach ensures consistency and comparability across survey areas.
• Random sampling eliminates bias while maximizing resource efficiency.
• Multimodal data collection (ground surveys + drones) enhances reliability.
• Geotagged data aids in spatial mapping of waste accumulation patterns.
• Business surveys provide insights into plastic consumption sources.

Data Analysis and Reporting

• Quantitative Measures: Total weight, volume, and type of collected plastic.
• GIS Mapping: Spatial distribution of plastic waste hotspots.
• Comparison Across Zones: Identifying trends and problem areas for intervention.
• Validation: Cross-referencing drone imagery with on-ground findings.

Ethical Considerations

• Informed consent obtained for business surveys.
• Anonymity and confidentiality maintained in data reporting.
• Surveys conducted with minimal disruption to daily activities.

For a comprehensive discussion of the research methodology, including detailed procedural steps and theoretical justifications, please find the
Survey Methodology Handbook *(Mamun, 2025)*.

7.

CONCLUSION

SUMMARY OF FINDINGS

• The survey methodology effectively captured plastic waste distribution across St. Martin's Island through inland quadrant surveys, beach transect surveys, drone assessments, and business surveys.

• Plastic waste hotspots were identified in high-footfall areas such as tourist beaches, and commercial areas, confirming the role of tourism and local business practices in plastic waste generation.

• The business survey highlighted the prevalence of single-use plastics in retail, particularly in grocery stores, restaurants, and street vendors.

• Drone imagery and GIS mapping validated ground observations, ensuring a comprehensive assessment of plastic waste accumulation.

KEY INSIGHTS AND IMPLICATIONS

• High plastic density along the shoreline suggests significant marine plastic influx, necessitating enhanced waste interception and collection efforts.

• Random sampling across inland areas indicated widespread plastic littering, reinforcing the need for better waste disposal facilities and community engagement.

• Retail dependency on plastic packaging points to the necessity for policy interventions promoting sustainable alternatives.

• The combination of on-ground and aerial survey methods proved effective in ensuring data accuracy and broad spatial coverage.

POLICY AND MANAGEMENT RECOMMENDATIONS

• Strengthen waste management infrastructure on the island, including waste bins, recycling stations, and efficient collection systems.
• Regulate plastic use in businesses through policy incentives.
• Enhance public awareness through targeted education programs for tourists and water-based passengers, focusing on responsible waste disposal practices and environmental stewardship.
• Expand research efforts using periodic drone surveys and longitudinal studies to track changes over time.

FUTURE RESEARCH DIRECTIONS

• Assess seasonal variations in plastic waste accumulation to understand peak pollution periods.

• Investigate the impact of policy changes on plastic waste reduction.

• Expand drone-based monitoring to improve remote sensing of marine debris.

FINAL REMARKS

This study provides a data-driven foundation for tackling plastic pollution on St. Martin's Island. The findings highlight the urgent need for sustainable waste management strategies, with a focus on policy implementation, business regulation, and community engagement. Future research and continuous monitoring will be crucial in ensuring the long-term environmental sustainability of the island.

STATISTICAL ESTIMATION

STATISTICAL ESTIMATION OF AVERAGE AND TOTAL TRASH COUNTS [INLAND]

Marine debris poses a significant threat to coastal and marine ecosystems globally, impacting wildlife, water quality, and human activities. Understanding the abundance and distribution of different debris types is crucial for effective management and mitigation strategies. This study focuses on St. Martin's Island, a vulnerable coastal area in Bangladesh, where tourism and fishing activities contribute to marine debris accumulation. To assess the extent of this issue, we conducted a comprehensive survey of marine debris on the island.

Survey Design

From approximately 20,000 potential survey sites, we randomly selected 1940 sites using a simple random sampling approach. This design ensures that each site had an equal chance of being selected, providing a representative snapshot of debris distribution across the island. At each site, we meticulously recorded the counts of various debris types, categorizing them into distinct groups (e.g., plastic bottles, fishing gear, foam debris). Using this data, we employed statistical methods to estimate the mean count of each debris type per site and the total count across the entire island. These estimates will provide valuable insights into the composition and magnitude of marine debris pollution on St. Martin's Island, informing targeted interventions to address this pressing environmental challenge.

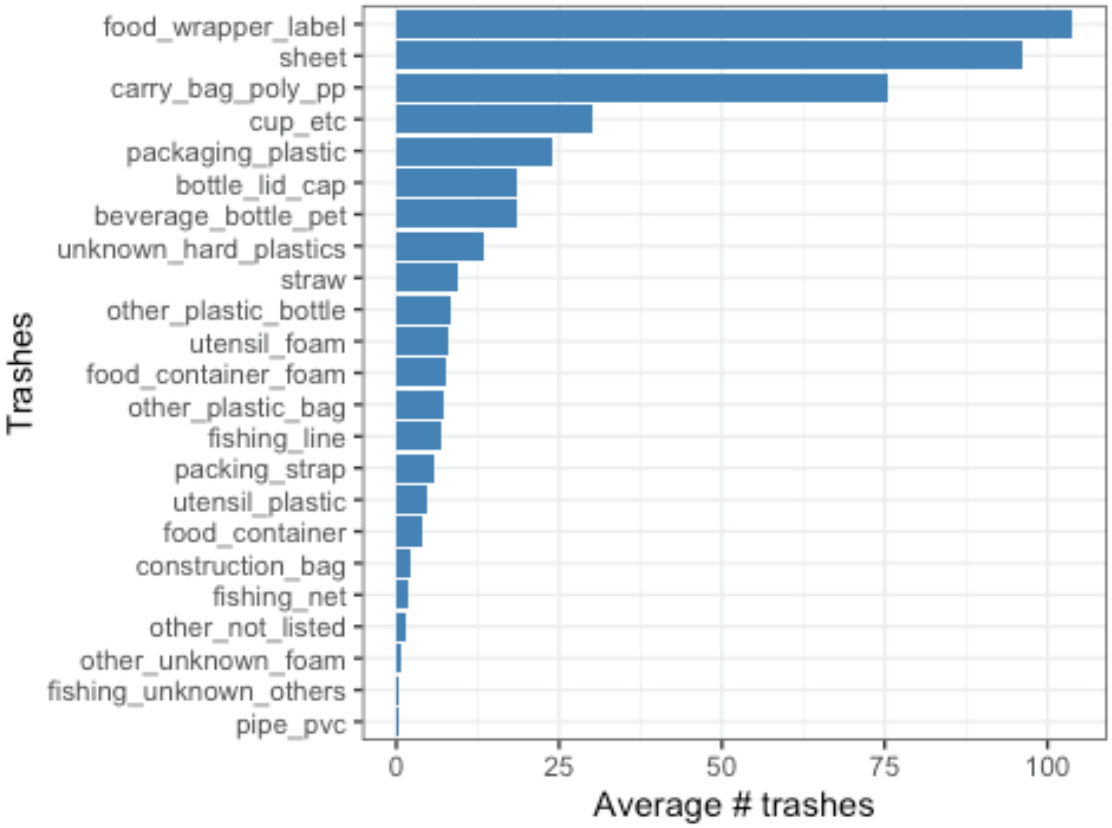
LOAD LIBRARIES

Use df as the table name
Relace NA values with zero

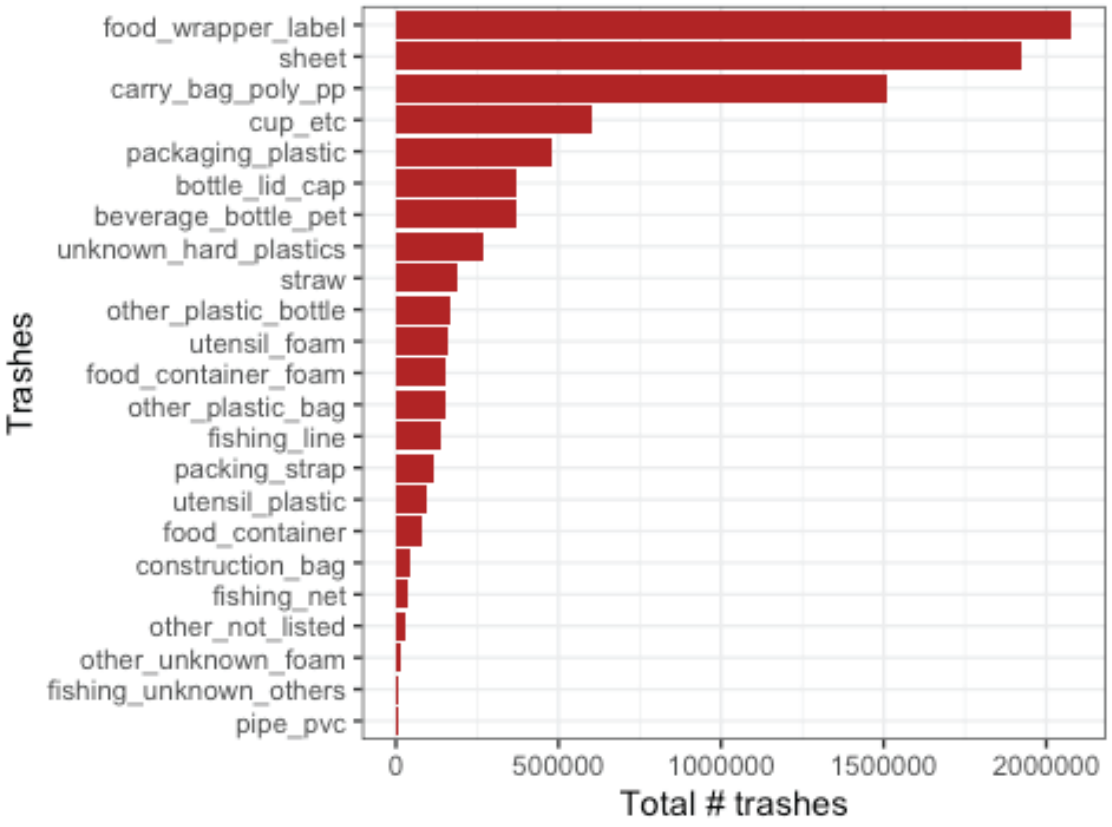
```
 DATA
 [1] "Timestamp"                "Surveyor name/initial"
 [3] "Grid ID"                  "Quad ID"
 [5] "Longitude"                "Latitude"
 [7] "Start time"               "End time"
 [9] "% of Bare ground"         "% of area surveyed"
[11] "Evidence of dumping"      "Scale of dumping"
[13] "Item list"                "Pipe/PVC"
[15] "Beverage bottle PET"      "Other plastic bottle"
[17] "Bottle lid/cap"           "Utensil (Plastic)"
[19] "Unknown Hard Plastics"    "Food wrapper/label"
[21] "Carry bag (Poly/PP)"      "Sheet"
[23] "Cup/etc"                  "Straw"
[25] "Construction bag"         "Other plastic bag"
[27] "Packing strap"            "Food container"
[29] "Packaging plastic"        "Food container (Foam)"
[31] "Utensil (Foam)"           "Other unknown  (Foam)"
[33] "Fishing Net"              "Fishing Line"
[35] "Fishing Buoys"            "Fishing  Unknown others"
[37] "Other not listed"
```

```
 [1] "timestamp"              "surveyor_name_initial"  "grid_id"
 [4] "quad_id"                "longitude"              "latitude"
 [7] "start_time"             "end_time"               "of_bare_ground"
[10] "of_area_surveyed"       "evidence_of_dumping"    "scale_of_dumping"
[13] "item_list"              "pipe_pvc"               "beverage_bottle_pet"
[16] "other_plastic_bottle"   "bottle_lid_cap"         "utensil_plastic"
[19] "unknown_hard_plastics"  "food_wrapper_label"     "carry_bag_poly_pp"
[22] "sheet"                  "cup_etc"                "straw"
[25] "construction_bag"       "other_plastic_bag"      "packing_strap"
[28] "food_container"         "packaging_plastic"      "food_container_foam"
[31] "utensil_foam"           "other_unknown_foam"     "fishing_net"
[34] "fishing_line"           "fishing_buoys"          "fishing_unknown_others"
[37] "other_not_listed"
```

Estimated average counts of trashes by type/Grid



Estimated total counts of trashes by type



FEATURE	MEAN	MEAN_SE	MEAN_LOWERCL	MEAN_UPPERCL	TOTAL	TOTAL_SE	TOTAL_LOWERCI	TOTAL_UPPERCI
pipe_pvc	0.3	0.1	0.1	0.5	6030.9	2126.7	1862.6	10199.3
beverage_bottle_pet	18.5	2.1	14.4	22.7	370299.0	42276.4	287438.7	453159.3
other_plastic_bottle	8.3	1.1	6.3	10.4	166958.8	21053.7	125694.3	208223.2
bottle_lid_cap	18.6	2.8	13.0	24.2	371752.6	56896.2	260238.1	483267.1
utensil_plastic	4.8	0.7	3.3	6.2	95103.1	14400.0	66879.6	123326.6
unknown_hard_plastics	13.5	1.7	10.2	16.9	270886.6	33925.4	204394.0	337379.2
food_wrapper_label	103.9	16.6	71.4	136.4	2078886.6	331618.4	1428926.5	2728846.7
carry_bag_poly_pp	75.6	17.8	40.7	110.4	1511113.4	355646.9	814058.3	2208168.5
sheet	96.2	23.1	50.9	141.5	1923463.9	462170.1	1017627.2	2829300.6
cup_etc	30.2	4.6	21.2	39.2	604278.4	92111.9	423742.3	784814.4
straw	9.5	1.4	6.7	12.3	189515.5	28664.0	133335.1	245695.8
construction_bag	2.3	0.4	1.6	3.1	46288.7	7542.6	31505.5	61071.8
other_plastic_bag	7.4	1.1	5.3	9.6	148958.8	21999.8	105839.9	192077.7
packing_strap	5.8	2.9	0.1	11.5	115845.4	57838.7	2483.7	229207.0
food_container	4.0	1.2	1.6	6.5	80855.7	24932.4	31989.0	129722.3
packaging_plastic	24.1	8.1	8.3	39.9	481835.1	161140.7	166005.1	797665.0
food_container_foam	7.7	2.7	2.5	13.0	154649.5	53693.5	49412.1	259886.9
utensil_foam	8.1	1.0	6.2	10.1	162793.8	19921.8	123747.8	201839.9
other_unknown_foam	0.9	0.3	0.2	1.6	18010.3	6757.4	4766.1	31254.5
fishing_net	1.7	0.2	1.3	2.0	33185.6	3719.6	25895.3	40475.8
fishing_line	6.8	0.7	5.4	8.3	136556.7	14926.3	107301.6	165811.8
fishing_unknown_others	0.4	0.2	0.1	0.6	7061.9	3012.5	1157.4	12966.3
other_not_listed	1.5	0.4	0.8	2.2	29938.1	7207.3	15812.2	44064.1

TABLE 1 Statistical estimation of average and total trash counts [inland]

STATISTICAL ESTIMATION OF AVERAGE AND TOTAL TRASH COUNTS [BEACH]

Systematic Survey setup

This study investigates the abundance of marine debris along the beaches of St. Martin's Island, a significant yet vulnerable coastal region in Bangladesh. To efficiently assess the debris distribution across the island's shoreline, we employed a systematic sampling approach. The beaches were conceptually divided into 5600 potential sampling units. From these, we systematically selected 225 sites for detailed debris surveys. This systematic design, with a sampling interval (K) of 25, ensured even coverage and a representative sample across the island's beaches.

At each selected site, we meticulously recorded the presence of various debris types, categorizing them into specific groups (e.g., plastic bottles, fishing gear, foam debris). The survey data was then analyzed using the survey package in R to estimate both the mean occurrence of each debris type per sampling unit and the total debris count for the entire island. This approach accounts for the systematic sampling design and provides robust estimates of mean and total debris abundance, along with their 95% confidence intervals. These findings offer valuable insights into the prevalent types and quantities of marine debris impacting the beaches of St. Martin's Island, which are crucial for guiding targeted management strategies to mitigate the ecological and socioeconomic impacts of marine debris pollution in this vital coastal area.

Analyzing Systematic Sampling Data with the survey Package in R

Here's how to use the survey package in R to analyze systematic sampling data where samples were taken every other unit, along with sample data and code to estimate the population total:

```
                          total   SE
beverage_bottle_pet 17500 1607
```

This code will estimate the population total based on the systematic sample, taking into account the sampling design.

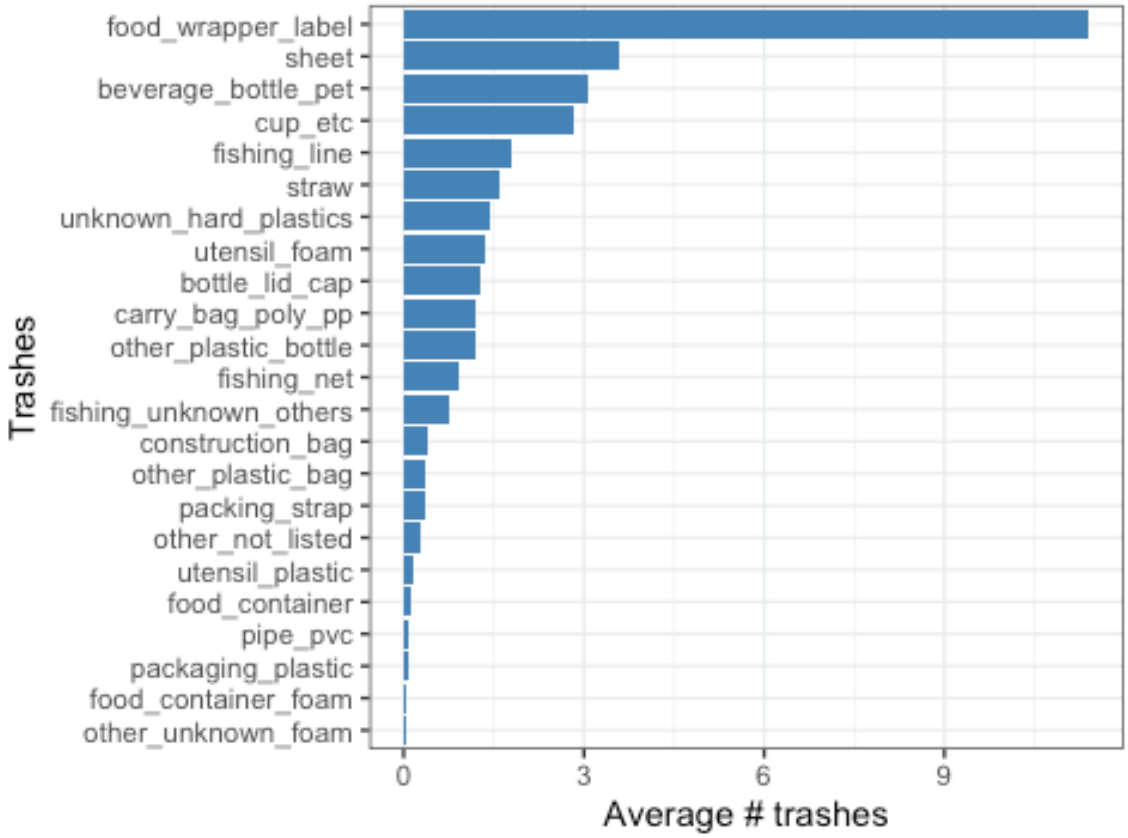
LOAD LIBRARIES

Use df as the table name
Relace NA values with zero

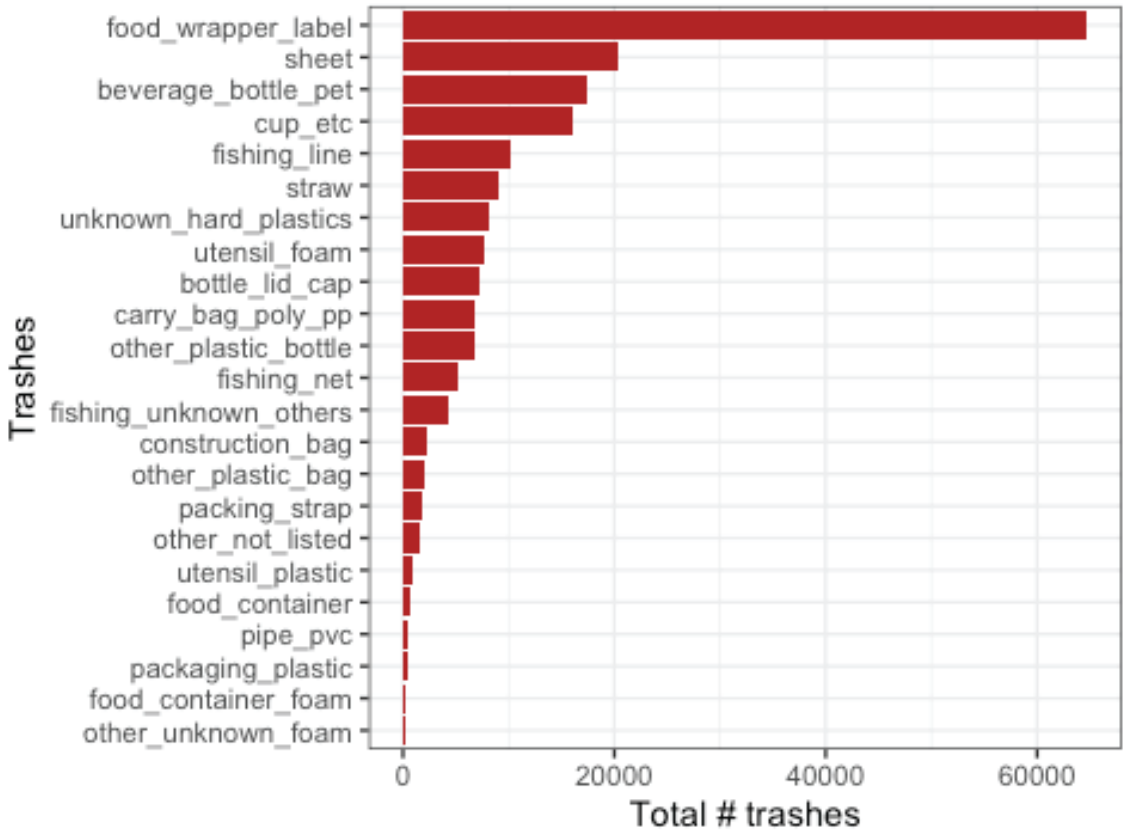
```
 DATA
 [1] "Timestamp"                 "Surveyor name/initial"
 [3] "Grid ID"                   "Quad ID"
 [5] "Longitude"                 "Latitude"
 [7] "Start time"                "End time"
 [9] "% of Bare ground"          "% of area surveyed"
[11] "Evidence of dumping"       "Scale of dumping"
[13] "Item list"                 "Pipe/PVC"
[15] "Beverage bottle PET"       "Other plastic bottle"
[17] "Bottle lid/cap"            "Utensil (Plastic)"
[19] "Unknown Hard Plastics"     "Food wrapper/label"
[21] "Carry bag (Poly/PP)"       "Sheet"
[23] "Cup/etc"                   "Straw"
[25] "Construction bag"          "Other plastic bag"
[27] "Packing strap"             "Food container"
[29] "Packaging plastic"         "Food container (Foam)"
[31] "Utensil (Foam)"            "Other unknown  (Foam)"
[33] "Fishing Net"               "Fishing Line"
[35] "Fishing Buoys"             "Fishing  Unknown others"
[37] "Other not listed"
```

```
 [1] "timestamp"              "surveyor_name_initial"  "grid_id"
 [4] "quad_id"                "longitude"              "latitude"
 [7] "start_time"             "end_time"               "of_bare_ground"
[10] "of_area_surveyed"       "evidence_of_dumping"    "scale_of_dumping"
[13] "item_list"              "pipe_pvc"               "beverage_bottle_pet"
[16] "other_plastic_bottle"   "bottle_lid_cap"         "utensil_plastic"
[19] "unknown_hard_plastics"  "food_wrapper_label"     "carry_bag_poly_pp"
[22] "sheet"                  "cup_etc"                "straw"
[25] "construction_bag"       "other_plastic_bag"      "packing_strap"
[28] "food_container"         "packaging_plastic"      "food_container_foam"
[31] "utensil_foam"           "other_unknown_foam"     "fishing_net"
[34] "fishing_line"           "fishing_buoys"          "fishing_unknown_others"
[37] "other_not_listed"
```

Estimated average counts of trashes by type



Estimated total counts of trashes by type

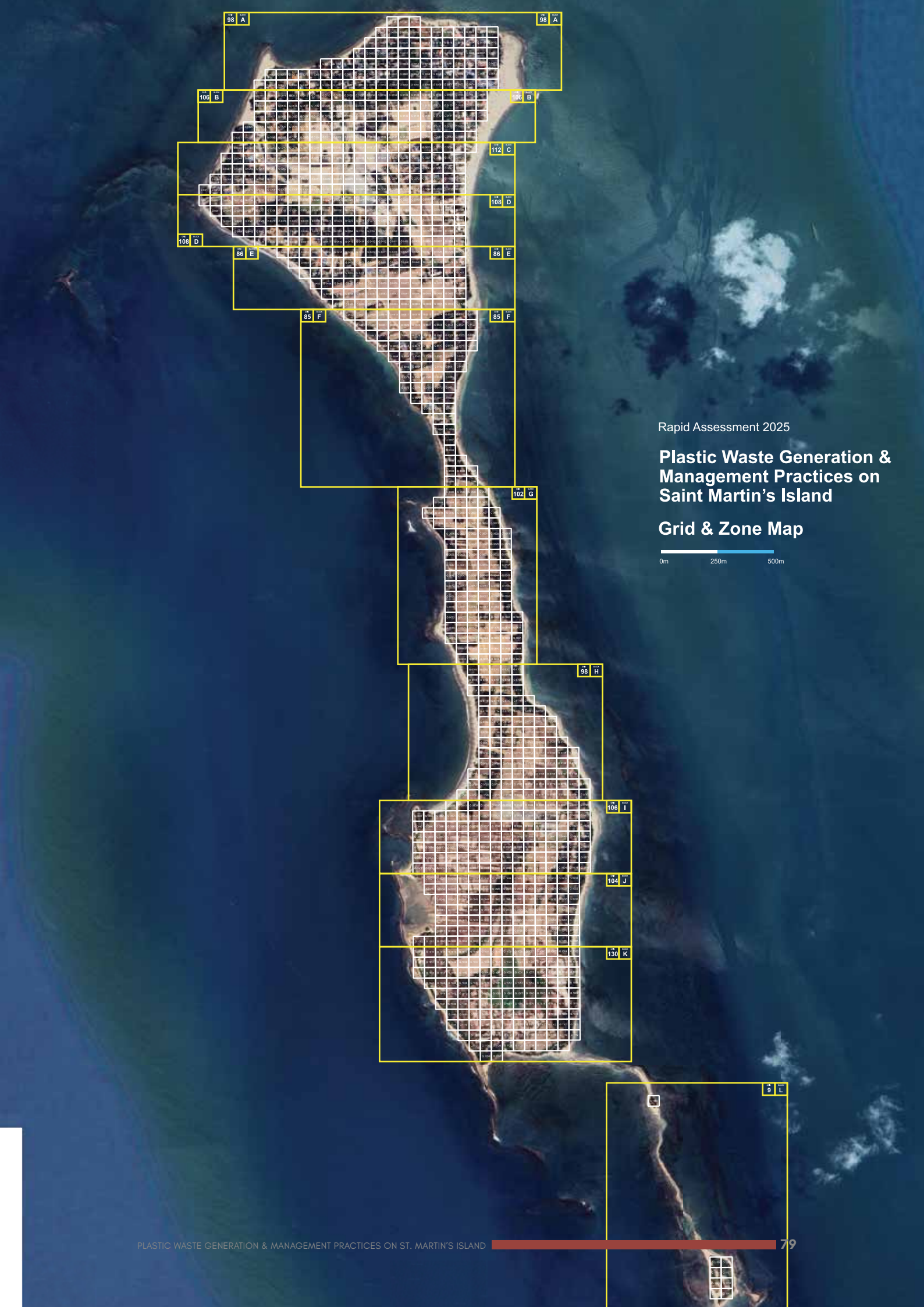


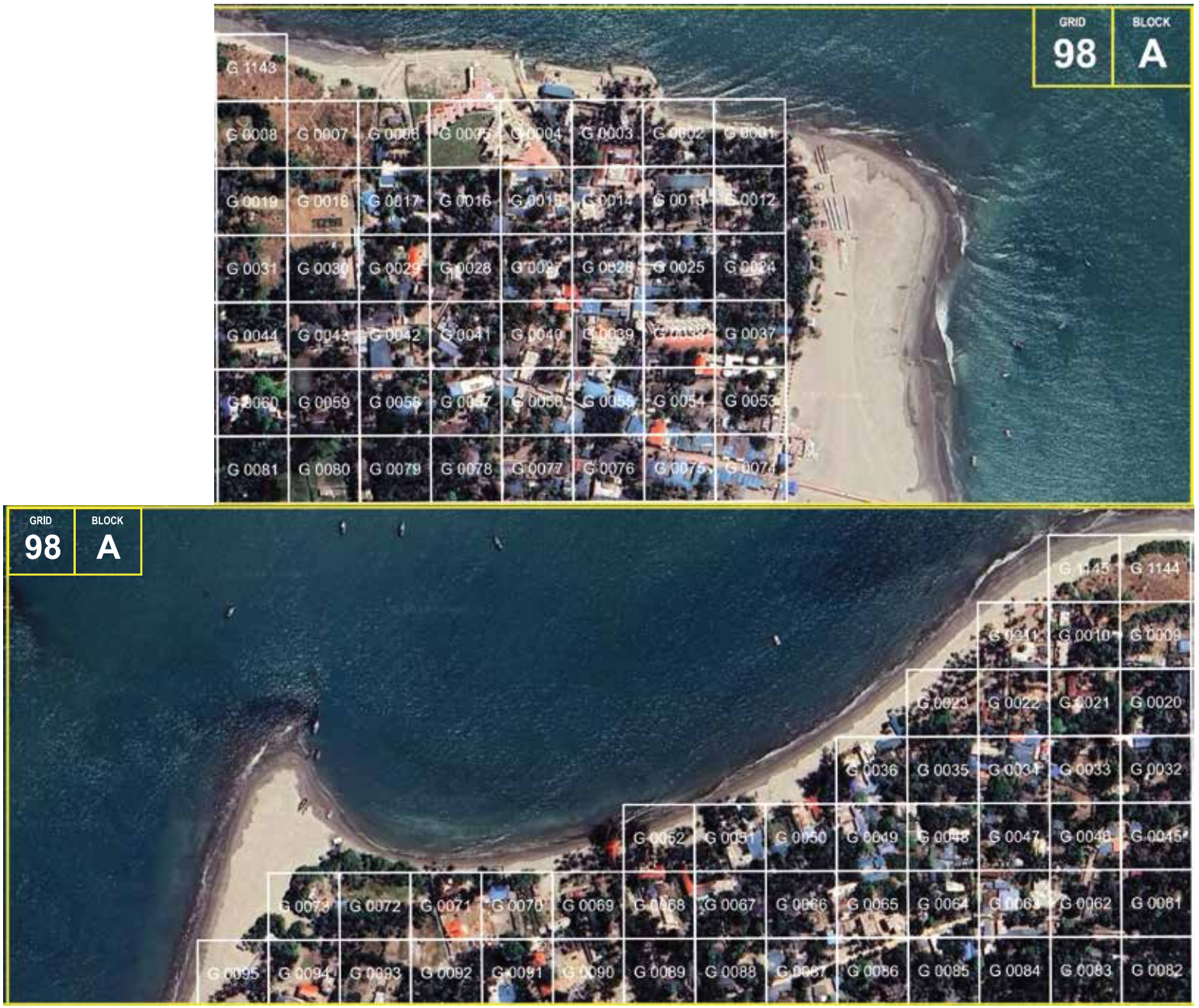
VARIABLE	Estimated_Mean	Standard_Error	Lower_CI	Upper_CI
pipe_pvc	0.09	0.03	0.03	0.15
beverage_bottle_pet	3.08	0.28	0.28	3.64
other_plastic_bottle	1.19	0.20	0.20	1.58
bottle_lid_cap	1.27	0.15	0.15	1.56
utensil_plastic	0.15	0.04	0.04	0.23
unknown_hard_plastics	1.42	0.22	0.22	1.84
food_wrapper_label	11.41	1.93	1.93	15.18
carry_bag_poly_pp	1.20	0.20	0.20	1.58
sheet	3.59	0.84	0.84	5.24
cup_etc	2.81	0.61	0.61	4.01
straw	1.60	0.45	0.45	2.48
construction_bag	0.41	0.06	0.06	0.53
other_plastic_bag	0.37	0.07	0.07	0.51
packing_strap	0.34	0.08	0.08	0.49
food_container	0.13	0.10	0.10	0.32
packaging_plastic	0.09	0.05	0.05	0.18
food_container_foam	0.05	0.02	0.02	0.10
utensil_foam	1.34	0.16	0.16	1.64
other_unknown_foam	0.03	0.02	0.02	0.06
fishing_net	0.90	0.16	0.16	1.22
fishing_line	1.81	0.18	0.18	2.17
fishing_unknown_others	0.77	0.14	0.14	1.04
other_not_listed	0.26	0.07	0.07	0.40

TABLE 2.1 Estimated average counts of trashes by type [Beach]

VARIABLE	Estimated_Total	Standard_Error	Lower_CI	Upper_CI
pipe_pvc	525	175.36	181.29	868.71
beverage_bottle_pet	17500	1606.98	14350.38	20649.62
other_plastic_bottle	6750	1126.50	4542.10	8957.90
bottle_lid_cap	7200	841.12	5551.43	8848.57
utensil_plastic	875	227.07	429.95	1320.05
unknown_hard_plastics	8050	1223.48	5652.02	10447.98
food_wrapper_label	64750	10928.27	43330.99	86169.01
carry_bag_poly_pp	6800	1119.32	4606.18	8993.82
sheet	20375	4772.49	11021.10	29728.90
cup_etc	15975	3458.29	9196.87	22753.13
straw	9075	2544.65	4087.58	14062.42
construction_bag	2300	361.29	1591.88	3008.12
other_plastic_bag	2100	405.44	1305.35	2894.65
packing_strap	1925	432.72	1076.88	2773.12
food_container	725	542.87	-339.01	1789.01
packaging_plastic	525	267.79	0.15	1049.85
food_container_foam	300	128.39	48.37	551.63
utensil_foam	7600	885.18	5865.08	9334.92
other_unknown_foam	175	87.75	3.01	346.99
fishing_net	5125	905.03	3351.18	6898.82
fishing_line	10275	1026.92	8262.27	12287.73
fishing_unknown_others	4375	793.02	2820.72	5929.28
other_not_listed	1500	388.16	739.23	2260.77

TABLE 2.2 Estimated Trash Totals by type [Beach]

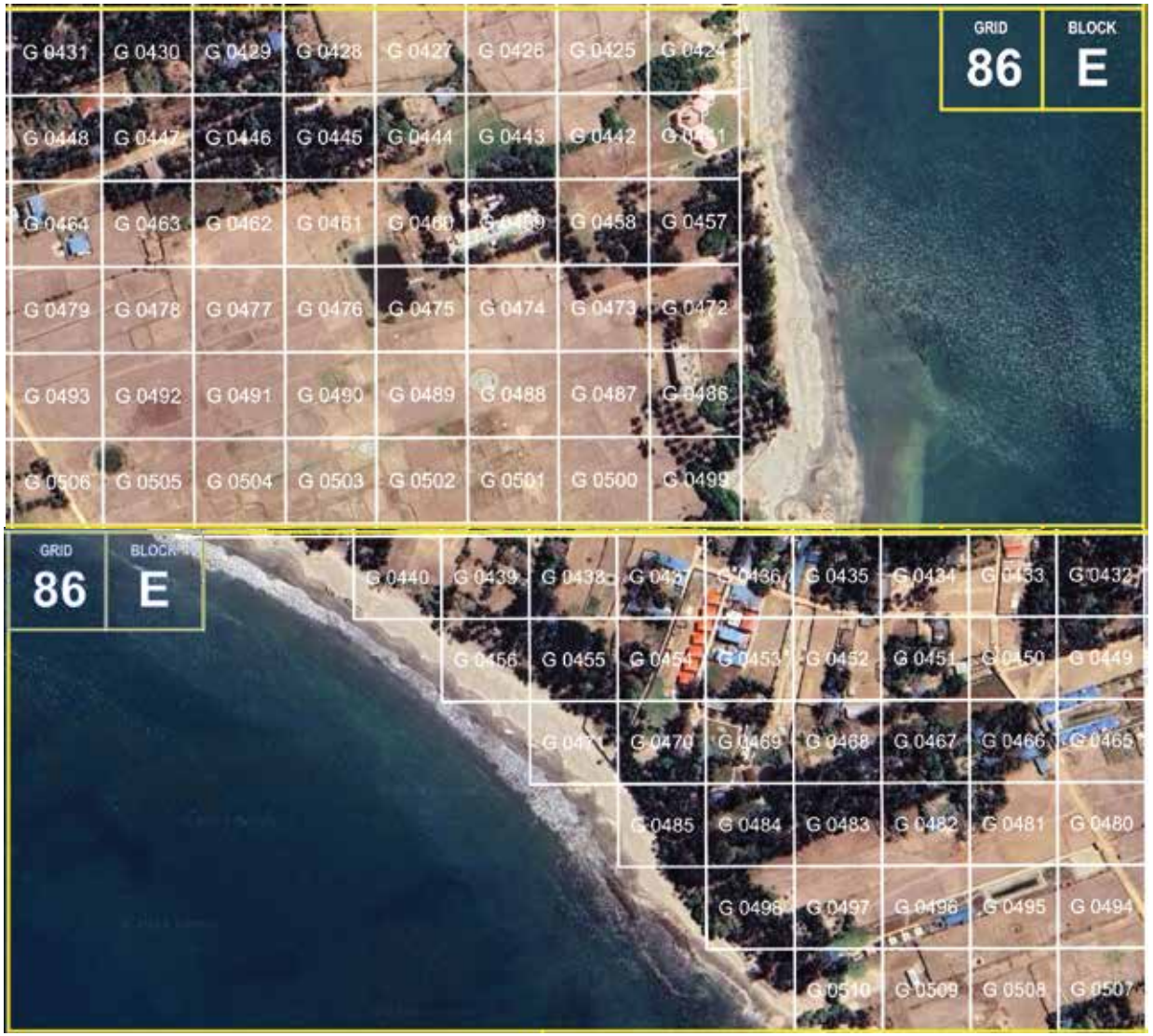

98 A
98 A
106 B
106 B
112 C
108 D
108 D
86 E
86 E
85 F
85 F
102 G
98 H
106 I
104 J
130 K
9 L
Rapid Assessment 2025
Plastic Waste Generation & Management Practices on Saint Martin's Island
Grid & Zone Map
0m
250m
500m


GRID
98
BLOCK
A
G 1143
G 0008
G 0007
G 0006
G 0005
G 0004
G 0003
G 0002
G 0001
G 0019
G 0018
G 0017
G 0016
G 0015
G 0014
G 0013
G 0012
G 0031
G 0030
G 0029
G 0028
G 0027
G 0026
G 0025
G 0024
G 0044
G 0043
G 0042
G 0041
G 0040
G 0039
G 0038
G 0037
G 0060
G 0059
G 0058
G 0057
G 0056
G 0055
G 0054
G 0053
G 0081
G 0080
G 0079
G 0078
G 0077
G 0076
G 0075
G 0074
GRID
98
BLOCK
A
G 1145
G 1144
G 0024
G 0010
G 0009
G 0023
G 0022
G 0021
G 0020
G 0036
G 0035
G 0034
G 0033
G 0032
G 0052
G 0051
G 0050
G 0049
G 0048
G 0047
G 0046
G 0045
G 0073
G 0072
G 0071
G 0070
G 0069
G 0068
G 0067
G 0066
G 0065
G 0064
G 0063
G 0062
G 0061
G 0095
G 0094
G 0093
G 0092
G 0091
G 0090
G 0089
G 0088
G 0087
G 0086
G 0085
G 0084
G 0083
G 0082

GRID
106
BLOCK
B
G 0106
G 0105
G 0104
G 0103
G 0102
G 0101
G 0100
G 0099
G 0098
G 0097
G 0096
G 0127
G 0126
G 0125
G 0124
G 0123
G 0122
G 0121
G 0120
G 0119
G 0118
G 0117
G 0148
G 0147
G 0146
G 0145
G 0144
G 0143
G 0142
G 0141
G 0140
G 0139
G 0138
G 0168
G 0167
G 0166
G 0165
G 0164
G 0163
G 0162
G 0161
G 0160
G 0159
G 0189
G 0188
G 0187
G 0186
G 0185
G 0184
G 0183
G 0182
G 0181
G 0180
GRID
106
BLOCK
B
G 0116
G 0115
G 0114
G 0113
G 0112
G 0111
G 0110
G 0109
G 0108
G 0107
G 0137
G 0136
G 0135
G 0134
G 0133
G 0132
G 0131
G 0130
G 0129
G 0128
G 0158
G 0157
G 0156
G 0155
G 0154
G 0153
G 0152
G 0151
G 0150
G 0149
G 0179
G 0178
G 0177
G 0176
G 0175
G 0174
G 0173
G 0172
G 0171
G 0170
G 0169
G 0201
G 0200
G 0199
G 0198
G 0197
G 0196
G 0195
G 0194
G 0193
G 0192
G 0191
G 0190

GRID
112
BLOCK
C
G 0212
G 0211
G 0210
G 0209
G 0208
G 0207
G 0206
G 0205
G 0204
G 0203
G 0202
G 0233
G 0232
G 0231
G 0230
G 0229
G 0228
G 0227
G 0226
G 0225
G 0224
G 0255
G 0254
G 0253
G 0252
G 0251
G 0250
G 0249
G 0248
G 0247
G 0246
G 0277
G 0276
G 0275
G 0274
G 0273
G 0272
G 0271
G 0270
G 0269
G 0268
G 0300
G 0299
G 0298
G 0297
G 0296
G 0295
G 0294
G 0293
G 0292
G 0291
G 0223
G 0222
G 0221
G 0220
G 0219
G 0218
G 0217
G 0216
G 0215
G 0214
G 0213
G 0245
G 0244
G 0243
G 0242
G 0241
G 0240
G 0239
G 0238
G 0237
G 0236
G 0235
G 0234
G 0267
G 0266
G 0265
G 0264
G 0263
G 0262
G 0261
G 0260
G 0259
G 0258
G 0257
G 0256
G 0290
G 0289
G 0288
G 0287
G 0286
G 0285
G 0284
G 0283
G 0282
G 0281
G 0280
G 0279
G 0278
G 0314
G 0313
G 0312
G 0311
G 0310
G 0309
G 0308
G 0307
G 0306
G 0305
G 0304
G 0303
G 0302
G 0301

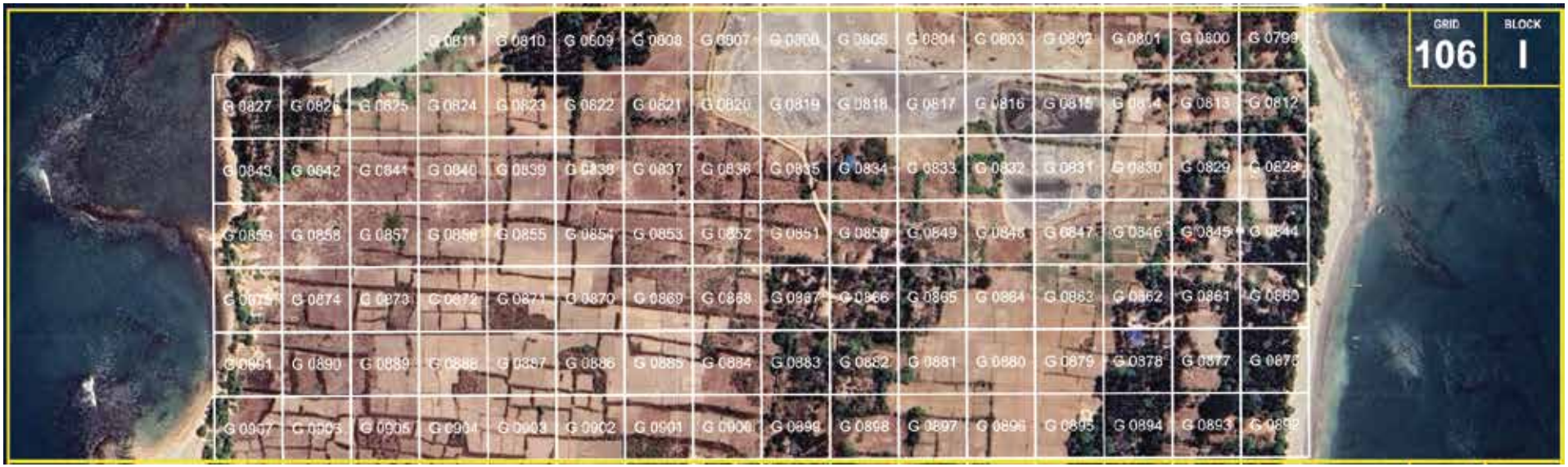
GRID
108
BLOCK
D
G 0324
G 0322
G 0321
G 0320
G 0319
G 0318
G 0317
G 0348
G 0347
G 0346
G 0345
G 0344
G 0343
G 0342
G 0389
G 0371
G 0370
G 0369
G 0368
G 0367
G 0366
G 0365
G 0364
G 0393
G 0392
G 0391
G 0390
G 0389
G 0388
G 0387
G 0386
G 0414
G 0413
G 0412
G 0411
G 0410
G 0409
G 0408
G 0407
G 0406
G 0338
G 0337
G 0336
G 0335
G 0334
G 0333
G 0332
G 0331
G 0330
G 0329
G 0328
G 0327
G 0326
G 0325
G 0361
G 0360
G 0359
G 0358
G 0357
G 0356
G 0355
G 0354
G 0353
G 0352
G 0351
G 0350
G 0349
G 0383
G 0382
G 0381
G 0380
G 0379
G 0378
G 0377
G 0376
G 0375
G 0374
G 0373
G 0372
G 0404
G 0403
G 0402
G 0401
G 0400
G 0399
G 0398
G 0397
G 0396
G 0395
G 0394
G 0423
G 0422
G 0421
G 0420
G 0419
G 0418
G 0417
G 0416
G 0415
GRID
108
BLOCK
D

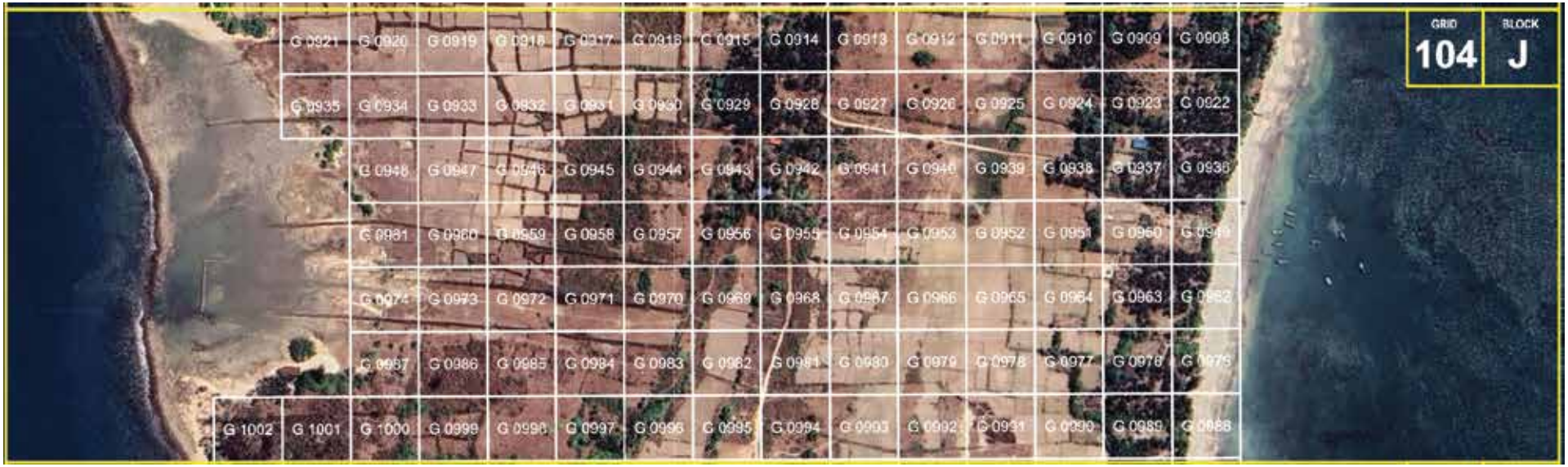

GRID
86
BLOCK
E
G 0431
G 0430
G 0429
G 0428
G 0427
G 0426
G 0425
G 0424
G 0448
G 0447
G 0446
G 0445
G 0444
G 0443
G 0442
G 0464
G 0463
G 0462
G 0461
G 0460
G 0459
G 0458
G 0457
G 0479
G 0478
G 0477
G 0476
G 0475
G 0474
G 0473
G 0472
G 0493
G 0492
G 0491
G 0490
G 0489
G 0488
G 0487
G 0486
G 0506
G 0505
G 0504
G 0503
G 0502
G 0501
G 0500
G 0499
GRID
86
BLOCK
E
G 0440
G 0439
G 0438
G 0437
G 0436
G 0435
G 0434
G 0433
G 0432
G 0456
G 0455
G 0454
G 0453
G 0452
G 0451
G 0450
G 0449
G 0470
G 0469
G 0468
G 0467
G 0466
G 0465
G 0485
G 0484
G 0483
G 0482
G 0481
G 0480
G 0498
G 0497
G 0496
G 0495
G 0494
G 0510
G 0509
G 0508
G 0507

GRID
85
BLOCK
F
G 0522
G 0521
G 0520
G 0519
G 0518
G 0517
G 0516
G 0515
G 0514
G 0513
G 0512
G 0511
G 0532
G 0531
G 0529
G 0528
G 0527
G 0526
G 0525
G 0524
G 0543
G 0542
G 0541
G 0540
G 0539
G 0538
G 0537
G 0536
G 0535
G 0534
G 0551
G 0550
G 0549
G 0548
G 0547
G 0546
G 0545
G 0544
G 0559
G 0557
G 0556
G 0555
G 0554
G 0553
G 0565
G 0564
G 0563
G 0562
G 0561
G 0560
G 0575
G 0574
G 0573
G 0572
G 0571
G 0579
G 0577
G 0576
G 0588
G 0589
G 0587
G 0588
G 0593
G 0592
G 0591
G 0594
GRID
85
BLOCK
F

GRID
102
BLOCK
G
G 0600
G 0599
G 0598
G 0597
G 0605
G 0604
G 0603
G 0602
G 0601
G 0612
G 0611
G 0610
G 0609
G 0608
G 0607
G 0606
G 0618
G 0617
G 0616
G 0615
G 0614
G 0613
G 0624
G 0623
G 0622
G 0621
G 0620
G 0619
G 0630
G 0629
G 0628
G 0627
G 0626
G 0625
G 0636
G 0635
G 0634
G 0633
G 0632
G 0631
G 0642
G 0641
G 0640
G 0639
G 0638
G 0637
G 0648
G 0647
G 0646
G 0645
G 0644
G 0643
G 0654
G 0653
G 0652
G 0651
G 0650
G 0649
G 0660
G 0659
G 0658
G 0657
G 0656
G 0655
G 0666
G 0665
G 0664
G 0663
G 0662
G 0661
G 0673
G 0672
G 0671
G 0670
G 0669
G 0668
G 0667
G 0680
G 0679
G 0678
G 0677
G 0676
G 0675
G 0674
G 0687
G 0686
G 0685
G 0684
G 0683
G 0682
G 0681
G 0693
G 0692
G 0691
G 0690
G 0689
G 0688
G 0699
G 0698
G 0697
G 0696
G 0695
G 0694

GRID
98
BLOCK
H


GRID
106
BLOCK
I


GRID
104
BLOCK
J
G 0921
G 0920
G 0919
G 0918
G 0917
G 0916
G 0915
G 0914
G 0913
G 0912
G 0911
G 0910
G 0909
G 0908
G 0935
G 0934
G 0933
G 0932
G 0931
G 0930
G 0929
G 0928
G 0927
G 0926
G 0925
G 0924
G 0923
G 0922
G 0948
G 0947
G 0946
G 0945
G 0944
G 0943
G 0942
G 0941
G 0940
G 0939
G 0938
G 0937
G 0936
G 0961
G 0960
G 0959
G 0958
G 0957
G 0956
G 0955
G 0954
G 0953
G 0952
G 0951
G 0950
G 0949
G 0974
G 0973
G 0972
G 0971
G 0970
G 0969
G 0968
G 0967
G 0966
G 0965
G 0964
G 0963
G 0962
G 0987
G 0986
G 0985
G 0984
G 0983
G 0982
G 0981
G 0980
G 0979
G 0978
G 0977
G 0976
G 0975
G 1002
G 1001
G 1000
G 0999
G 0998
G 0997
G 0996
G 0995
G 0994
G 0993
G 0992
G 0991
G 0990
G 0989
G 0988

GRID
130
BLOCK
K
G 1016
G 1015
G 1014
G 1013
G 1012
G 1011
G 1010
G 1009
G 1008
G 1007
G 1006
G 1005
G 1004
G 1003
G 1031
G 1030
G 1029
G 1028
G 1027
G 1026
G 1025
G 1024
G 1023
G 1022
G 1021
G 1020
G 1019
G 1018
G 1046
G 1045
G 1044
G 1043
G 1042
G 1041
G 1040
G 1039
G 1038
G 1037
G 1036
G 1035
G 1034
G 1033
G 1061
G 1060
G 1059
G 1058
G 1057
G 1056
G 1055
G 1054
G 1053
G 1052
G 1051
G 1050
G 1049
G 1048
G 1074
G 1073
G 1072
G 1071
G 1070
G 1069
G 1068
G 1067
G 1066
G 1065
G 1064
G 1063
G 1062
G 1087
G 1088
G 1085
G 1084
G 1083
G 1082
G 1081
G 1080
G 1079
G 1078
G 1077
G 1076
G 1075
G 1099
G 1098
G 1097
G 1096
G 1095
G 1094
G 1093
G 1092
G 1091
G 1090
G 1089
G 1088
G 1111
G 1110
G 1109
G 1108
G 1107
G 1106
G 1105
G 1104
G 1103
G 1102
G 1101
G 1100
G 1122
G 1121
G 1120
G 1119
G 1118
G 1117
G 1116
G 1115
G 1114
G 1113
G 1112
G 1131
G 1130
G 1129
G 1128
G 1127
G 1126
G 1125
G 1124
G 1123
G 1133
G 1132

ORTHOPHOTO MAP

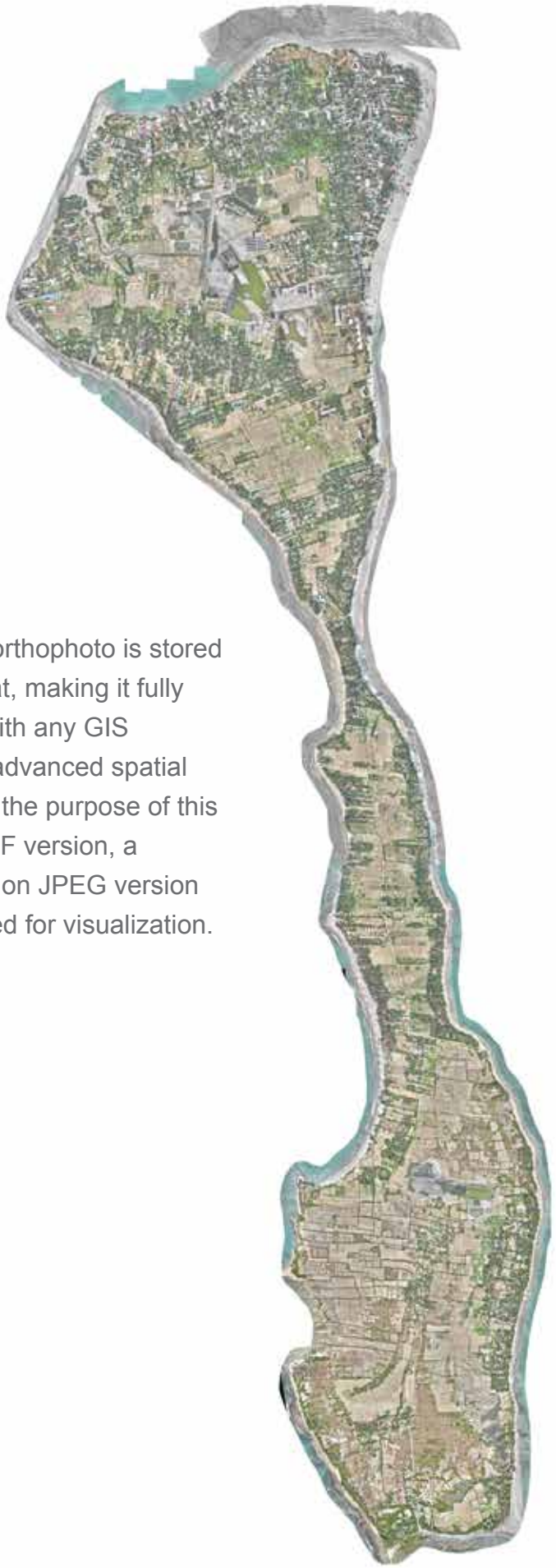
As part of a rapid assessment and to support future monitoring efforts, an aerial survey of Saint Martin's Island (SMI) was conducted using advanced drone technology. The high-resolution imagery captured during this mission was processed to produce an orthophoto map—a geometrically corrected image that accurately represents the Earth's surface with a consistent scale and precise geographic coordinates.

Unlike standard aerial photographs, the orthophoto map corrects for distortions caused by camera tilt, lens aberrations, and terrain variations. As a result, it enables precise spatial analysis, including reliable measurements of distances, areas, and feature locations across the island.

The orthophoto now serves as a foundational dataset for a wide range of applications, including environmental assessments, tourism impact evaluations, infrastructure development, and coastal zone management.

The original orthophoto is stored in TIFF format, making it fully compatible with any GIS software for advanced spatial analysis. For the purpose of this printed or PDF version, a lower-resolution JPEG version has been used for visualization.

This initiative marks a critical step toward integrating geospatial intelligence into the sustainable management of SMI, offering enhanced visual clarity and spatial accuracy for researchers, planners, and policy-makers working to protect and develop the island responsibly.



The original orthophoto is stored in TIFF format, making it fully compatible with any GIS software for advanced spatial analysis. For the purpose of this printed or PDF version, a lower-resolution JPEG version has been used for visualization.

GRID ID	LAT	LONG
GC 0001	20.63493	92.32772
GC 0002	20.63493	92.32724
GC 0003	20.63493	92.32676
GC 0004	20.63493	92.32628
GC 0005	20.63492	92.3258
GC 0006	20.63492	92.32532
GC 0007	20.63492	92.32484
GC 0008	20.63492	92.32436
GC 0009	20.63492	92.32388
GC 0010	20.63491	92.3234
GC 0011	20.63491	92.32292
GC 0012	20.63448	92.32772
GC 0013	20.63448	92.32724
GC 0014	20.63448	92.32676
GC 0015	20.63447	92.32628
GC 0016	20.63447	92.3258
GC 0017	20.63447	92.32532
GC 0018	20.63447	92.32484
GC 0019	20.63447	92.32436
GC 0020	20.63446	92.32388
GC 0021	20.63446	92.3234
GC 0022	20.63446	92.32292
GC 0023	20.63446	92.32244
GC 0024	20.63403	92.32773
GC 0025	20.63403	92.32725
GC 0026	20.63402	92.32677
GC 0027	20.63402	92.32629
GC 0028	20.63402	92.32581
GC 0029	20.63402	92.32533
GC 0030	20.63402	92.32485
GC 0031	20.63401	92.32437
GC 0032	20.63401	92.32389
GC 0033	20.63401	92.32341
GC 0034	20.63401	92.32293
GC 0035	20.63401	92.32245
GC 0036	20.63401	92.32197
GC 0037	20.63358	92.32773
GC 0038	20.63357	92.32725
GC 0039	20.63357	92.32677
GC 0040	20.63357	92.32629
GC 0041	20.63357	92.32581
GC 0042	20.63357	92.32533
GC 0043	20.63356	92.32485
GC 0044	20.63356	92.32437
GC 0045	20.63356	92.32389
GC 0046	20.63356	92.32341
GC 0047	20.63356	92.32293
GC 0048	20.63356	92.32245
GC 0049	20.63355	92.32197
GC 0050	20.63355	92.32149
GC 0051	20.63355	92.32101
GC 0052	20.63355	92.32053
GC 0053	20.63312	92.32773
GC 0054	20.63312	92.32725
GC 0055	20.63312	92.32677
GC 0056	20.63312	92.32629
GC 0057	20.63312	92.32581
GC 0058	20.63311	92.32533
GC 0059	20.63311	92.32485
GC 0060	20.63311	92.32437
GC 0061	20.63311	92.32389
GC 0062	20.63311	92.32341
GC 0063	20.63311	92.32293
GC 0064	20.6331	92.32245
GC 0065	20.6331	92.32197
GC 0066	20.6331	92.32149
GC 0067	20.6331	92.32101
GC 0068	20.6331	92.32053
GC 0069	20.63309	92.32005
GC 0070	20.63309	92.31957
GC 0071	20.63309	92.31909
GC 0072	20.63309	92.31861
GC 0073	20.63309	92.31813
GC 0074	20.63267	92.32773
GC 0075	20.63267	92.32725
GC 0076	20.63267	92.32677
GC 0077	20.63267	92.32629
GC 0078	20.63266	92.32581
GC 0079	20.63266	92.32533
GC 0080	20.63266	92.32485
GC 0081	20.63266	92.32437
GC 0082	20.63266	92.32389
GC 0083	20.63266	92.32341
GC 0084	20.63265	92.32293
GC 0085	20.63265	92.32245
GC 0086	20.63265	92.32197
GC 0087	20.63265	92.32149
GC 0088	20.63265	92.32101
GC 0089	20.63264	92.32053
GC 0090	20.63264	92.32005
GC 0091	20.63264	92.31957
GC 0092	20.63264	92.31909

GRID ID	LAT	LONG
GC 0093	20.63264	92.31861
GC 0094	20.63263	92.31813
GC 0095	20.63263	92.31765
GC 0096	20.63222	92.32725
GC 0097	20.63222	92.32677
GC 0098	20.63221	92.32629
GC 0099	20.63221	92.32581
GC 0100	20.63221	92.32533
GC 0101	20.63221	92.32485
GC 0102	20.63221	92.32437
GC 0103	20.63221	92.32389
GC 0104	20.6322	92.32341
GC 0105	20.6322	92.32293
GC 0106	20.6322	92.32245
GC 0107	20.6322	92.32197
GC 0108	20.6322	92.32149
GC 0109	20.63219	92.32101
GC 0110	20.63219	92.32053
GC 0111	20.63219	92.32006
GC 0112	20.63219	92.31958
GC 0113	20.63219	92.3191
GC 0114	20.63218	92.31862
GC 0115	20.63218	92.31814
GC 0116	20.63218	92.31766
GC 0117	20.63177	92.32726
GC 0118	20.63177	92.32678
GC 0119	20.63176	92.3263
GC 0120	20.63176	92.32582
GC 0121	20.63176	92.32534
GC 0122	20.63176	92.32486
GC 0123	20.63176	92.32438
GC 0124	20.63175	92.3239
GC 0125	20.63175	92.32342
GC 0126	20.63175	92.32294
GC 0127	20.63175	92.32246
GC 0128	20.63175	92.32198
GC 0129	20.63174	92.3215
GC 0130	20.63174	92.32102
GC 0131	20.63174	92.32054
GC 0132	20.63174	92.32006
GC 0133	20.63174	92.31958
GC 0134	20.63173	92.3191
GC 0135	20.63173	92.31862
GC 0136	20.63173	92.31814
GC 0137	20.63173	92.31766
GC 0138	20.63132	92.32726

GRID ID	LAT	LONG
GC 0139	20.63131	92.32678
GC 0140	20.63131	92.3263
GC 0141	20.63131	92.32582
GC 0142	20.63131	92.32534
GC 0143	20.63131	92.32486
GC 0144	20.6313	92.32438
GC 0145	20.6313	92.3239
GC 0146	20.6313	92.32342
GC 0147	20.6313	92.32294
GC 0148	20.6313	92.32246
GC 0149	20.63129	92.32198
GC 0150	20.63129	92.3215
GC 0151	20.63129	92.32102
GC 0152	20.63129	92.32054
GC 0153	20.63129	92.32006
GC 0154	20.63129	92.31958
GC 0155	20.63128	92.3191
GC 0156	20.63128	92.31862
GC 0157	20.63128	92.31814
GC 0158	20.63128	92.31766
GC 0159	20.63086	92.32678
GC 0160	20.63086	92.3263
GC 0161	20.63086	92.32582
GC 0162	20.63086	92.32534
GC 0163	20.63085	92.32486
GC 0164	20.63085	92.32438
GC 0165	20.63085	92.3239
GC 0166	20.63085	92.32342
GC 0167	20.63085	92.32294
GC 0168	20.63084	92.32246
GC 0169	20.63084	92.32198
GC 0170	20.63084	92.3215
GC 0171	20.63084	92.32102
GC 0172	20.63084	92.32054
GC 0173	20.63084	92.32006
GC 0174	20.63083	92.31958
GC 0175	20.63083	92.3191
GC 0176	20.63083	92.31862
GC 0177	20.63083	92.31814
GC 0178	20.63083	92.31766
GC 0179	20.63082	92.31718
GC 0180	20.63041	92.32678
GC 0181	20.63041	92.3263
GC 0182	20.63041	92.32582
GC 0183	20.6304	92.32534
GC 0184	20.6304	92.32486

GRID ID	LAT	LONG
GC 0185	20.6304	92.32438
GC 0186	20.6304	92.3239
GC 0187	20.6304	92.32342
GC 0188	20.63039	92.32294
GC 0189	20.63039	92.32246
GC 0190	20.63039	92.32198
GC 0191	20.63039	92.3215
GC 0192	20.63039	92.32102
GC 0193	20.63039	92.32054
GC 0194	20.63038	92.32006
GC 0195	20.63038	92.31958
GC 0196	20.63038	92.3191
GC 0197	20.63038	92.31862
GC 0198	20.63038	92.31814
GC 0199	20.63037	92.31766
GC 0200	20.63037	92.31718
GC 0201	20.63037	92.3167
GC 0202	20.62996	92.32678
GC 0203	20.62996	92.3263
GC 0204	20.62995	92.32582
GC 0205	20.62995	92.32534
GC 0206	20.62995	92.32486
GC 0207	20.62995	92.32438
GC 0208	20.62995	92.3239
GC 0209	20.62994	92.32342
GC 0210	20.62994	92.32294
GC 0211	20.62994	92.32246
GC 0212	20.62994	92.32198
GC 0213	20.62994	92.3215
GC 0214	20.62994	92.32102
GC 0215	20.62993	92.32054
GC 0216	20.62993	92.32007
GC 0217	20.62993	92.31959
GC 0218	20.62993	92.31911
GC 0219	20.62993	92.31863
GC 0220	20.62992	92.31815
GC 0221	20.62992	92.31767
GC 0222	20.62992	92.31719
GC 0223	20.62992	92.31671
GC 0224	20.6295	92.32631
GC 0225	20.6295	92.32583
GC 0226	20.6295	92.32535
GC 0227	20.6295	92.32487
GC 0228	20.6295	92.32439
GC 0229	20.62949	92.32391
GC 0230	20.62949	92.32343

GRID ID	LAT	LONG
GC 0231	20.62949	92.32295
GC 0232	20.62949	92.32247
GC 0233	20.62949	92.32199
GC 0234	20.62949	92.32151
GC 0235	20.62948	92.32103
GC 0236	20.62948	92.32055
GC 0237	20.62948	92.32007
GC 0238	20.62948	92.31959
GC 0239	20.62948	92.31911
GC 0240	20.62947	92.31863
GC 0241	20.62947	92.31815
GC 0242	20.62947	92.31767
GC 0243	20.62947	92.31719
GC 0244	20.62947	92.31671
GC 0245	20.62946	92.31623
GC 0246	20.62905	92.32631
GC 0247	20.62905	92.32583
GC 0248	20.62905	92.32535
GC 0249	20.62905	92.32487
GC 0250	20.62905	92.32439
GC 0251	20.62904	92.32391
GC 0252	20.62904	92.32343
GC 0253	20.62904	92.32295
GC 0254	20.62904	92.32247
GC 0255	20.62904	92.32199
GC 0256	20.62903	92.32151
GC 0257	20.62903	92.32103
GC 0258	20.62903	92.32055
GC 0259	20.62903	92.32007
GC 0260	20.62903	92.31959
GC 0261	20.62902	92.31911
GC 0262	20.62902	92.31863
GC 0263	20.62902	92.31815
GC 0264	20.62902	92.31767
GC 0265	20.62902	92.31719
GC 0266	20.62901	92.31671
GC 0267	20.62901	92.31623
GC 0268	20.6286	92.32631
GC 0269	20.6286	92.32583
GC 0270	20.6286	92.32535
GC 0271	20.6286	92.32487
GC 0272	20.62859	92.32439
GC 0273	20.62859	92.32391
GC 0274	20.62859	92.32343
GC 0275	20.62859	92.32295
GC 0276	20.62859	92.32247

GRID ID	LAT	LONG
GC 0277	20.62858	92.32199
GC 0278	20.62858	92.32151
GC 0279	20.62858	92.32103
GC 0280	20.62858	92.32055
GC 0281	20.62858	92.32007
GC 0282	20.62857	92.31959
GC 0283	20.62857	92.31911
GC 0284	20.62857	92.31863
GC 0285	20.62857	92.31815
GC 0286	20.62857	92.31767
GC 0287	20.62857	92.31719
GC 0288	20.62856	92.31671
GC 0289	20.62856	92.31623
GC 0290	20.62856	92.31575
GC 0291	20.62815	92.32631
GC 0292	20.62815	92.32583
GC 0293	20.62815	92.32535
GC 0294	20.62814	92.32487
GC 0295	20.62814	92.32439
GC 0296	20.62814	92.32391
GC 0297	20.62814	92.32343
GC 0298	20.62814	92.32295
GC 0299	20.62813	92.32247
GC 0300	20.62813	92.32199
GC 0301	20.62813	92.32151
GC 0302	20.62813	92.32103
GC 0303	20.62813	92.32055
GC 0304	20.62812	92.32007
GC 0305	20.62812	92.31959
GC 0306	20.62812	92.31911
GC 0307	20.62812	92.31863
GC 0308	20.62812	92.31815
GC 0309	20.62812	92.31767
GC 0310	20.62811	92.31719
GC 0311	20.62811	92.31671
GC 0312	20.62811	92.31623
GC 0313	20.62811	92.31575
GC 0314	20.62811	92.31527
GC 0315	20.6277	92.32631
GC 0316	20.6277	92.32583
GC 0317	20.62769	92.32535
GC 0318	20.62769	92.32487
GC 0319	20.62769	92.32439
GC 0320	20.62769	92.32391
GC 0321	20.62769	92.32343
GC 0322	20.62768	92.32295
GC 0323	20.62768	92.32247
GC 0324	20.62768	92.32199
GC 0325	20.62768	92.32151
GC 0326	20.62768	92.32103
GC 0327	20.62767	92.32055
GC 0328	20.62767	92.32008
GC 0329	20.62767	92.3196
GC 0330	20.62767	92.31912
GC 0331	20.62767	92.31864
GC 0332	20.62767	92.31816
GC 0333	20.62766	92.31768
GC 0334	20.62766	92.3172
GC 0335	20.62766	92.31672
GC 0336	20.62766	92.31624
GC 0337	20.62766	92.31576
GC 0338	20.62765	92.31528
GC 0339	20.62725	92.32632
GC 0340	20.62724	92.32584
GC 0341	20.62724	92.32536
GC 0342	20.62724	92.32488
GC 0343	20.62724	92.3244
GC 0344	20.62724	92.32392
GC 0345	20.62723	92.32344
GC 0346	20.62723	92.32296
GC 0347	20.62723	92.32248
GC 0348	20.62723	92.322
GC 0349	20.62723	92.32152
GC 0350	20.62722	92.3210
GC 0351	20.62722	92.32056
GC 0352	20.62722	92.32008
GC 0353	20.62722	92.3196
GC 0354	20.62722	92.31912
GC 0355	20.62722	92.31864
GC 0356	20.62721	92.31816
GC 0357	20.62721	92.31768
GC 0358	20.62721	92.3172
GC 0359	20.62721	92.31672
GC 0360	20.62721	92.31624
GC 0361	20.6272	92.31576
GC 0362	20.62679	92.32632
GC 0363	20.62679	92.32584
GC 0364	20.62679	92.32536
GC 0365	20.62679	92.32488
GC 0366	20.62679	92.3244
GC 0367	20.62678	92.32392
GC 0368	20.62678	92.32344

GRID ID	LAT	LONG
GC 0369	20.62678	92.32296
GC 0370	20.62678	92.32248
GC 0371	20.62678	92.322
GC 0372	20.62677	92.32152
GC 0373	20.62677	92.32104
GC 0374	20.62677	92.32056
GC 0375	20.62677	92.32008
GC 0376	20.62677	92.3196
GC 0377	20.62677	92.31912
GC 0378	20.62676	92.31864
GC 0379	20.62676	92.31816
GC 0380	20.62676	92.31768
GC 0381	20.62676	92.3172
GC 0382	20.62676	92.31672
GC 0383	20.62675	92.31624
GC 0384	20.62634	92.32632
GC 0385	20.62634	92.32584
GC 0386	20.62634	92.32536
GC 0387	20.62634	92.32488
GC 0388	20.62633	92.3244
GC 0389	20.62633	92.32392
GC 0390	20.62633	92.32344
GC 0391	20.62633	92.32296
GC 0392	20.62633	92.32248
GC 0393	20.62633	92.322
GC 0394	20.62632	92.32152
GC 0395	20.62632	92.32104
GC 0396	20.62632	92.32056
GC 0397	20.62632	92.32008
GC 0398	20.62632	92.3196
GC 0399	20.62631	92.31912
GC 0400	20.62631	92.318644
GC 0401	20.62631	92.31816
GC 0402	20.62631	92.31768
GC 0403	20.62631	92.3172
GC 0404	20.6263	92.31672
GC 0405	20.62589	92.32632
GC 0406	20.62589	92.32584
GC 0407	20.62589	92.32536
GC 0408	20.62588	92.32488
GC 0409	20.62588	92.3244
GC 0410	20.62588	92.32392
GC 0411	20.62588	92.32344
GC 0412	20.62588	92.32296
GC 0413	20.62588	92.32248
GC 0414	20.62587	92.322
GC 0415	20.62587	92.32152
GC 0416	20.62587	92.32104
GC 0417	20.62587	92.32056
GC 0418	20.62587	92.32008
GC 0419	20.62586	92.3196
GC 0420	20.62586	92.31912
GC 0421	20.62586	92.31864
GC 0422	20.62586	92.31816
GC 0423	20.62586	92.31768
GC 0424	20.62544	92.32632
GC 0425	20.62544	92.32584
GC 0426	20.62543	92.32536
GC 0427	20.62543	92.32488
GC 0428	20.62543	92.3244
GC 0429	20.62543	92.32392
GC 0430	20.62543	92.32344
GC 0431	20.62543	92.32296
GC 0432	20.62542	92.32248
GC 0433	20.62542	92.322
GC 0434	20.62542	92.32152
GC 0435	20.62542	92.32104
GC 0436	20.62542	92.32056
GC 0437	20.62541	92.32009
GC 0438	20.62541	92.31961
GC 0439	20.62541	92.31913
GC 0440	20.62541	92.31865
GC 0441	20.62499	92.32633
GC 0442	20.62498	92.32585
GC 0443	20.62498	92.32537
GC 0444	20.62498	92.32489
GC 0445	20.62498	92.32441
GC 0446	20.62498	92.32393
GC 0447	20.62498	92.32345
GC 0448	20.62497	92.32297
GC 0449	20.62497	92.32249
GC 0450	20.62497	92.32201
GC 0451	20.62497	92.32153
GC 0452	20.62497	92.32105
GC 0453	20.62496	92.32057
GC 0454	20.62496	92.32009
GC 0455	20.62496	92.31961
GC 0456	20.62496	92.31913
GC 0457	20.62453	92.32633
GC 0458	20.62453	92.32585
GC 0459	20.62453	92.32537
GC 0460	20.62453	92.32489

GRID ID	LAT	LONG
GC 0461	20.62453	92.32441
GC 0462	20.62453	92.32393
GC 0463	20.62452	92.32345
GC 0464	20.62452	92.32297
GC 0465	20.62452	92.32249
GC 0466	20.62452	92.32201
GC 0467	20.62452	92.32153
GC 0468	20.62451	92.32105
GC 0469	20.62451	92.32057
GC 0470	20.62451	92.32009
GC 0471	20.62451	92.31961
GC 0472	20.62408	92.32633
GC 0473	20.62408	92.32585
GC 0474	20.62408	92.32537
GC 0475	20.62408	92.32489
GC 0476	20.62408	92.32441
GC 0477	20.62407	92.32393
GC 0478	20.62407	92.32345
GC 0479	20.62407	92.32297
GC 0480	20.62407	92.32249
GC 0481	20.62407	92.32201
GC 0482	20.62406	92.32153
GC 0483	20.62406	92.32105
GC 0484	20.62406	92.32057
GC 0485	20.62406	92.32009
GC 0486	20.62363	92.32633
GC 0487	20.62363	92.32585
GC 0488	20.62363	92.32537
GC 0489	20.62363	92.32489
GC 0490	20.62362	92.32441
GC 0491	20.62362	92.32393
GC 0492	20.62362	92.32345
GC 0493	20.62362	92.32297
GC 0494	20.62362	92.32249
GC 0495	20.62361	92.32201
GC 0496	20.62361	92.32153
GC 0497	20.62361	92.32105
GC 0498	20.62361	92.32057
GC 0499	20.62318	92.32633
GC 0500	20.62318	92.32585
GC 0501	20.62318	92.32537
GC 0502	20.62317	92.32489
GC 0503	20.62317	92.32441
GC 0504	20.62317	92.32393
GC 0505	20.62317	92.32345
GC 0506	20.62317	92.32297
GC 0507	20.62316	92.32249
GC 0508	20.62316	92.32201
GC 0509	20.62316	92.32153
GC 0510	20.62316	92.32105
GC 0511	20.62273	92.32682
GC 0512	20.62273	92.32634
GC 0513	20.62273	92.32586
GC 0514	20.62272	92.32538
GC 0515	20.62272	92.3249
GC 0516	20.62272	92.32442
GC 0517	20.62272	92.32394
GC 0518	20.62272	92.32346
GC 0519	20.62271	92.32298
GC 0520	20.62271	92.3225
GC 0521	20.62271	92.32202
GC 0522	20.62271	92.32154
GC 0523	20.62228	92.32682
GC 0524	20.62228	92.32634
GC 0525	20.62227	92.32586
GC 0526	20.62227	92.32538
GC 0527	20.62227	92.3249
GC 0528	20.62227	92.32442
GC 0529	20.62227	92.32394
GC 0530	20.62226	92.32346
GC 0531	20.62226	92.32298
GC 0532	20.62226	92.3225
GC 0533	20.62226	92.32202
GC 0534	20.62183	92.32682
GC 0535	20.62182	92.32634
GC 0536	20.62182	92.32586
GC 0537	20.62182	92.32538
GC 0538	20.62182	92.3249
GC 0539	20.62182	92.32442
GC 0540	20.62181	92.32394
GC 0541	20.62181	92.32346
GC 0542	20.62181	92.32298
GC 0543	20.62181	92.3225
GC 0544	20.62137	92.32682
GC 0545	20.62137	92.32634
GC 0546	20.62137	92.32586
GC 0547	20.62137	92.32538
GC 0548	20.62137	92.3249
GC 0549	20.62136	92.32442
GC 0550	20.62136	92.32394
GC 0551	20.62136	92.32346
GC 0552	20.62136	92.32298

GRID ID	LAT	LONG
GC 0553	20.62092	92.32634
GC 0554	20.62092	92.32586
GC 0555	20.62092	92.32538
GC 0556	20.62092	92.3249
GC 0557	20.62091	92.32442
GC 0558	20.62091	92.32394
GC 0559	20.62091	92.32346
GC 0560	20.62047	92.32635
GC 0561	20.62047	92.32587
GC 0562	20.62047	92.32539
GC 0563	20.62046	92.32491
GC 0564	20.62046	92.32443
GC 0565	20.62046	92.32395
GC 0566	20.62002	92.32587
GC 0567	20.62001	92.32539
GC 0568	20.62001	92.32491
GC 0569	20.62001	92.32443
GC 0570	20.62001	92.32395
GC 0571	20.61956	92.32587
GC 0572	20.61956	92.32539
GC 0573	20.61956	92.32491
GC 0574	20.61956	92.32443
GC 0575	20.61956	92.32395
GC 0576	20.61911	92.32587
GC 0577	20.61911	92.32539
GC 0578	20.61911	92.32491
GC 0579	20.61911	92.32443
GC 0580	20.61866	92.32587
GC 0581	20.61866	92.32539
GC 0582	20.61866	92.32491
GC 0583	20.61821	92.32588
GC 0584	20.61821	92.3254
GC 0585	20.61776	92.32588
GC 0586	20.61775	92.3254
GC 0587	20.6173	92.32588
GC 0588	20.61685	92.32588
GC 0589	20.6164	92.32636
GC 0590	20.6164	92.32588
GC 0591	20.61595	92.32685
GC 0592	20.61595	92.32637
GC 0593	20.61595	92.32589
GC 0594	20.6155	92.32685
GC 0595	20.6155	92.32637
GC 0596	20.6155	92.32589
GC 0597	20.61505	92.32733
GC 0598	20.61505	92.32685
GC 0599	20.61505	92.32637
GC 0600	20.61505	92.32589
GC 0601	20.6146	92.32733
GC 0602	20.6146	92.32685
GC 0603	20.6146	92.32637
GC 0604	20.61459	92.32589
GC 0605	20.61459	92.32541
GC 0606	20.61415	92.32781
GC 0607	20.61415	92.32733
GC 0608	20.61415	92.32685
GC 0609	20.61414	92.32637
GC 0610	20.61414	92.32589
GC 0611	20.61414	92.32541
GC 0612	20.61414	92.32493
GC 0613	20.6137	92.32781
GC 0614	20.6137	92.32733
GC 0615	20.61369	92.32686
GC 0616	20.61369	92.32638
GC 0617	20.61369	92.3259
GC 0618	20.61369	92.32542
GC 0619	20.61325	92.3283
GC 0620	20.61325	92.32782
GC 0621	20.61324	92.32734
GC 0622	20.61324	92.32686
GC 0623	20.61324	92.32638
GC 0624	20.61324	92.3259
GC 0625	20.6128	92.3283
GC 0626	20.61279	92.32782
GC 0627	20.61279	92.32734
GC 0628	20.61279	92.32686
GC 0629	20.61279	92.32638
GC 0630	20.61279	92.3259
GC 0631	20.61234	92.3283
GC 0632	20.61234	92.32782
GC 0633	20.61234	92.32734
GC 0634	20.61234	92.32686
GC 0635	20.61234	92.32638
GC 0636	20.61234	92.3259
GC 0637	20.61189	92.3283
GC 0638	20.61189	92.32782
GC 0639	20.61189	92.32734
GC 0640	20.61189	92.32686
GC 0641	20.61189	92.32638
GC 0642	20.61188	92.3259
GC 0643	20.61144	92.3283
GC 0644	20.61144	92.32782

GRID ID	LAT	LONG
GC 0645	20.61144	92.32734
GC 0646	20.61144	92.32686
GC 0647	20.61143	92.32639
GC 0648	20.61143	92.32591
GC 0649	20.61099	92.32831
GC 0650	20.61099	92.32783
GC 0651	20.61099	92.32735
GC 0652	20.61098	92.32687
GC 0653	20.61098	92.32639
GC 0654	20.61098	92.32591
GC 0655	20.61054	92.32831
GC 0656	20.61054	92.32783
GC 0657	20.61053	92.32735
GC 0658	20.61053	92.32687
GC 0659	20.61053	92.32639
GC 0660	20.61053	92.32591
GC 0661	20.61009	92.32831
GC 0662	20.61008	92.32783
GC 0663	20.61008	92.32735
GC 0664	20.61008	92.32687
GC 0665	20.61008	92.32639
GC 0666	20.61008	92.32591
GC 0667	20.60964	92.32879
GC 0668	20.60963	92.32831
GC 0669	20.60963	92.32783
GC 0670	20.60963	92.32735
GC 0671	20.60963	92.32687
GC 0672	20.60963	92.32639
GC 0673	20.60962	92.32591
GC 0674	20.60918	92.32879
GC 0675	20.60918	92.32831
GC 0676	20.60918	92.32783
GC 0677	20.60918	92.32735
GC 0678	20.60918	92.32687
GC 0679	20.60917	92.3264
GC 0680	20.60917	92.32592
GC 0681	20.60873	92.3288
GC 0682	20.60873	92.32832
GC 0683	20.60873	92.32784
GC 0684	20.60873	92.32736
GC 0685	20.60872	92.32688
GC 0686	20.60872	92.3264
GC 0687	20.60872	92.32592
GC 0688	20.60828	92.3288
GC 0689	20.60828	92.32832
GC 0690	20.60828	92.32784
GC 0691	20.60827	92.32736
GC 0692	20.60827	92.32688
GC 0693	20.60827	92.3264
GC 0694	20.60783	92.3288
GC 0695	20.60783	92.32832
GC 0696	20.60782	92.32784
GC 0697	20.60782	92.32736
GC 0698	20.60782	92.32688
GC 0699	20.60782	92.3264
GC 0700	20.60738	92.3288
GC 0701	20.60738	92.32832
GC 0702	20.60737	92.32784
GC 0703	20.60737	92.32736
GC 0704	20.60737	92.32688
GC 0705	20.60693	92.3288
GC 0706	20.60692	92.32832
GC 0707	20.60692	92.32784
GC 0708	20.60692	92.32736
GC 0709	20.60692	92.32688
GC 0710	20.60647	92.32881
GC 0711	20.60647	92.32833
GC 0712	20.60647	92.32785
GC 0713	20.60647	92.32737
GC 0714	20.60647	92.32689
GC 0715	20.60602	92.32929
GC 0716	20.60602	92.32881
GC 0717	20.60602	92.32833
GC 0718	20.60602	92.32785
GC 0719	20.60602	92.32737
GC 0720	20.60557	92.32977
GC 0721	20.60557	92.32929
GC 0722	20.60557	92.32881
GC 0723	20.60557	92.32833
GC 0724	20.60557	92.32785
GC 0725	20.60556	92.32737
GC 0726	20.60512	92.33025
GC 0727	20.60512	92.32977
GC 0728	20.60512	92.32929
GC 0729	20.60512	92.32881
GC 0730	20.60512	92.32833
GC 0731	20.60511	92.32785
GC 0732	20.60511	92.32737
GC 0733	20.60467	92.33025
GC 0734	20.60467	92.32977
GC 0735	20.60467	92.32929
GC 0736	20.60467	92.32881

GRID ID	LAT	LONG
GC 0737	20.60466	92.32833
GC 0738	20.60466	92.32785
GC 0739	20.60466	92.32737
GC 0740	20.60422	92.33074
GC 0741	20.60422	92.33026
GC 0742	20.60422	92.32978
GC 0743	20.60422	92.3293
GC 0744	20.60421	92.32882
GC 0745	20.60421	92.32834
GC 0746	20.60421	92.32786
GC 0747	20.60421	92.32738
GC 0748	20.60377	92.33122
GC 0749	20.60377	92.33074
GC 0750	20.60377	92.33026
GC 0751	20.60377	92.32978
GC 0752	20.60376	92.3293
GC 0753	20.60376	92.32882
GC 0754	20.60376	92.32834
GC 0755	20.60376	92.32786
GC 0756	20.60376	92.32738
GC 0757	20.60332	92.33122
GC 0758	20.60332	92.33074
GC 0759	20.60332	92.33026
GC 0760	20.60331	92.32978
GC 0761	20.60331	92.3293
GC 0762	20.60331	92.32882
GC 0763	20.60331	92.32834
GC 0764	20.60331	92.32786
GC 0765	20.60331	92.32738
GC 0766	20.60287	92.33122
GC 0767	20.60287	92.33074
GC 0768	20.60286	92.33026
GC 0769	20.60286	92.32978
GC 0770	20.60286	92.3293
GC 0771	20.60286	92.32882
GC 0772	20.60286	92.32834
GC 0773	20.60286	92.32786
GC 0774	20.60285	92.32738
GC 0775	20.60285	92.3269
GC 0776	20.60242	92.3317
GC 0777	20.60242	92.33122
GC 0778	20.60241	92.33074
GC 0779	20.60241	92.33026
GC 0780	20.60241	92.32978
GC 0781	20.60241	92.3293
GC 0782	20.60241	92.32882
GC 0783	20.60241	92.32834
GC 0784	20.6024	92.32786
GC 0785	20.6024	92.32738
GC 0786	20.6024	92.3269
GC 0787	20.60197	92.3317
GC 0788	20.60196	92.33122
GC 0789	20.60196	92.33075
GC 0790	20.60196	92.33027
GC 0791	20.60196	92.32979
GC 0792	20.60196	92.32931
GC 0793	20.60196	92.32883
GC 0794	20.60195	92.32835
GC 0795	20.60195	92.32787
GC 0796	20.60195	92.32739
GC 0797	20.60195	92.32691
GC 0798	20.60195	92.32643
GC 0799	20.60152	92.33171
GC 0800	20.60151	92.33123
GC 0801	20.60151	92.33075
GC 0802	20.60151	92.33027
GC 0803	20.60151	92.32979
GC 0804	20.60151	92.32931
GC 0805	20.6015	92.32883
GC 0806	20.6015	92.32835
GC 0807	20.6015	92.32787
GC 0808	20.6015	92.32739
GC 0809	20.6015	92.32691
GC 0810	20.60149	92.32643
GC 0811	20.60149	92.32595
GC 0812	20.60106	92.33171
GC 0813	20.60106	92.33123
GC 0814	20.60106	92.33075
GC 0815	20.60106	92.33027
GC 0816	20.60106	92.32979
GC 0817	20.60105	92.32931
GC 0818	20.60105	92.32883
GC 0819	20.60105	92.32835
GC 0820	20.60105	92.32787
GC 0821	20.60105	92.32739
GC 0822	20.60104	92.32691
GC 0823	20.60104	92.32643
GC 0824	20.60104	92.32595
GC 0825	20.60104	92.32547
GC 0826	20.60104	92.32499
GC 0827	20.60104	92.32451
GC 0828	20.60061	92.33171

GRID ID	LAT	LONG
GC 0829	20.60061	92.33123
GC 0830	20.60061	92.33075
GC 0831	20.60061	92.33027
GC 0832	20.6006	92.32979
GC 0833	20.6006	92.32931
GC 0834	20.6006	92.32883
GC 0835	20.6006	92.32835
GC 0836	20.6006	92.32787
GC 0837	20.60059	92.32739
GC 0838	20.60059	92.32691
GC 0839	20.60059	92.32643
GC 0840	20.60059	92.32595
GC 0841	20.60059	92.32547
GC 0842	20.60059	92.32499
GC 0843	20.60058	92.32451
GC 0844	20.60016	92.33171
GC 0845	20.60016	92.33123
GC 0846	20.60016	92.33075
GC 0847	20.60015	92.33027
GC 0848	20.60015	92.32979
GC 0849	20.60015	92.32931
GC 0850	20.60015	92.32883
GC 0851	20.60015	92.32835
GC 0852	20.60014	92.32787
GC 0853	20.60014	92.32739
GC 0854	20.60014	92.32691
GC 0855	20.60014	92.32643
GC 0856	20.60014	92.32595
GC 0857	20.60014	92.32548
GC 0858	20.60013	92.325
GC 0859	20.60013	92.32452
GC 0860	20.59971	92.33171
GC 0861	20.59971	92.33123
GC 0862	20.5997	92.33075
GC 0863	20.5997	92.33028
GC 0864	20.5997	92.3298
GC 0865	20.5997	92.32932
GC 0866	20.5997	92.32884
GC 0867	20.59969	92.32836
GC 0868	20.59969	92.32788
GC 0869	20.59969	92.3274
GC 0870	20.59969	92.32692
GC 0871	20.59969	92.32644
GC 0872	20.59969	92.32596
GC 0873	20.59968	92.32548
GC 0874	20.59968	92.325
GC 0875	20.59968	92.32452
GC 0876	20.59926	92.33172
GC 0877	20.59925	92.33124
GC 0878	20.59925	92.33076
GC 0879	20.59925	92.33028
GC 0880	20.59925	92.3298
GC 0881	20.59925	92.32932
GC 0882	20.59925	92.32884
GC 0883	20.59924	92.32836
GC 0884	20.59924	92.32788
GC 0885	20.59924	92.3274
GC 0886	20.59924	92.32692
GC 0887	20.59924	92.32644
GC 0888	20.59923	92.32596
GC 0889	20.59923	92.32548
GC 0890	20.59923	92.325
GC 0891	20.59923	92.32452
GC 0892	20.5988	92.33172
GC 0893	20.5988	92.33124
GC 0894	20.5988	92.33076
GC 0895	20.5988	92.33028
GC 0896	20.5988	92.3298
GC 0897	20.5988	92.32932
GC 0898	20.59879	92.32884
GC 0899	20.59879	92.32836
GC 0900	20.59879	92.32788
GC 0901	20.59879	92.3274
GC 0902	20.59879	92.32692
GC 0903	20.59878	92.32644
GC 0904	20.59878	92.32596
GC 0905	20.59878	92.32548
GC 0906	20.59878	92.325
GC 0907	20.59878	92.32452
GC 0908	20.59835	92.33124
GC 0909	20.59835	92.33076
GC 0910	20.59835	92.33028
GC 0911	20.59835	92.3298
GC 0912	20.59834	92.32932
GC 0913	20.59834	92.32884
GC 0914	20.59834	92.32836
GC 0915	20.59834	92.32788
GC 0916	20.59834	92.3274
GC 0917	20.59833	92.32692
GC 0918	20.59833	92.32644
GC 0919	20.59833	92.32596
GC 0920	20.59833	92.32548

GRID ID	LAT	LONG
GC 0921	20.59833	92.325
GC 0922	20.5979	92.33124
GC 0923	20.5979	92.33076
GC 0924	20.5979	92.33028
GC 0925	20.59789	92.3298
GC 0926	20.59789	92.32932
GC 0927	20.59789	92.32884
GC 0928	20.59789	92.32836
GC 0929	20.59789	92.32788
GC 0930	20.59788	92.3274
GC 0931	20.59788	92.32692
GC 0932	20.59788	92.32644
GC 0933	20.59788	92.32596
GC 0934	20.59788	92.32549
GC 0935	20.59787	92.32501
GC 0936	20.59745	92.33124
GC 0937	20.59745	92.33076
GC 0938	20.59744	92.33028
GC 0939	20.59744	92.32981
GC 0940	20.59744	92.32933
GC 0941	20.59744	92.32885
GC 0942	20.59744	92.32837
GC 0943	20.59743	92.32789
GC 0944	20.59743	92.32741
GC 0945	20.59743	92.32693
GC 0946	20.59743	92.32645
GC 0947	20.59743	92.32597
GC 0948	20.59742	92.32549
GC 0949	20.597	92.33125
GC 0950	20.59699	92.33077
GC 0951	20.59699	92.33029
GC 0952	20.59699	92.32981
GC 0953	20.59699	92.32933
GC 0954	20.59699	92.32885
GC 0955	20.59698	92.32837
GC 0956	20.59698	92.32789
GC 0957	20.59698	92.32741
GC 0958	20.59698	92.32693
GC 0959	20.59698	92.32645
GC 0960	20.59697	92.32597
GC 0961	20.59697	92.32549
GC 0962	20.59654	92.33125
GC 0963	20.59654	92.33077
GC 0964	20.59654	92.33029
GC 0965	20.59654	92.32981
GC 0966	20.59654	92.32933
GC 0967	20.59653	92.32885
GC 0968	20.59653	92.32837
GC 0969	20.59653	92.32789
GC 0970	20.59653	92.32741
GC 0971	20.59653	92.32693
GC 0972	20.59653	92.32645
GC 0973	20.59652	92.32597
GC 0974	20.59652	92.32549
GC 0975	20.59609	92.33125
GC 0976	20.59609	92.33077
GC 0977	20.59609	92.33029
GC 0978	20.59609	92.32981
GC 0979	20.59608	92.32933
GC 0980	20.59608	92.32885
GC 0981	20.59608	92.32837
GC 0982	20.59608	92.32789
GC 0983	20.59608	92.32741
GC 0984	20.59608	92.32693
GC 0985	20.59607	92.32645
GC 0986	20.59607	92.32597
GC 0987	20.59607	92.32549
GC 0988	20.59564	92.33125
GC 0989	20.59564	92.33077
GC 0990	20.59564	92.33029
GC 0991	20.59563	92.32981
GC 0992	20.59563	92.32933
GC 0993	20.59563	92.32885
GC 0994	20.59563	92.32837
GC 0995	20.59563	92.32789
GC 0996	20.59563	92.32741
GC 0997	20.59562	92.32693
GC 0998	20.59562	92.32645
GC 0999	20.59562	92.32597
GC 1000	20.59562	92.3255
GC 1001	20.59562	92.32502
GC 1002	20.59561	92.32454
GC 1003	20.59519	92.33125
GC 1004	20.59519	92.33077
GC 1005	20.59518	92.33029
GC 1006	20.59518	92.32982
GC 1007	20.59518	92.32934
GC 1008	20.59518	92.32886
GC 1009	20.59518	92.32838
GC 1010	20.59518	92.3279
GC 1011	20.59517	92.32742
GC 1012	20.59517	92.32694

GRID ID	LAT	LONG
GC 1013	20.59517	92.32646
GC 1014	20.59517	92.32598
GC 1015	20.59517	92.3255
GC 1016	20.59516	92.32502
GC 1017	20.59516	92.32454
GC 1018	20.59474	92.33126
GC 1019	20.59473	92.33078
GC 1020	20.59473	92.3303
GC 1021	20.59473	92.32982
GC 1022	20.59473	92.32934
GC 1023	20.59473	92.32886
GC 1024	20.59473	92.32838
GC 1025	20.59472	92.3279
GC 1026	20.59472	92.32742
GC 1027	20.59472	92.32694
GC 1028	20.59472	92.32646
GC 1029	20.59472	92.32598
GC 1030	20.59471	92.3255
GC 1031	20.59471	92.32502
GC 1032	20.59471	92.32454
GC 1033	20.59428	92.33126
GC 1034	20.59428	92.33078
GC 1035	20.59428	92.3303
GC 1036	20.59428	92.32982
GC 1037	20.59428	92.32934
GC 1038	20.59428	92.32886
GC 1039	20.59427	92.32838
GC 1040	20.59427	92.3279
GC 1041	20.59427	92.32742
GC 1042	20.59427	92.32694
GC 1043	20.59427	92.32646
GC 1044	20.59426	92.32598
GC 1045	20.59426	92.3255
GC 1046	20.59426	92.32502
GC 1047	20.59426	92.32454
GC 1048	20.59383	92.33126
GC 1049	20.59383	92.33078
GC 1050	20.59383	92.3303
GC 1051	20.59383	92.32982
GC 1052	20.59383	92.32934
GC 1053	20.59382	92.32886
GC 1054	20.59382	92.32838
GC 1055	20.59382	92.3279
GC 1056	20.59382	92.32742
GC 1057	20.59382	92.32694
GC 1058	20.59381	92.32646

GRID ID	LAT	LONG
GC 1059	20.59381	92.32598
GC 1060	20.59381	92.3255
GC 1061	20.59381	92.32502
GC 1062	20.59338	92.33126
GC 1063	20.59338	92.33078
GC 1064	20.59338	92.3303
GC 1065	20.59338	92.32982
GC 1066	20.59337	92.32934
GC 1067	20.59337	92.32886
GC 1068	20.59337	92.32838
GC 1069	20.59337	92.3279
GC 1070	20.59337	92.32742
GC 1071	20.59336	92.32694
GC 1072	20.59336	92.32646
GC 1073	20.59336	92.32598
GC 1074	20.59336	92.3255
GC 1075	20.59293	92.33126
GC 1076	20.59293	92.33078
GC 1077	20.59293	92.3303
GC 1078	20.59292	92.32982
GC 1079	20.59292	92.32935
GC 1080	20.59292	92.32887
GC 1081	20.59292	92.32839
GC 1082	20.59292	92.32791
GC 1083	20.59291	92.32743
GC 1084	20.59291	92.32695
GC 1085	20.59291	92.32647
GC 1086	20.59291	92.32599
GC 1087	20.59291	92.32551
GC 1088	20.59248	92.33127
GC 1089	20.59248	92.33079
GC 1090	20.59247	92.33031
GC 1091	20.59247	92.32983
GC 1092	20.59247	92.32935
GC 1093	20.59247	92.32887
GC 1094	20.59247	92.32839
GC 1095	20.59246	92.32791
GC 1096	20.59246	92.32743
GC 1097	20.59246	92.32695
GC 1098	20.59246	92.32647
GC 1099	20.59246	92.32599
GC 1100	20.59203	92.33127
GC 1101	20.59202	92.33079
GC 1102	20.59202	92.33031
GC 1103	20.59202	92.32983
GC 1104	20.59202	92.32935

GRID ID	LAT	LONG
GC 1105	20.59202	92.32887
GC 1106	20.59201	92.32839
GC 1107	20.59201	92.32791
GC 1108	20.59201	92.32743
GC 1109	20.59201	92.32695
GC 1110	20.59201	92.32647
GC 1111	20.59201	92.32599
GC 1112	20.59157	92.33127
GC 1113	20.59157	92.33079
GC 1114	20.59157	92.33031
GC 1115	20.59157	92.32983
GC 1116	20.59157	92.32935
GC 1117	20.59156	92.32887
GC 1118	20.59156	92.32839
GC 1119	20.59156	92.32791
GC 1120	20.59156	92.32743
GC 1121	20.59156	92.32695
GC 1122	20.59156	92.32647
GC 1123	20.59112	92.33079
GC 1124	20.59112	92.33031
GC 1125	20.59112	92.32983
GC 1126	20.59111	92.32935
GC 1127	20.59111	92.32887
GC 1128	20.59111	92.32839
GC 1129	20.59111	92.32791
GC 1130	20.59111	92.32743
GC 1131	20.59111	92.32695
GC 1132	20.59066	92.32792
GC 1133	20.59066	92.32744
GC 1134	20.58872	92.33469
GC 1135	20.58175	92.33785
GC 1136	20.58174	92.33737
GC 1137	20.58129	92.33785
GC 1138	20.58129	92.33737
GC 1139	20.58084	92.33785
GC 1140	20.58084	92.33737
GC 1141	20.58039	92.33786
GC 1142	20.58039	92.33738
GC 1143	20.63537	92.32436
GC 1144	20.63537	92.32388
GC 1145	20.63537	92.3234