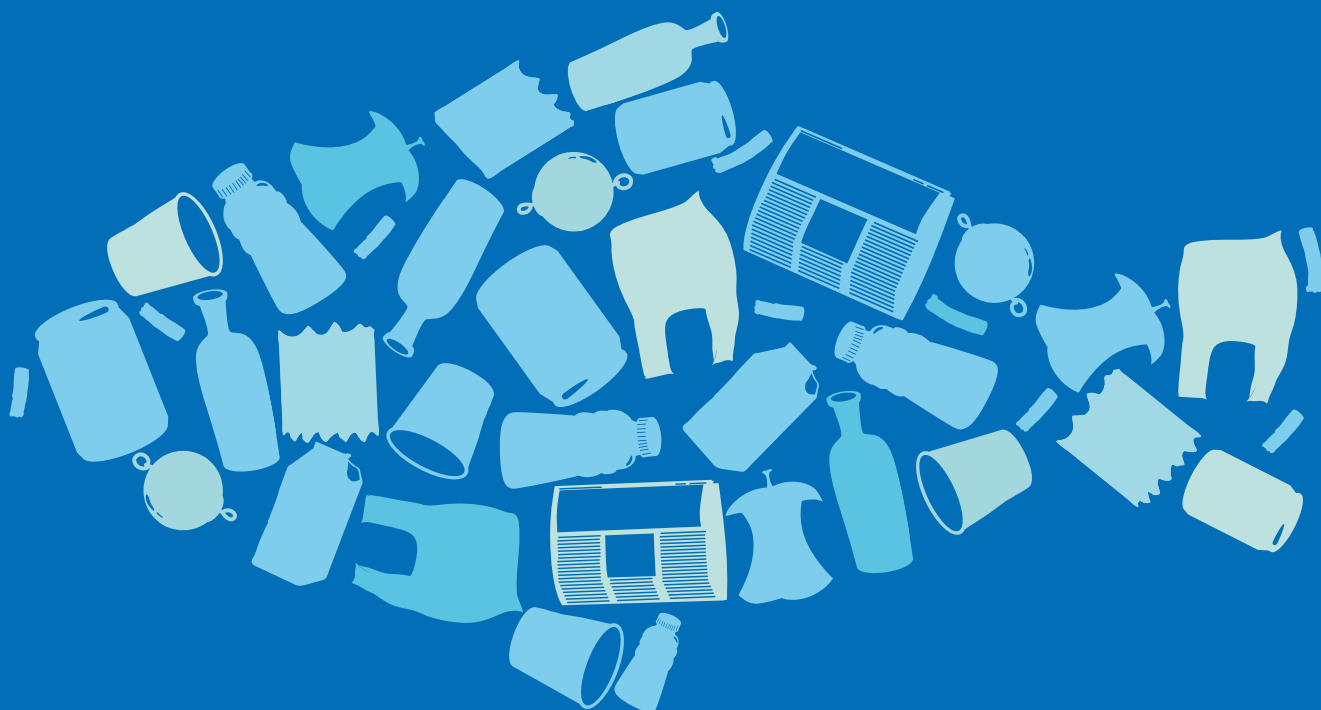




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MARINE LITTER

COASTAL WATCH

Teaching Manual

(For Secondary School teachers)

PARTNERS



海岸清潔跨部門工作小組
Inter-departmental Working Group on Clean Shorelines



SUPPORTED BY

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Recommended Sources

Publisher: WWF-Hong Kong
 Authors: Maggie Kwok, Patrick Yeung
 Editors: Michael Quinn (English version), Lam Yan Yan (Chinese version)
 Design: Sea Leung

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Booklet objectives and related secondary school curriculum modules

The Coastal Watch project conceived as a response to the plastic pellet spill disaster of August 2012, Coastal Watch was a collaborative coastal clean-up and survey project which aimed not only to remove marine litter from Hong Kong's coastlines, but **to survey, organize and classify the litter in order to provide useful data** which will assist those who are developing solutions to Hong Kong's marine litter problem.

To sustain the spirit of the Coastal Watch Project, WWF-Hong Kong has developed this education booklet. Our hope is that the booklet will help **educate future generations about the problem of marine litter and, more importantly, present solutions**. This booklet provides important information about marine litter, scientifically sound data, interactive teaching plans, case studies, diagrams, anecdotes from teachers and useful resources which will equip you with everything you need to know about marine litter in Hong Kong, its impacts and effects.

The ultimate goal of this booklet is to integrate the marine litter issue into the secondary school curriculum, thus **raising awareness about the problem among students and motivating them to reduce waste in their daily lives**.

Target subjects:

| Form | Subjects | Modules | Teaching Plan |
|--------|-----------------------------|--|---------------|
| F. 1-3 | Geography | - Elective modules: Oceans in trouble | 1 and 2 |
| | Science | - Environmental problems associated with the disposal of plastics | 1 |
| | Integrated humanities | - Place and Environment | 1 |
| F. 4-6 | Biology | - Compulsory section: Ecosystems – Conservation of ecosystems - Elective section: Applied Ecology c. Conservation d. Global issues (recognizing the causes and problems of global issues) - Scientific Investigation | 1 |
| | OLE | _____ | 1 |
| | CAS (IB) | Service learning | 1 |
| | Geography | - Compulsory section: Building a Sustainable City – Are environmental conservation and urban development mutually exclusive? | 2 |
| | Integrated Science | - Modules C6: Balance in Nature (C6.5 The hunt for balance) - focusing on waste management and pollution control | 2 |
| F. 1-6 | Liberal Studies | - Module 2: Hong Kong Today (Theme 1: Quality of life) - Module 6: Energy Technology and the Environment (Theme 2: The environment and sustainable development) | 2 |
| | Service learning programmes | _____ | 1 |
| F. 1-6 | Life-wide learning | _____ | 1 |

Chapter 1 Introduction

“With every drop of water you drink, every breath you take, you are connected to the sea.”

*- Sylvia Earle,
Marine Biologist*



What is Marine Litter?

Marine litter can be broadly defined as “all objects that do not naturally occur in the marine and coastal environment but are nevertheless found there”. Marine litter may be deposited on beaches or coastlines, float on the surface of the sea, float within the ocean itself or sink to the seabed.

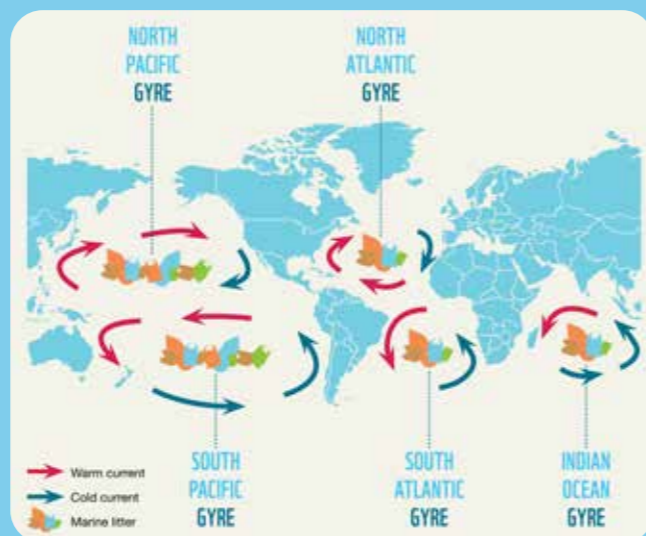
Affected Areas

Since marine litter travels, it affects all the oceans of the world. Marine litter is without question a global problem.

So how does marine litter travel?

Our oceans have systems of currents which circulate water around the planet. These are called gyres. These gyres are formed by global wind patterns and the forces created by the rotation of the Earth. The movement of these ocean gyres helps drive the “ocean conveyor belt”, a process which is essential for regulating nutrient flows throughout the world’s oceans as well as their temperature and salinity.

Sadly, every year, millions and millions of tonnes of litter end up in the ocean from sources all over the planet. Individual pieces of litter are transported by currents and atmospheric winds, transporting marine litter thousands of miles from its original entry point into the ocean. Seasonal weather and large storms can also affect the movement of litter.



The Sources of Marine Litter

There are many forms of marine litter. These are produced by both land-based and sea-based activities. Data from Ocean Conservancy’s International Coastal Cleanup¹ indicates that 60 to 80 per cent of marine debris is generated from land-based sources, with the primary sources being littering, dumping in rivers and streams which lead to the sea and industrial mishaps or losses – for example the spillage of plastic resin pellets during production, processing or transportation – something which occurred on a major scale in Hong Kong in 2012. This debris can be blown, swept or washed out to sea. At the same time, 20 to 40 per cent of marine litter originates from sources at sea.

The sources of debris include offshore oil and gas rigs or platforms, fishing boats, merchant ships, container ships, ferries and cruise liners. This debris is often dumped overboard or swept or blown off vessels and stationary platforms.



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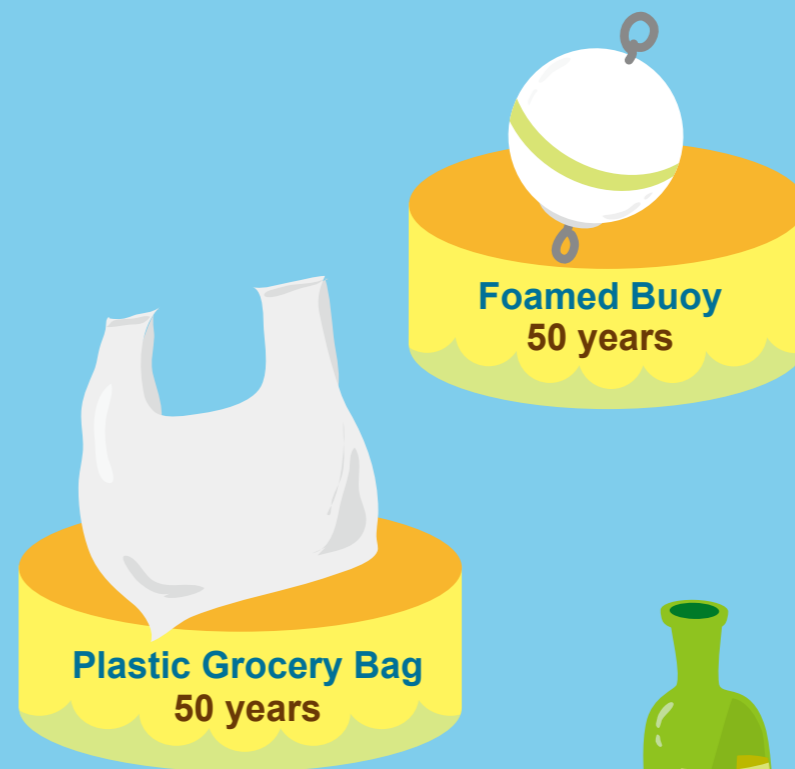
Reference

1: http://act.oceanconservancy.org/images/2010ICCRReportRelease_pressPhotos/2010_ICC_Report.pdf

Decomposition Rates of Marine Litter

Now that we know roughly what marine litter is, where it comes from and how it moves around, let us take a look at the decomposition of marine litter. By looking at the **decomposition*** rates of different types of litter, we are able to examine how marine litter accumulates and its long-term impacts. The illustration below gives a general estimate of how long it takes common marine litter items to decompose².

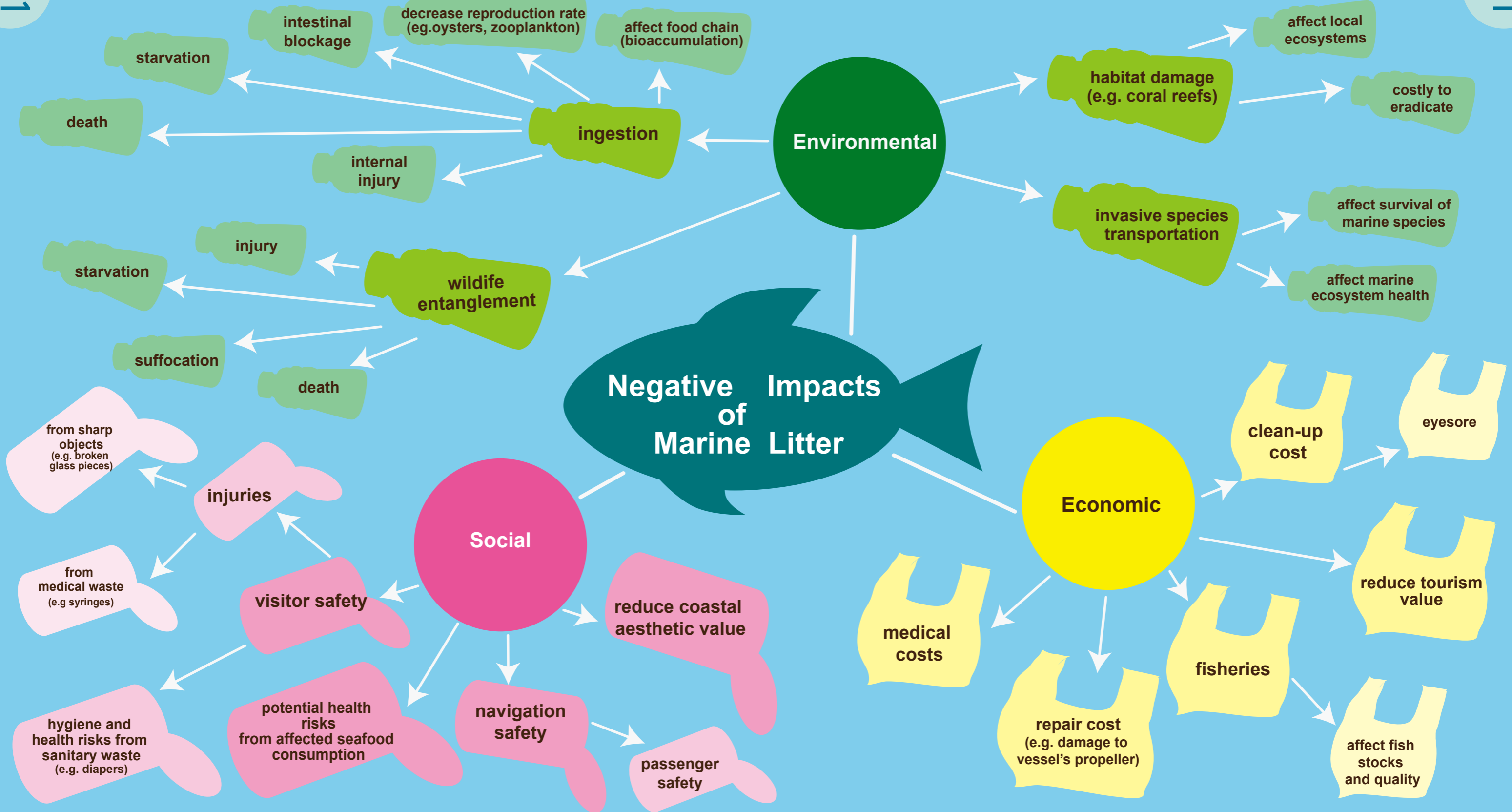
* **Decomposition** is the process of breaking down into pieces or simpler elements by natural processes, chemicals, or some other force³.



Reference
2: NOAA (National Oceanic and atmospheric Association)
3: Oxford & Merriam-Webster.

The Negative Impacts of Marine Litter

- Marine litter creates both direct and indirect impacts.
- The mind map below explores the three ways in which marine litter has a negative impact on sustainable development.



Chapter 2

Marine Litter in Hong Kong

Hong Kong marine environment profile

A recent survey recorded 5,684 marine species living in Hong Kong waters. Although Hong Kong occupies only 0.03 per cent of China's total marine area, the number of marine species recorded in our waters is approximately 25 per cent of the country's total marine species. The number of marine species per unit area in Hong Kong is a few hundred times higher than many other regions of the world, underlining the exceptional marine biodiversity of our waters⁴. Regrettably, our highly diverse and precious marine ecosystem faces a barrage of threats, and our rich biodiversity is deteriorating drastically and rapidly. Scientists have observed that local waters are actually close to ecosystem collapse; it goes without saying that this would have disastrous effects on our marine biodiversity.



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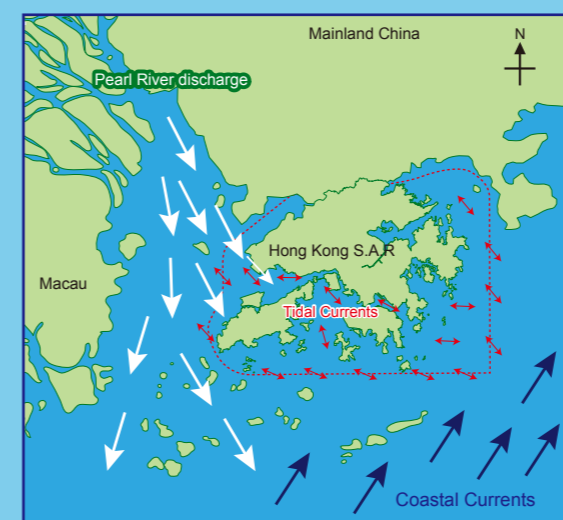
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Factors influencing Hong Kong's hydrography during the wet and dry seasons

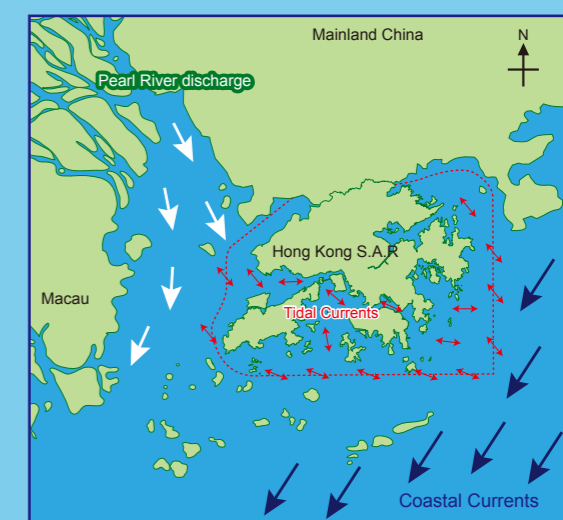
Marine litter may be deposited on beaches or coastlines, float on the surface of the sea, float within the sea or sink to the seabed. It is a persistent problem in Hong Kong, largely because our 263 islands and 733 km of coastline are situated in one of the world's most densely populated areas.

As mentioned previously, marine litter is transported by wind and the ocean currents. Thus, in order to determine where marine litter might accumulate, we need to understand the different factors which influence Hong Kong's hydrography during the wet and dry seasons

A report released by the Environmental Protection Department in 2015 explains the broader picture. During the wet season, Hong Kong is influenced by the waters of southeast China, where the south-westerly oceanic flow prevails during the summertime. The influence of the outflow of the Pearl River and the oceanic flow progressively diminishes towards the east of the territory, and as a result the eastern and north-eastern coastlines of Hong Kong are less affected by marine litter during the wet season. However during the dry season, Hong Kong is primarily influenced by a north-easterly oceanic flow, meaning that more marine litter accumulates along the eastern and north-eastern coasts of Hong Kong in the winter months⁵.



Wet Season



Dry Season

Reference

4: Environmental Conservation Fund <http://www.ecf.gov.hk/en/approved/201127.html>

Reference

5: Project WATERMAN, University of HONG KONG, 2010.

Coastal Watch: a collaborative coastal survey project

Coastal Watch is the only collaborative conservation project in Hong Kong to concurrently conduct marine litter and ecological surveys on seashores, in coastal waters and underwater. Survey data was collected between July 2014 and July 2016, and classified into five main types: ecological, land-based macro-litter, land-based micro-litter, coastal floating litter and underwater litter.

I. Ecological Survey

- Average number of species recorded in land-based habitats:
Mangroves : 29 Mudflats : 36 Rocky shores : 26 Sandy beaches : 12
- Coral coverage at the underwater sites: 6%



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Mangrove trees provide shelter and nutrient to other marine organisms in the intertidal habitats.



©Patrick Yeung / WWF-Hong Kong

Colorful snails found at intertidal area during the low tide.



©Patrick Yeung / WWF-Hong Kong

Horseshoe crabs spend their early age on sandy beach and mudflat.



©Patrick Yeung / WWF-Hong Kong

High diversity of coral is recorded in Hong Kong, supporting large variety of marine life.

II. Marine Litter Survey

Average number of pieces of litter

| | Land-based macro-debris (in each five-metre belt transect) | Land-based micro-debris (in every one sq. metre quadrat) | Coastal floating litter (collected every two hours) | Underwater litter (along each 100 metre transect) |
|--------------------------|---|---|--|--|
| Average number of pieces | 391.4 | 89.3 | 517.6 | 30.0 |

1. Composition of Marine Litter

| | Land-based macro-debris | Land-based micro-debris | Coastal floating litter | Underwater litter |
|---------|-------------------------|-------------------------|-------------------------|-------------------|
| Plastic | 64.6% | 75.6% | 83.7% | 65.5% |
| Glass | 23.2% | 18.0% | 0.5% | 6.7% |
| Metal | 3.1% | 0.3% | 4.1% | 17.2% |
| Wood | 2.3% | - | 3.3% | 1.0% |
| Rubber | 0.6% | - | 0.5% | 0.2% |
| Paper | 0.3% | 0.7% | 4.3% | 0.4% |
| Cloth | 0.7% | - | 0.2% | 1.3% |
| Others | 5.2% | 5.4% | 3.3% | 7.7% |

2. Top Ten Categories of Litter

Key: Plastic item

| Land-based macro-debris | |
|-------------------------|---|
| Rank | Categories |
| 1 | Glass fragments |
| 2 | Polystyrene - fragments |
| 3 | Plastic packaging (wrappers) and film - fragments |
| 4 | Polystyrene - food boxes & cups |
| 5 | Plastic fragments - hard |
| 6 | Drink bottle caps |
| 7 | Thin rope, string, ribbon pieces |
| 8 | Straws & stirrers |
| 9 | Plastic packaging (wrappers) and film |
| 10 | Miscellaneous plastic items |



©Tiffany Zau / WWF-Hong Kong

Disposable plastic litter, e.g. food boxes, bottles, are commonly accumulated in coastal areas.



©Tiffany Zau / WWF-Hong Kong

Broken glass fragments spread on beaches cause potential harm to visitors

| Coastal floating litter | |
|-------------------------|---|
| Rank | Categories |
| 1 | Polystyrene - fragments |
| 2 | Plastic packaging (wrappers) and film - fragments |
| 3 | Plastic packaging (wrappers) and film |
| 4 | Drink bottles 1L and less |
| 5 | Polystyrene - food boxes & cups |
| 6 | Polystyrene boxes |
| 7 | Fast food containers, lids & cups |
| 8 | Plastic shopping bags |
| 9 | Thin rope, string, ribbon pieces |
| 10 | Straws & stirrers |



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Due to their light weight and neutral or positive buoyancy, many disposable plastic litter types floats and spread widely across the sea



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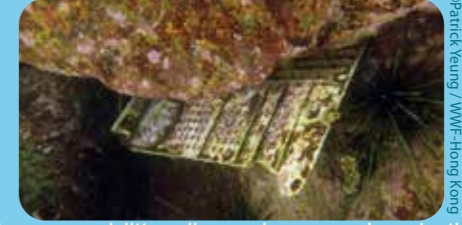
Polystyrene fish boxes generated from the fishing industry. They can easily break into small pieces and become very difficult to be removed from the environment.

| Underwater litter | |
|-------------------|--|
| Rank | Categories |
| 1 | Fishing net pieces |
| 2 | Plastic packaging (wrappers) and film fragments |
| 3 | Metal cans (food or drink), lids |
| 4 | Fishing items (floats, lures, buoys, fishing line) |
| 5 | Ceramics pieces |
| 6 | Plastic fragments - hard |
| 7 | Plastic packaging (wrappers) and film |
| 8 | Metal other |
| 9 | Glass fragments |
| 10 | Drink bottles 1L and less |



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Abandoned fishing nets can keep on tangling marine lives, causing injury and even death to them.



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Mismanaged litter disposal may end up in the sea and cause persisting impact to the environment.

2012 Plastic pellet disaster

The plastic pellet spill disaster of August 2012 marked a watershed moment for Hong Kong's marine environment. On the night of 23 July 2012, a severe typhoon swept by south China. Six containers loaded with 150 tonnes of polypropylene pellets – the raw material used to make thousands of kinds of plastic products – fell off a vessel in rough seas east of the Ninepin Islands.



© Gary Stokes

As the containers smashed onto various islands and ripped open, sacks filled with the polypropylene floated free and burst, releasing billions of pellets less than one cm in size. These then washed up onto Hong Kong's coastlines, and piles resembling snowdrifts began forming on beaches. The spill took many weeks to clean up, and pellets are still present to this day. While the immediate pellet spill crisis has now passed, marine debris remains a constant presence on Hong Kong's beaches and coastlines.

Coastal Watch project background

The spirit of the Coastal Watch project involves bringing forward the momentum created in the wake of the plastic pellet spill which will encourage every Hongkonger to cherish our oceans and keep them clean. Developed by WWF and six strategic partner organizations, Coastal Watch was a two year **citizen science project*** which used scientifically-sound methodologies to study, protect and provide year-round monitoring of Hong Kong's ecologically valuable coastal habitats.

The ultimate objectives of Coastal Watch were to develop a long-term solution to the marine litter problem, educate a broad segment of the Hong Kong public about our marine environment and then inspire and mobilize these people to take positive action to shape the future of our waters. We chose six marine habitats for this project: mangroves, mudflats, sandy shores, rocky shores, coral communities and coastal water areas. By coming to understand the biodiversity of these areas and the way in which they are impacted by the marine litter problem, Coastal Watch aimed to formulate practical solutions to conserve our marine environment.



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***Citizen science project:** A project which involves public participation and collaboration in scientific research to increase scientific knowledge. Through citizen science, people can share and contribute to data monitoring and collection projects, enabling a greater amount and a wider spread of data to be captured⁶.
SOURCE 6: National Geographic <http://education.nationalgeographic.org/encyclopedia/citizen-science/>

Lap Sap Wan – Where did the pristine pebble beach go?

Located in southeast Hong Kong Island near Shek O, Lap Sap Wan is a remote pebble beach that was basically unknown until recently. Despite its natural coastal habitat and close proximity to the Cape D'Aguiar Marine Reserve, an enormous amount of marine litter is flung and washed into this bay by the waves and tides every day. The accumulated litter has turned this once-pristine pebble beach into an unsightly dumping site. Its serious litter problem was first documented 20 years ago when it was given the name Lap Sap Wan (Rubbish Bay).



In late April 2015, Coastal Watch led a group of volunteers and media groups to Lap Sap Wan to conduct a marine litter survey. The hope was that we would learn more about accumulated marine litter and create substantial public awareness across Hong Kong. The survey estimated the total weight of marine litter present in the bay, which has a frontage of only 140m, at a staggering 185 tonnes.

Reacting to this discovery and the resulting media coverage, the Hong Kong government acted promptly and after three months of hard work, the macro-marine litter was finally cleared from the bay. A whopping 8,290 bags of marine litter were removed and the pebble beach was visible once again. However, the sea is relentless; as is, it seems humankind's ability to produce marine litter. The sea continues to wash marine litter into this beautiful bay. Another visit at the end of January 2016 showed that the beach has begun to be covered by marine debris once again. Will this beautiful pebble beach ever return to its natural state?



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1995



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April 2015



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July 2015

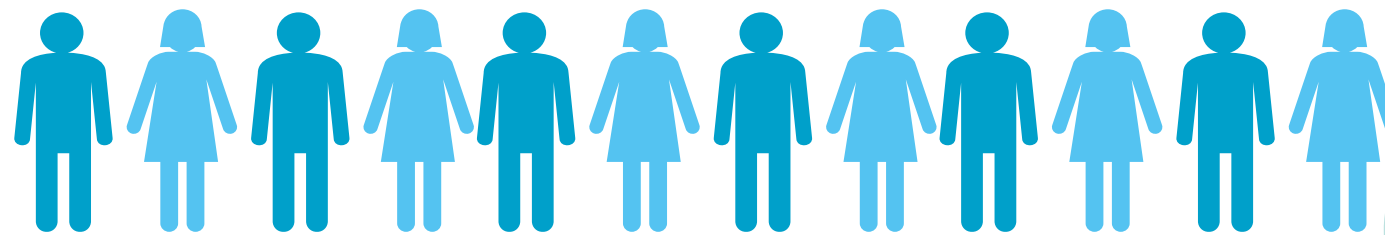


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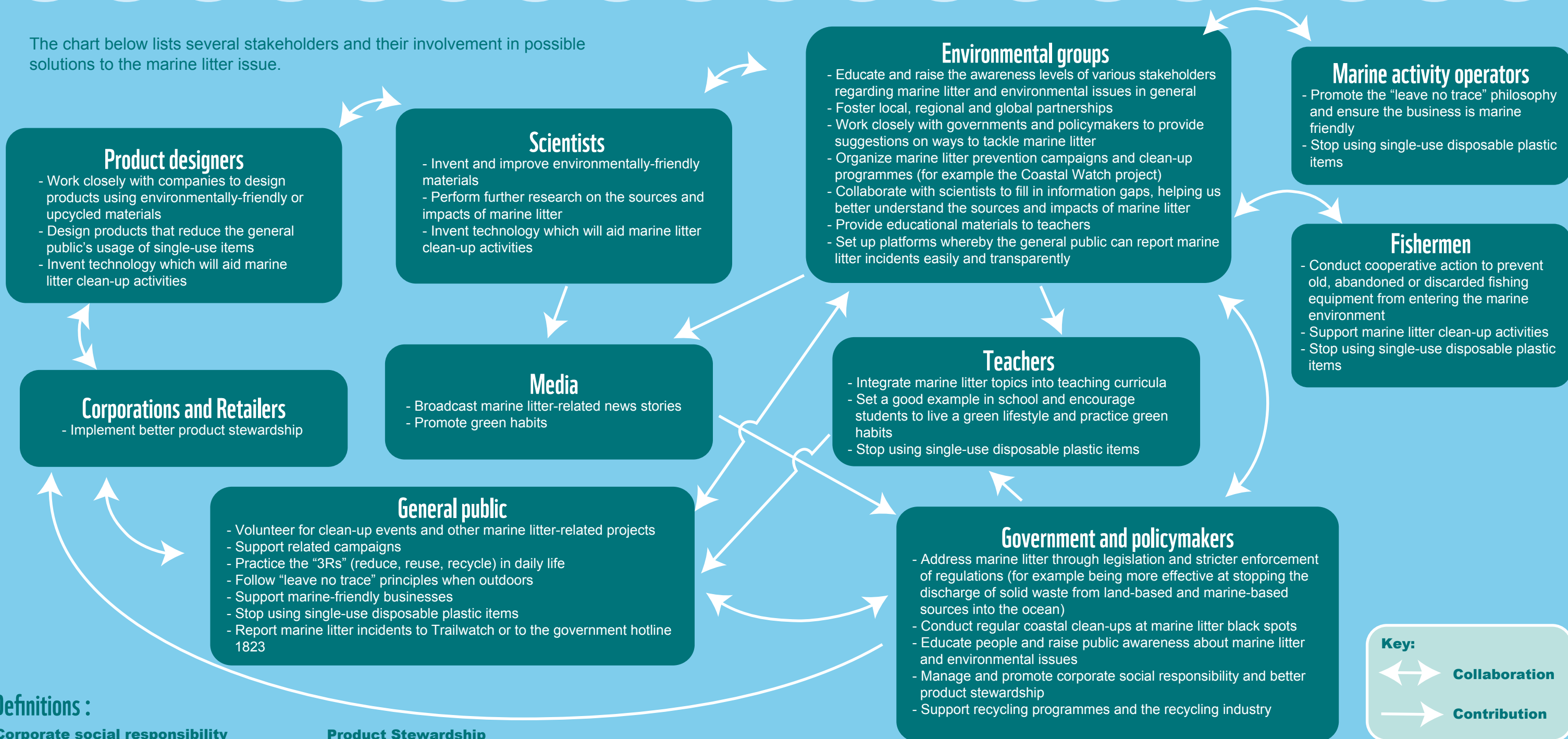
January 2016

Chapter 3

Reducing Marine Litter: Possible



The chart below lists several stakeholders and their involvement in possible solutions to the marine litter issue.



Key:

- ↔ Collaboration
- Contribution

Definitions :

Corporate social responsibility

– The ways in which companies integrate environmental and social concerns into their business operations and in their interaction with relevant groups on a voluntary basis ⁷.
Reference 7: CSR Guide for SMEs in Hong Kong.

Product Stewardship

– The principle that directs all actors in the life cycle of a product to minimize the impacts of that product on the environment. Product stewardship means that all parties who have a role in designing, producing, selling or using a product assume responsibility for the environmental impacts of that product throughout its life ⁸.
Reference 8: U.S Environmental Protection Agency.

Chapter 4

Recommended Teaching Plans

Marine litter is one of the biggest threats to the world's oceans; however everyone on Earth can also play a part in finding and developing a solution to this global problem. In this chapter, we provide two teaching plans which were designed to be flexible, allowing them to be integrated with various subjects in the Hong Kong secondary school curriculum. We hope these plans will inspire and aid teachers to contribute to finding a solution to Hong Kong's marine litter problem and help our future generations to do the same.

“Tell me and I forget, teach me and I may remember, involve me and I learn.”

- Confucius



Teaching Plan 1 : How to be a Coastal Watcher? (Field work)

Target subjects:

| Form | Subjects | Modules |
|--------|-----------------------------|--|
| F. 1-3 | Geography | - Elective modules: Oceans in trouble |
| | Science | - Environmental problems associated with the disposal of plastics |
| | Integrated humanities | - Place and Environment |
| F. 4-6 | Biology | - Compulsory section: Ecosystems - Conservation of ecosystems - Elective section: Applied Ecology c. Conservation d. Global issues (recognizing the causes and problems of global issues) - Scientific Investigation |
| | OLE | _____ |
| | CAS (IB) | Service learning |
| Other | Service learning programmes | _____ |
| | Life-wide learning | _____ |

Introduction:

This lesson aims to give students hands-on field survey experience, allowing teachers and students alike to put various survey skills into practice. Involving students in surveys and clean-up activities will help them acquire a first-hand understanding of marine litter and its impacts on our environment. The students will also act as volunteers and actively reduce marine litter in our beautiful coastal environment.

A video tutorial is available to enhance your ability to understand the surveys, explain them to students and actually perform the surveys in coastal areas. For the video please visit: <https://wwf.hk/coastalsurveys>.

Objectives:

- Students will acquire a first-hand understanding of the marine litter issue
- Students will learn several scientific survey methods and put this knowledge into action
- Students will learn to nurture positive values and attitudes towards our coastal environment
- Students will actively reduce their production of marine litter and initiate a life-long engagement in marine litter reduction

| Lesson plan | Location | Run-down | | References in this booklet | Page | Time |
|---|--------------------|---|---|---|---------------|----------------------|
| 1. Introduction Pre-field work lesson plan | Indoor | General and Geography | <ul style="list-style-type: none"> ▶ Background of the marine litter issue <ul style="list-style-type: none"> - What is marine litter? - Affected areas - Possible types and sources of marine litter ▶ Brief introduction to the field work, survey techniques and methods ▶ Set key learning outcomes* according to teaching needs <ul style="list-style-type: none"> ■ This will get students to start thinking about the issue and what they will need to keep in mind during the field work. <p>(*Key learning outcomes: the knowledge and outcomes you would like students to gain from the field work based on your target subject.)</p> | <ul style="list-style-type: none"> ●Chapter 1: Introduction ●Recommended sources ●Infographic poster - A sad splash | P.3-4 P.40 | 40 mins (one lesson) |
| | | Biology | <ul style="list-style-type: none"> ▶ Go through the data from the Marine Litter in Hong Kong chapter with students. ▶ Set a hypothesis before your field work: <ul style="list-style-type: none"> - Ecology: species type and species distribution in different zones (zonation) - Marine litter: the top marine litter category and possible source of litter. | <ul style="list-style-type: none"> ●Appendix I Teaching Plan 1 - Field Work materials ●Video tutorial | P.25-34 | |
| 2. Field work Hands-on survey experience and clean-up activity | Outdoor | <ul style="list-style-type: none"> ▶ Field work briefing ▶ Set up survey area ▶ Divide students into teams and survey groups ▶ Survey techniques briefing ▶ Conduct surveys <ul style="list-style-type: none"> - Ecological survey - Macro-marine litter survey - Micro-marine litter survey ▶ Overall clean-up (optional*) | | <ul style="list-style-type: none"> ●Appendix I Teaching Plan 1 - Field Work materials | P.25-34 | At least 1.5 hours |
| | | Outdoor/ Indoor | I- Facts and feelings <ul style="list-style-type: none"> ▪ What was your most memorable moment of the day? (before, during and after the hands-on survey) | | | 10-15 mins |
| 3. Debrief Reflection and Action | Outdoor/ Indoor | General and Biology | II- Findings (relate these to the key topics and make connections) <ul style="list-style-type: none"> ▪ Discuss the findings of the different surveys. ▪ What is the top marine litter category? ▪ How many of the pieces of marine litter that you found are ones that we produce every day? ▪ How much of the marine litter can be recycled? ▪ Referring to the decomposition diagram, go through the decomposition rates of the marine litter you collected with the students. ▪ Any interesting findings? (e.g. bite marks on marine litter) ▪ Did you find any marine species during your ecological survey? ▪ What are the potential impacts of marine litter on our ecosystem? <p>Biology-specific questions:</p> <ul style="list-style-type: none"> ▪ Were there any variations between the species types and numbers between the different quadrats? (zonation) ▪ Did the data match the hypothesis you set? | <ul style="list-style-type: none"> ●Chapter 1: Introduction - Decomposition rates of Marine Litter | P.5-6 | 20 mins |
| | | | <ul style="list-style-type: none"> ●Chapter 1: Introduction - The negative Impacts of Marine Litter | P.7-8 | | |

| Lesson plan | Location | Run-down | | References in this booklet | Page | Time |
|-------------|--------------------|---|--|--|---------|------------|
| | Indoor | Geography | <ul style="list-style-type: none"> ▪ Go through the Coastal Watch project survey data with students. - Analyse the data collected during the field work and create graphs and charts similar to the ones in Chapter 2 (e.g. the top 10 marine litter categories). - Compare the data to see if the data the students collected data follows the same trend. If not, why not? Is it because of specific land-use or nearby activities? - Introduce the Lap Sap Wan case study to show how marine litter affects even remote coastal areas in Hong Kong. The case study also shows the dramatic results of marine litter accumulation. - Reasons for marine litter accumulation: <ol style="list-style-type: none"> 1) Location and ocean currents 2) Referring to the decomposition diagram, go through the decomposition rates of the different marine litter items with the students to show the longevity of some types of marine litter. ▪ What are the potential impacts of marine litter on our ecosystem? | <ul style="list-style-type: none"> ●Chapter 2: Marine Litter in Hong Kong | P.9-14 | 30-40 mins |
| | | | <ul style="list-style-type: none"> ●Chapter 1: Introduction - Decomposition rates of Marine Litter ●Chapter 1: Introduction - The negative Impacts of Marine Litter | P.5-6 P.7-8 | | |
| | Outdoor/ Indoor | III-The Future (Solutions: internal and external) <ul style="list-style-type: none"> ▪ Pick a specific piece of marine litter you collected that you use or produce in your daily life. How can you reduce your daily usage of that specific item? (e.g. straws – you can say “no” to straws when ordering cold drinks) ▪ Ask the students what they think is the main type of material or main marine litter item that we should tackle? ▪ Divide students into groups to discuss how their local community (e.g. their school or their household) can stop this material or item from ending up in the ocean or on our coastlines. For ideas, go through the 10 Ways to Reduce Marine Litter infographic and Chapter 3 with students. ▪ Taking action: <ol style="list-style-type: none"> 1) Come up with a feasible plan and try to implement it in your local community. 2) Poster making: Ask the groups to make a poster to spread their messages and ideas about marine litter and marine litter reduction. This will help educate others in their local community. | | <ul style="list-style-type: none"> ●Infographic poster -10 Ways to Reduce Marine Litter in Hong Kong ●Chapter 3: Reducing Marine Litter Possible - Stakeholder Relationship Diagram | P.15-16 | 30 mins |
| | | 4. Additional lessons (optional*) | Indoor | <ul style="list-style-type: none"> ▪ Detailed data analysis and evaluation of the collected data. ▪ Create a data pool for a specific coastal site and monitor marine litter trends throughout the seasons and throughout the year. ▪ Hold an upcycling or a sea glass workshop | | |

Teacher Stories

After reading through the Coastal Watch survey methodology, you might ask yourself questions like “How feasible will this method be for secondary school students?” and “What sort of questions will students gain from this type of field work?” If these are some of your concerns, we have answers for you! The two stories below are from teachers who have either conducted Coastal Watch surveys with their students for the Coastal Watch project, or who have integrated the survey methodology into their own curriculum.

Mr Garrish,
Experiential
Learning
Coordinator at
St. Paul’s Co-
educational
College

“Working with WWF on implementing our Form 4 Coastal Ecology and Marine Litter programme has been very beneficial, in that it adds a credible methodology to our work. It expands the programme from an internal one to a much wider, more impactful, more meaningful endeavour, where the results can be used for genuine advocacy and lobbying to effect real change. This is a very tangible outcome which inspires students to work more accurately and diligently. Anecdotal evidence of the outcomes of this programme suggest that students have been shocked by the amount and variety of litter on Hong Kong beaches, as well as by the difficulty in its removal and prevention. Several students have commented that this programme has made them more aware of environmental issues and has increased their desire to be involved in other environmental actions in the future.”

Ms Safaya,
teacher at the
Canadian
International
School of
Hong Kong

“Coastal Watch surveys provide a natural opportunity for the subjects of geography and science to be woven together to explore the topics of ecology, biodiversity, waste management, land-use zoning and local environmental issues. Having personally been involved in two surveys for the Coastal Watch project in Lantau and Sai Kung, I have a good understanding of the detailed methodology, and realize how clear and accessible it is for Grade 9 students. Our students found the experience of participating in authentic and purposeful investigation to be especially motivating, since the results of their hard work would not only be used for academic assessment, but be compiled in reports and eventually help to inform the Hong Kong government’s conservation policies. What an incredible example of citizen geo-science for the greater good of the Hong Kong community – no better way to apply one’s education!”

Teaching Plan 2: Creating a marine litter free city (Role-play)

Target subjects:

| Form | Subjects | Modules |
|--------|--------------------|--|
| F. 1-3 | Geography | - Elective modules: Oceans in trouble |
| F. 4-6 | Geography | ▶ Compulsory section: Building a Sustainable City – Are environmental conservation and urban development mutually exclusive? |
| | Integrated Science | ▶ Modules C6: Balance in Nature (C6.5 The hunt for balance) - focusing on waste management and pollution control |
| | Liberal Studies | ▶ Module 2: Hong Kong Today (Theme 1: Quality of life) ▶ Module 6: Energy Technology and the Environment (Theme 2: The environment and sustainable development) ■ Key concepts: Sustainable development, Green lifestyle, Waste Management |

Introduction:

The marine litter problem is highly complex and involves a number of stakeholders. It also covers a variety of environmental, social and economic aspects. This interactive role-play session will be facilitated by teachers and will allow students to explore the subject in depth, deepening their knowledge of marine litter, and marine litter reduction and its relationship with the sustainable lifestyle.

Objectives:

- ▶ Students will acquire a deeper understanding of marine litter and the importance of the sustainable lifestyle
- Discussion 1: (for F.1-6)
 - Students will use critical thinking to look at marine litter from different perspectives using a real life local example.
- Discussion 2: (for F.4-6)
 - Students will learn about several feasible solutions which can reduce marine litter.
 - Students will come to understand the relationship between marine litter reduction and sustainable development.
- Action:
 - Students will be encouraged to practice a sustainable lifestyle so as to reduce marine litter.

| Lesson plan | Rundown | References in this booklet | Page | Time |
|--|--|---|---|---------|
| 3. Discussion 2 Create a Marine Litter Reduction Plan (F.4-F.6) | <ul style="list-style-type: none"> ▶ Get students to form a "Marine Litter Working Group" which includes the different stakeholders from the previous discussion. ▶ First, set the tone for discussion Facts: <ol style="list-style-type: none"> 1) Economic prosperity and an increase in our living standards has led to a corresponding rise in the consumption of goods and the amount of waste we generate. According to the Hong Kong Blueprint for Sustainable Use of Resources Report (2013-2022), Hong Kong's daily per capita domestic waste generation rate is high, even when compared to other cities in Asia which are at similar stages of economic development. 2) Using the Global Flows of Plastic Packaging Materials in 2013 diagram, show the students that 32 per cent of plastic packaging leaks into our natural environment (including the ocean), and an overwhelming 72 per cent of plastic packaging is never recovered. ▶ Have the Marine Litter Working Group propose a marine litter reduction plan that balances the environment, economic development and Hong Kong's fast-paced lifestyle. <ol style="list-style-type: none"> 1) Give the Stakeholder Information Pack to the students, and give each student 10 minutes to go through the information. 2) Get the groups to look through the Coastal Watch marine litter data, then ask each working group to pick a specific type of marine litter or material that they would like to tackle. 3) Then get the groups to discuss and come up with ideas for reduction plans that can be implemented in Hong Kong. (Hint: multiple ideas involving different stakeholders can be combined to form such a plan). 4) Each group then presents their plan. ▶ Discussion 2 conclusion: <ul style="list-style-type: none"> ■ Teacher consolidates points that have been raised during the discussions. Highlight the following topics: <ul style="list-style-type: none"> - Using the Possible Stakeholder Relationship diagram, show the interaction between the different stakeholders and the importance of collaborative involvement. - Highlight the relationship between marine litter reduction and sustainable development. | <ul style="list-style-type: none"> ●Recommended sources ●Appendix II Teaching Plan 2 - Stakeholder Information Pack ●Chapter 2: Marine Litter in Hong Kong ●Chapter 3: Reducing Marine Litter Possible - Stakeholder Relationship Diagram | P.40 P.38-39 P.11-12 P.15-16 | 30 mins |
| 4. Action Take action, change your daily habits! | <ul style="list-style-type: none"> ▶ Give the students five minutes to discuss with their group the types of litter they might produce each day (start from the moment they wake up until when they go to bed). ▶ Ask students to come up with feasible changes that they could implement in their daily lives to reduce their own litter production. ▶ Each group then presents their ideas. | | | 15 mins |

| Lesson plan | Rundown | References in this booklet | Page | Time |
|---|---|---|---|---------------------------|
| 1. Introduction | <ul style="list-style-type: none"> ▶ At home preparation (for students) <ul style="list-style-type: none"> ■ Provide students with facts and videos on the subject of marine litter. ■ Warm-up exercise: Students complete the marine litter introduction worksheet. ■ Students to research information (e.g. news clippings, videos) on Lap Sap Wan. ▶ Provide a background to the marine litter issue <ul style="list-style-type: none"> ■ What is marine litter? ■ Affected areas ■ Sources of marine litter ■ Decomposition rates ■ The negative impacts of marine litter ▶ Case study: Lap Sap Wan | <ul style="list-style-type: none"> ●Chapter 1: Introduction ●Appendix II Teaching Plan 2 - Marine Litter Introduction Worksheet ●Recommended Source | P.3-8 P.35 P.40 | |
| 2. Discussion 1 What should be done about the on-going accumulation of marine litter along our coastlines? (F.1-F.6) | <ul style="list-style-type: none"> ▶ Divide students into different "stakeholder" groups. These groups can be individual people or groups of people. If dividing into groups, a similar or equal number of students are needed per group (no more than 5 students per group). Provide stakeholder introduction to students accordingly. Stakeholders: <ul style="list-style-type: none"> ■ Government and policy makers – One of the main players during the Lap Sap Wan clean-up, this is the only stakeholder that can address marine litter through legislation and the enforcement of regulations. ■ General public – This group does not understand much about marine litter and they are not sure why people who do not live near Lap Sap Wan need to take responsibility for the problem. ■ Environmental groups – This group conducts marine litter surveys at Lap Sap Wan to understand the seriousness of the marine litter accumulation. They also create public awareness in different sectors of society. ■ Fishermen – This group is directly affected by marine litter. They also have a high chance of contributing to the marine litter problem without realising the potential impacts of their actions. ■ Scientists (optional) – This group performs research to gather information on the potential impacts of marine litter and to devise solutions. ■ Marine animals (optional) – This group highlights the impacts of marine litter on marine animals and the marine ecology. ▶ Discussion questions: <ol style="list-style-type: none"> 1) How does marine litter affect you? 2) What are the responsibilities of and the barriers faced by the different stakeholders when dealing with marine litter in Lap Sap Wan? 3) Are clean-up activities the most cost effective and the best solution to the situation? If not, what are your suggestions? ▶ Discussion 1 conclusion: <ul style="list-style-type: none"> ■ Teachers to consolidate points that have been raised during discussions. Highlight the following topics: <ul style="list-style-type: none"> - Negative impacts of marine litter - Decomposition rates of marine litter - Marine litter accumulation (on land, on the water's surface and underwater) - Ways to reduce marine litter | <ul style="list-style-type: none"> ●Appendix II Teaching Plan 2 - Stakeholder Introduction ●Chapter 1: Introduction ●Chapter 2: Marine Litter in Hong Kong - Case study: Lap Sap Wan ●Chapter 1: Introduction ●Recommended sources ●Infographic poster - A sad splash ●Chapter 2: Marine Litter in Hong Kong - Case study: Lap Sap Wan ●Chapter 1: Introduction ●Appendix II Teaching Plan 2 - Stakeholder Introduction ●Chapter 1: Introduction ●Chapter 1: Introduction - The negative impacts of marine litter ●Chapter 1: Introduction - Decomposition rates of Marine Litter ●Infographic poster- 10 Ways to Reduce Marine Litter in HK | P.37 P.3-8 P.40 P.9-10 P.14 P.37 P.7-8 P.5-6 | 20 mins 25-30 mins |

Teaching Plan 1 field work materials

The best way to understand the problem of marine litter in the local context is to actually see, feel and experience it in person. In this Appendix, we include some suggested survey sites and the methodologies of several land-based scientific surveys that were used by researchers and citizen scientists during the Coastal Watch project. This Appendix breaks down the survey methodologies into a step-by-step guide and also provides a link to a video tutorial (<https://wwf.hk/coastalsurveys>). We hope this will enhance your ability to understand the surveys, explain them to your students and actually perform the surveys in coastal areas.

Survey Types

1. Ecological survey
 - Help students gain a better understanding of the diversity and richness of species found in the coastal habitat being surveyed.
2. Marine litter survey (both macro- and micro-marine litter)
 - Help students develop a better understanding of the marine litter problem.
 - Increase students' knowledge of the principle types and sources of litter which enter our marine environment.

Survey Methodologies

*All surveys use stratified random line-transect and quadrat sampling methods.

• Before the survey

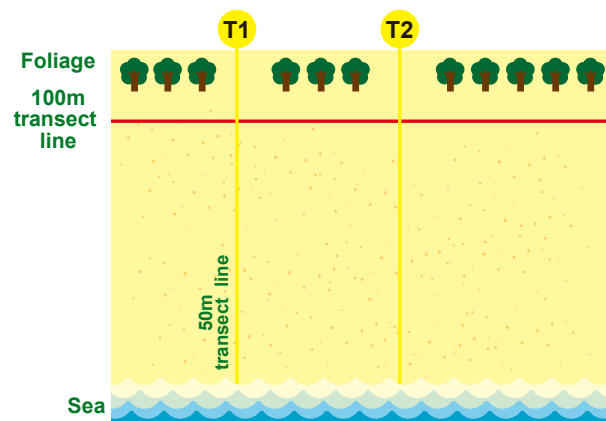
- I. Decide which coastal site you will bring the students to (P.29-30 for coastal survey sites suggestions).
- II. Check the local predicted tide tables (http://www.hko.gov.hk/tide/etide_main.htm) and plan to arrive at the site during low tide (it is best if the tide is below 1.5m).
- III. Check out the video tutorial (<https://wwf.hk/coastalsurveys>).

• Marking out the survey area

Equipment needed:

- ▶ Hand-held GPS device
- ▶ 1 x 100m fiberglass measuring tape
- ▶ 1 x 50m fiberglass measuring tape per team (final number is dependent on the number of survey teams)

- I. Lay a 100m base transect at the back of the site, parallel to the shoreline (in front of any foliage areas). Record the GPS coordinates of the start and end point of this base transect.
- II. Along the 100m base transect line, randomly choose points for the transect lines perpendicular to the shore and extend these transect lines all the way to the sea. Note: The lengths of these transect lines may vary in different locations due to differences in topography and tidal levels.



1) Ecological Survey

Quadrat size: 0.5m x 0.5m

Starting point: Near the edge of the water

Total number of quadrats that need to be completed per transect: 5

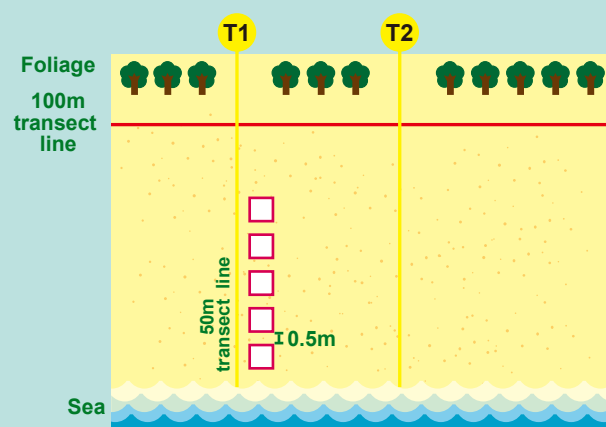
Distance between the quadrats: 0.5m

Equipment needed:

- ▶ 0.5m x 0.5m quadrat
- ▶ Gloves
- ▶ Clipboards, data sheets, pencils
- ▶ Scoop
- ▶ Camera
- ▶ Coastal ecology ID guide/ books

Carefully follow the steps below to complete the survey:

- i. Place the quadrats at the chosen points (to the right of the transect line when you are looking at the land).
- ii. Record the name of the species found inside the square of each quadrat. If the quadrat lies on loose sediment with sand, small rocks and pebbles, turn the pebbles over or dig down to a depth of between 5 and 10 cm to find creatures living beneath the surface. Remember to be gentle when digging!
 - *Please note: digging is prohibited in marine parks.
- iii. Take picture of each species type you find within the quadrats (both known and unknown).
- iv. Return the mud, sand and rocks back to their original position after the survey.
- v. Move on to the next quadrat point.



2) Macro-marine litter survey (marine litter bigger than 1cm)

Collection area: 2.5m on either side of the randomly chosen transect, from the base transect up to the edge of the water (the total collection area is 5m wide).

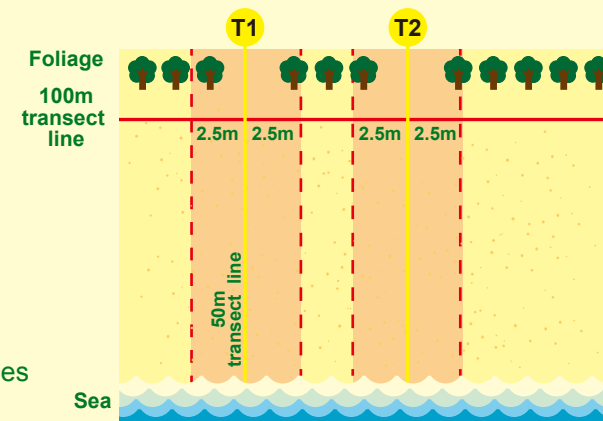
Equipment needed:

- ▶ Gloves
- ▶ 2x ropes per transect to demarcate the collection area
- ▶ Tongs
- ▶ Camera
- ▶ Black and white bin bags
- ▶ Clipboards, data sheets, pencils
- ▶ Scales
- ▶ ID guides
- ▶ Buckets for litter collection (optional)

- i. Collect the debris and divide it into five main category piles (for example: plastic, metal, glass, paper and others).
- ii. Take photos of any items with product branding (i.e. drinks bottles, cans, packaging and so on).
- iii. Carefully read through the macro-marine litter identification card or data sheet and further categorize the items in each pile. Tally each item and mark down the figures on the data sheet.
- iv. Divide the plastic and metal items into recyclable and non-recyclable piles and weigh each pile separately.
- v. Place recyclable plastics into the white bin bags and non-recyclable plastics into the black bin bags.
- vi. Weigh the rest of the categories according to the data sheet.
- vii. Properly pack up all litter and place it in the appropriate location.

Note: Do not collect the following items:

- Natural debris
- Dead animals
- Food waste



3) Micro-marine litter survey (marine litter from 1mm-1cm)

Quadrat size: 1m x 1m

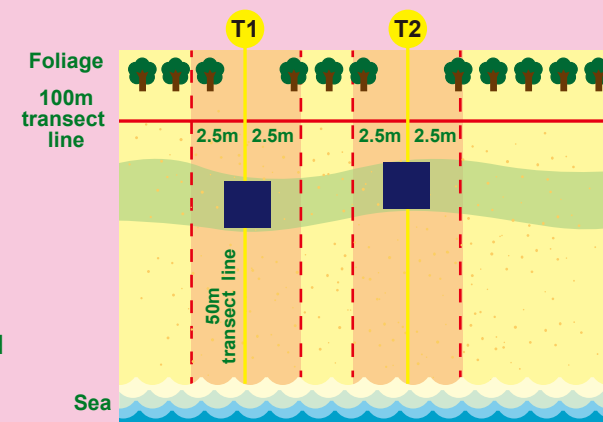
Collection site: Place the quadrat at the high tide debris deposit line within the collection area for the macro-marine litter survey – 2.5m on both sides of the randomly chosen transect line.

Equipment needed:

- ▶ Gloves
- ▶ 1m x 1m quadrat
- ▶ 2x ropes per transect to demarcate the collection area
- ▶ Shovel
- ▶ Bucket (with a 10 litre marking)
- ▶ Sieves (5mm and 1mm)
- ▶ Other containers / large buckets to hold sieved water and sediment
- ▶ Clipboards, data sheets, pencils
- ▶ ID guides

Carefully follow the steps below to complete the survey:

- i. Select a collection site at the high tide debris deposit line, along the randomly chosen transect line and some where within the 5m-wide collection area.
- ii. Place the quadrat at the chosen point.
- iii. Remove large pieces of natural debris, like seaweed, leaves and wood within the quadrat.
- iv. Using the small shovel, evenly scoop off the surface of the grid and place the sand in the bucket. Stop when the sand in the bucket reaches the 10 litre mark. This amount represents approximately 3cm of sand taken from the quadrat's surface.
- v. Sieve all of the collected sand through the sieves. Please note: if the sand is wet you will likely need to flush the sand through the sieves with water.
- vi. Empty the sample into another container and sort the collected debris into the categories listed on the data sheet. Please note: glass fragments can often be found, so be careful when sorting.
- vii. Count the items and tally the results on the data sheet.



Survey groups

| Team | Survey groups | Action | Number of students | Estimated time |
|------|---------------|--------------|--------------------|-----------------|
| A | 1 | Ecological | 3-5 | Around one hour |
| | 2 | Macro-litter | 4-6 | |
| | 3 | Micro-litter | 4 | |

Action details:

- Conduct surveys and record data along the transect.
- Depending on the time available and the key learning outcomes, teachers have the option to choose between:
 - ▶ Rotating survey groups every 20 minutes, so students get to try out the different surveys.
 - Note: Since the rotation might affect the accuracy of the data, we do NOT recommend this option if data accuracy is important for your field work.
 - ▶ No rotation between the survey groups, so each group of students will conduct a specific survey per transect.

*Note: The number of transects depends on the number of teams and the time available for the survey. If time allows, each team can complete more than one transect, but we do not recommend that students complete more than two transects as they may lose focus.

Clean-up activity

If time allows, an overall marine litter clean-up at the site will provide an opportunity for the students to become volunteers, take social responsibility and physically make a difference to the coastal environment.

Code of Conduct

- 1) Take nothing but pictures; leave nothing but footprints.
- 2) Do not touch, feed, or disturb any wildlife and maintain your distance from animals.
- 3) Do not fish or collect animals or shells.
- 4) Avoid using a flash when taking photographs of animals or birds.
- 5) Carefully choose your trails and rest areas to minimize disturbance to the environment.
- 6) Wherever you are, if you notice litter, remove it and place it in the appropriate recycling and/or rubbish bins.
- 7) Walk slowly, make small movements and keep your voice level low.
- 8) To ensure all materials are fully utilized, please collect all gloves and other tools used after the activity, clean them and reuse them as many times as you can.

Safety Guidelines

- 1) Do not open any bottles you find, and generally be cautious with any debris or natural item which you are unsure.
- 2) Keep gloves on during field work.
- 3) Sharp objects such as broken glass should be handled carefully. Never place sharp objects in plastic bin bags, as they may cut through the bag and injure people. Instead, use discarded polystyrene boxes, sturdy buckets or other safe containers.
- 4) Be careful when attempting to remove heavy objects. If an item is too heavy, let it be.
- 5) Make sure a basic first aid kit is available before starting field work.
- 6) In the presence of thunder or lightning, stop work immediately and seek shelter. Do not shelter under lone trees in exposed locations.
- 7) Avoid slippery and unstable terrain.
- 8) Make sure to keep hydrated and avoid working in extreme weather for long periods of time.
- 9) Never make direct contact with any medical waste (e.g. syringes), sanitary items (e.g. diapers, tampons), or dead, entangled, or injured animals.

What to wear and bring for field work

What to wear



What to bring



Full survey equipment list

| Equipment for marking out the survey area | Necessary amount |
|---|---------------------------|
| Base transect (100m) | 1 |
| Transect (50m) | Dependent on team numbers |

| Equipment for the ecological and marine litter survey | Necessary amount (per transect) |
|---|---------------------------------|
| Quadrat (0.5 x 0.5m) | 1 |
| Quadrat (1 x 1m) | 1 |
| Ropes to mark out the marine litter collection area | 2 |
| 5m measuring tape | 1 |
| Scoop for the eco-survey | 1 |
| Scoop for micro-debris | 1 |
| Sieve (5mm) | 2 |
| Sieve (1mm) | 2 |
| Bucket (10L) | 1 |
| Data sheets (eco) | 1 |
| Data sheets (macro-debris) | 1 |
| Data sheets (micro-debris) | 1 |
| Field guide books | 1 |
| Marine litter ID guide | 1 |
| Marine organism ID guide | 1 |
| Clipboard | 3 |
| Garbage bags (black) | 5 |
| Garbage bags (white) | 5 |
| Weigh scale | 1 |
| First aid kit | 1 |
| Bucket and other containers (<10L) | 2 |

* Estimated equipment cost (per transect): HK\$1000

Field Work: Possible Survey Locations

1 Locations: Lung Kwu Tan
Shoreline length: >800m
Habitat: Sandy shore
Accessibility: Good (accessible via public transport or chartered coach)
Estimated student capacity: ~100
Recommended student academic level: F.1-6
Rubbish collection: Refuse collection point is available near the site

2 Locations: Shui Hau
Shoreline length: >300m
Habitat: Sandy shore and Mangrove
Accessibility: Medium (via bus or chartered coach)
Estimated student capacity: ~100
Recommended student academic level: F.4-6
Rubbish collection: Contact FEHD (isdoeh@fehd.gov.hk)

3 Locations: Chi Ma Wan
Shoreline length: >100m
Habitat: Sandy shore
Accessibility: Difficult (Hike from Mui Wo, takes around one hour)
Estimated student capacity: <50
Recommended student academic level: F.4-6
Rubbish collection: Contact FEHD (stdoeh@fehd.gov.hk)

4 Locations: Cheung Chau (Tung Wan, non-gazetted area)
Shoreline length: ~150m
Habitat: Sandy shore
Accessibility: Good (via ferry from Central)
Estimated student capacity: ~50
Recommended student academic level: F.1-6
Rubbish collection: Contact FEHD (stdoeh@fehd.gov.hk)

5 Locations: Lamma Island (Sok Kwu Wan)
Shoreline length: ~500m
Habitat: Sandy shore
Accessibility: Good (via ferry from Central)
Estimated student capacity: ~100
Recommended student academic level: F.1-6
Rubbish collection: Contact FEHD (stdoeh@fehd.gov.hk)

6 Locations: Lamma Island (Shek Pai Wan)
Shoreline length: >500m
Habitat: Sandy shore
Accessibility: Medium (via ferry and hike from either Sok Kwu Wan or Mo Tat Wan)
Estimated student capacity: ~100
Recommended student academic level: F.1-6
Rubbish collection: Contact FEHD (stdoeh@fehd.gov.hk)

7 Locations: Shek O back beach(non-gazetted area)
Shoreline length: ~150m
Habitat: Sandy shore
Accessibility: Good (accessible via public transport or chartered coach)
Estimated student capacity: <50
Recommended student academic level: F.1-6
Rubbish collection: Refuse collection point is available near the car park

8 Locations: Clear Water Bay (non-gazetted area)
Shoreline length: >200m
Habitat: Rocky shore and Sandy shore
Accessibility: Good (accessible via public transport or chartered coach)
Estimated student capacity: ~50
Recommended student academic level: F.4-6
Rubbish collection: Refuse collection point is available near the car park

9 Locations: Little Palm Beach
Shoreline length: ~100m
Habitat: Rocky shore and Sandy shore
Accessibility: Good (accessible via chartered van with 28 seats)
Estimated student capacity: ~50
Recommended student academic level: F.4-6
Rubbish collection: Contact FEHD (stdoeh@fehd.gov.hk)

10 Locations: Starfish Bay
Shoreline length: >300m
Habitat: Sandy shore
Accessibility: Good (around 10 mins walk from Wu Kai Sha MTR station)
Estimated student capacity: ~100
Recommended student academic level: F.1-6
Rubbish collection: Contact FEHD (stdoeh@fehd.gov.hk)

Ecological Survey Data Sheet (F.1-3) Hong Kong Sandy Shores

General information

Site Name : _____ Date : _____
 Temperature : _____ Weather : _____ (sunny/cloudy/rainy)
 Wind direction : _____ (*Refer to HK Observatory website)
 Tidal level at start : _____
 Ebbing or rising tide : _____
 Others : _____ (e.g. recent typhoons, super high tides, etc.)
 Team name: _____ Transect: _____

Species present

| Species | Tally | = Total | Where are they located? (√) | |
|---------------------|-------|---------|-----------------------------|-------------|
| | | | On the surface | In the sand |
| Bivalves | | | | |
| Gastropods (Snails) | | | | |
| Starfish | | | | |
| Sea urchin | | | | |
| Sea cucumber | | | | |
| Worms | | | | |
| Shrimps | | | | |
| Crabs | | | | |
| Hermit crabs | | | | |
| Others | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Recommended field guide book: *Sandy shores* (Benny K.K. Chan & Kevin J. Caley)

Ecological Survey Data Sheet (F.4-6) Hong Kong Sandy Shores

General information

Site Name : _____ Date : _____
 Temperature : _____ Weather : _____ (sunny/cloudy/rainy)
 Wind direction : _____ (*Refer to HK Observatory website)
 Tidal level at start : _____
 Ebbing or rising tide : _____
 Others : _____ (e.g. recent typhoons, super high tides, etc.)
 Team name: _____ Transect: _____

Species present

| | |
|---|--|
| Bivalves | <i>Batillaria zonalis</i> (Mudsnail) |
| <i>Asaphis violascenes</i> (Violet asphis) | <i>Batillaria multiformis</i> (Mudsnail) |
| <i>Anomalocardia flexuosa</i> (False cockle) | <i>Nassarius festivus</i> |
| <i>Anomalocardia squamosa</i> (False cockle) | Starfish |
| <i>Marcia japonica</i> | <i>Archaster typicus</i> (Starfish) |
| <i>Marcia hiantina</i> | Worms |
| <i>Marcia marmorata</i> | <i>Siphonosoma cumanense</i> (Peanut worm) |
| <i>Gafrarium pectinatum</i> | <i>Ochetostoma erythrogrammon</i> (Innkeeper worm) |
| <i>Soletellina diphos</i> (Purple clam) | Brachiopods |
| <i>Coecella chinensis</i> (Chinese wedge shell) | <i>Lingula lingua</i> (Lamp shell) |
| <i>Venerupis philippinarum</i> (Manila clam) | Shrimps |
| <i>Dosinia japonica</i> | <i>Callinassa japonica</i> (Ghost shrimp) |
| <i>Cyclina sinensis</i> | <i>Austinogebia edulis</i> (Mud shrimp) |
| <i>Scapharca cornea</i> (Ark-shell) | Crabs |
| <i>Corbula crassa</i> | <i>Mictyris brevidactylus</i> (Soldier crab) |
| <i>Ervilia sp.</i> | <i>Tmethypocoelis ceratophora</i> (Buddhist crab) |
| <i>Donax spp.</i> (Wedge-shells) | <i>Ocypode cordimana</i> (Ghost crab) |
| Gastropods | <i>Uca vocans</i> (Fiddler crab) |
| <i>Polinices mammilla</i> (Moon snail) | <i>Uca lactea</i> (Fiddler crab) |
| <i>Onchidium hongkongensis</i> (Sea slug) | <i>Scopimera globosa</i> |
| <i>Clithon oualaniensis</i> (Nerite) | Hermit Crabs |
| <i>Cerithidea cingulata</i> (Mudsnail) | <i>Diogenes spinifrons</i> (Hermit crab) |
| <i>Cerithidea djadjariensis</i> (Mudsnail) | <i>Pagurus dubius</i> (Hermit crab) |
| <i>Cerithidea rhizophorarum</i> (Mudsnail) | <i>Clibanarius longitarsus</i> (Hermit crab) |

Others (Please specify)

| | |
|--|--|
| | |
| | |
| | |
| | |
| | |

Recommended field guide book: *Sandy shores* (Benny K.K. Chan & Kevin J. Caley)

Date: _____ Site: _____ Transect: _____

MARINE POLLUTION DEBRIS DATA CARD (PLASTIC)

| CODE | PLASTIC | TALLY(III) | TOTAL | CODE | PLASTIC | TALLY(III) | TOTAL |
|---|---|------------|-------|--------------------|--|------------|-------|
| A1 | Drink bottle caps | | | A29 | Plastic tags (shipping) | | |
| A2 | Other bottle caps, pump and spray lids | | | A30 | Construction - Thin strips | | |
| A3 | Drink bottles 1L and less | | | A31 | Construction other - filings, bits, etc | | |
| A4 | Drink bottles > 1L | | | A32 | Cable ties | | |
| A5 | Drums & buckets | | | A33 | Bendable sticks(have an inner and outer tube) | | |
| A6 | Cutlery, whole and pieces | | | A34 | Combs, brushes, hair ties, clips,toothbrushes | | |
| A7 | Straws & stirrers | | | A35 | Pens, markers, stationery | | |
| A8 | Six pack rings | | | A36 | Recreational & outdoor equipment (beach toys, swim goggles, flippers, etc) | | |
| A9 | Fast food containers, lids & cups, whole & pieces | | | A37 | Plastic house wares (clothes pegs, hangers, | | |
| A10 | Clear water cups, small, whole & pieces | | | A38 | food containers, broom, bristles, etc) | | |
| A11 | Plastic shopping bags | | | A39 | "Sheeting" ("ahmah"" bags, palette wrap, corrugated plastic sheets) | | |
| A12 | Toys | | | A40 | Strapping pieces | | |
| A13 | Cigarette lighters | | | A41 | Thick rope pieces | | |
| A14 | Cigarettes butts and filters | | | A42 | Thin rope, string, ribbon pieces | | |
| A15 | Cutlips (cotton buds) (marks at both ends) | | | A43 | Fishing net (big) | | |
| A16 | Lollipop sticks (hole at one end) | | | A44 | Fishing net pieces | | |
| A17 | Ice lolly tubes | | | A45 | Fishing items (floats, lures, buoys, fishing line) | | |
| A18 | Medical (syringes, vials, pill packs, bags) | | | A46 | Food netting | | |
| A19 | Baskets, crates & trays | | | A47 | Polystyrene - food boxes & cups (whole & identifiable pieces) | | |
| A20 | Mesh/ netting bags | | | A48 | Polystyrene boxes (whole & identifiable pieces) | | |
| A21 | Plastic hard packaging | | | A49 | Polystyrene - packaging & insulation (Thin sheets, chunky insulation) | | |
| A22 | Plastic packaging (wrappers) and film - whole & fragments | | | A50 | Polystyrene - packing peanuts | | |
| A23 | Plastic packaging - others | | | A51 | Polystyrene - fragments | | |
| A24 | Cleaning product bottles, bags, etc | | | A52 | Polystyrene - other (specify) | | |
| A25 | Personal care bottles, tubs (toothpaste, shampoo, etc) | | | A53 | Miscellaneous plastic items | | |
| A26 | Tissue packets (individual) | | | A54 | Plastic fragments -hard | | |
| A27 | Glow sticks & connectors | | | A55 | Plastic other (specify) | | |
| A28 | Plastic tubes, hose | | | | | | |
| | | | | Weight (kg) | | | |
| Recyclable Plastics (empty bottles, bottle lids and hard plastic): | | | | | | | |
| Other Plastics: | | | | | | | |
| Total Weight: | | | | | | | |

MARINE POLLUTION DEBRIS DATA CARD (Metal)

| CODE | METAL | TALLY(III) | TOTAL | CODE | PLASTIC | TALLY(III) | TOTAL |
|---------------------------|--|------------|-------|--------------------|---|------------|-------|
| B1 | Foil packaging | | | B6 | Metal paint tins, spray cans, buckets, aerosol cans (<4L) | | |
| B2 | Foil packaging fragments | | | B7 | Metal BBQ supplies (BBQ forks, etc) | | |
| B3 | Metal cans (food or drink), lids | | | B8 | Metal crab/ lobster / fish traps | | |
| B4 | Metal - wire, mesh, barbed wire, electrical wire | | | B9 | Metal other (specify) | | |
| B5 | Metal drums,gas bottles, buckets, cans (>4L) | | | | | | |
| | | | | Weight (kg) | | | |
| Recyclable Metals: | | | | | | | |
| Other Metals: | | | | | | | |
| Total Weight: | | | | | | | |

MARINE POLLUTION DEBRIS DATA CARD (Paper)

| CODE | PAPER | TALLY(III) | TOTAL | CODE | PAPER | TALLY(III) | TOTAL |
|----------------------|---|------------|-------|--------------------|-----------------------|------------|-------|
| C1 | Newspaper, magazines, brochures, sheets | | | C3 | Paper Fragments | | |
| C2 | Paper and cardboard packaging | | | C4 | Paper other (specify) | | |
| | | | | Weight (kg) | | | |
| Total Weight: | | | | | | | |

MARINE POLLUTION DEBRIS DATA CARD (Glass)

| CODE | GLASS | TALLY(III) | TOTAL | CODE | GLASS | TALLY(III) | TOTAL |
|----------------------|------------------------------------|------------|-------|--------------------|-----------------------|------------|-------|
| D1 | Drink bottles | | | D4 | Medical vials | | |
| D2 | Food bottles & jars, vitamin vials | | | D5 | Glass fragments | | |
| D3 | Light bulbs/ tubes | | | D6 | Glass other (specify) | | |
| | | | | Weight (kg) | | | |
| Total Weight: | | | | | | | |

MARINE POLLUTION DEBRIS DATA CARD (Other)

| CODE | PLASTIC | TALLY(III) | TOTAL | CODE | RUBBER | TALLY(III) | TOTAL |
|----------------------|---|------------|-------|----------------------|---|------------|-------|
| E1 | Clothing, hats, towels | | | G3 | Children's floor mat | | |
| E2 | Backpacks & bags | | | G4 | Rubber fragments | | |
| E3 | Canvas, sailcloth & sacking (hessian) | | | G5 | Rubber other (specify) | | |
| E4 | Cloth carpeting & furnishing | | | | | | |
| E5 | Cloth fragments | | | | | | |
| E6 | Cloth Other (specify) | | | | | | |
| CODE | WOOD | TALLY(III) | TOTAL | CODE | OTHER | TALLY(III) | TOTAL |
| F1 | Broom/brush handles | | | H1 | Shoes, flip flops | | |
| F2 | Wood furniture | | | H2 | Leather items | | |
| F3 | Chopsticks, toothpicks, ice cream sticks, etc | | | H3 | Sanitary items (pads, tampons, condoms, diapers, wet wipes) | | |
| F4 | Wood fishing traps and pots | | | H4 | Candles, wax | | |
| F5 | Wood pallets, processed timber | | | H5 | Batteries | | |
| F6 | Wood fragments | | | H6 | Tetra pak/ drink boxes | | |
| F7 | Wood other (specify) | | | H7 | Personal effects (money, wallet, glasses, jewellery, watch) (specify) | | |
| | | | | H8 | Ceramics whole | | |
| | | | | H9 | Ceramics pieces | | |
| | | | | H10 | Balloons (all types, whole and pieces) | | |
| | | | | H11 | Appliances & electronics (specify) | | |
| | | | | H12 | Other (specify) | | |
| CODE | RUBBER | TALLY(III) | TOTAL | | | | |
| G1 | Tyres | | | | | | |
| G2 | Rubber bands | | | | | | |
| | | | | Weight 重量(kg) | | | |
| Total Weight: | | | | | | | |

MICRO-DEBRIS DATA CARD (1mm - 1cm)

| CODE | PLASTIC | TALLY(III) | TOTAL | CODE | PLASTIC | TALLY(III) | TOTAL |
|------|-----------------------------|------------|-------|------|-----------------------|------------|-------|
| I1 | Plastic pellets | | | D4 | Medical vials | | |
| I2 | BB gun balls | | | D5 | Glass fragments | | |
| I3 | Plastic - hard | | | D6 | Glass other (specify) | | |
| I4 | Plastic - wrappers and film | | | | | | |

| CODE | PLASTIC | TALLY(III) | TOTAL | CODE | PLASTIC | TALLY(III) | TOTAL |
|------|-----------------|------------|-------|------|-------------------|------------|-------|
| J1 | Glass fragments | | | J3 | Paper fragments | | |
| J2 | Metal fragments | | | J4 | Non-plastic other | | |

| COMMENTS | SUGGESTIONS |
|----------|-------------|
| | |

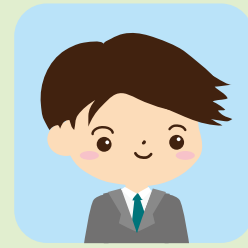
Stakeholder Introduction (for Discussion 1, F.1-6 students)

Please cut and distribute this information to the students, according to their stakeholder roles, before the start of Discussion 1.



► Environmental groups

Using Lap Sap Wan as an example, we hope to raise public concern about Hong Kong's serious marine litter problem. The enormous amount of litter at the site, particularly non-biodegradable plastics, not only affects the scenery but also poses multiple threats to the marine ecology (e.g. entanglement and ingestion). The litter also may cause potential health risks to humans. We should consider the long-term impacts of marine litter, and regardless of whether you are a consumer or a producer, we should all take responsibility for conserving our environment. The government also needs to step up inspection of other remote coastal areas and work out more effective long-term strategies and solutions to tackle this problem.



► An officer from the Inter-departmental Working Group on Clean Shorelines

In 2015, we identified Lap Sap Wan as one of the 27 priority sites prone to litter accumulation. However, because of its geographical constraints, on-site cleaning is restricted – occurring only between May and August each year. Different government departments (namely the FEHD and the MD) cooperated to begin cleaning the bay in May 2015, and within three months most of the accumulated marine litter had been cleared from the site. We will continue to step up our efforts to keep our shorelines clean, and we call on the public to join us and various organisations and local groups to keep litter out of Hong Kong's marine environment.

Clean Shorelines website:

http://www.epd.gov.hk/epd/clean_shorelines/index-2.html

FEHD = Food and Environmental Hygiene Department

MD = Marine Department

Government press release regarding Lap Sap Wan:

<http://www.info.gov.hk/gia/general/201507/28/P201507280729.htm>

Clean Shorelines website:

http://www.epd.gov.hk/epd/clean_shorelines/index-2.html



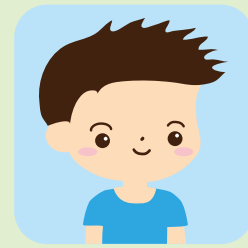
► A scientist

We are hard at work trying to discover the full extent of the impacts that marine litter has on our marine ecology. We are also trying to understand how marine litter is distributed and the differences between the various litter materials. To respond to the marine litter problem, some scientists are inventing machines that will help clean the world's oceans, while others are focusing on marine litter prevention and are inventing biodegradable materials that will eventually replace the materials we are currently using (e.g. plastic).



► The fishing community

The sea is like a home to us – we live, work and sleep there. The increase in marine litter potentially decreases the productivity of the fishery, and this directly affects our income. Marine litter like discarded fishing gear can also entangle boat propellers, leading to maritime incidents and accidents. On the other hand, it is difficult to avoid mishaps, and materials like polystyrene boxes and fishing gear do get knocked off the boat and become marine litter from time to time, especially under adverse weather conditions. Some fishermen may intentionally discard materials into the sea because it's "more efficient", but I understand that not all materials are biodegradable and I try to spread this message to my fellow fishermen.



► The general public

I don't think anyone wants to see marine litter on our shorelines or floating in the sea, but Lap Sap Wan is so remote that most people never even go there. Personally I don't think I have contributed to the marine litter that has accumulated here, but I do think that the government should keep monitoring the site and increase the frequency of clean-ups to keep this site and our shorelines clean.



► A marine creature (oyster)

Lap Sap Wan is located near Hong Kong's only marine reserve (Cape D'Aguilar). Like most marine creatures, we cannot tell the difference between tiny pieces of plastic and the food we usually eat, like plankton. But recent studies show that when we consume these pieces of plastic, we produce fewer and less healthy offspring, as they affect our reproductive systems. If the number of plastic pieces in the sea continues to increase, more and more of us will be affected. We hope that people will help us – and themselves – by using less plastic and being much more careful about waste disposal.

Stakeholder Information Pack (for Discussion 2, F.4-6 students)

This section includes several local and global examples of solutions to the marine litter problem that stakeholders are developing or have already implemented. These examples will provide the students with more background information on the stakeholders they are representing. Please cut and distribute this information pack to students, according to their stakeholder roles, before the start of Discussion 2.

*Please note: the "marine creature" role is not included as a stakeholder in this discussion.

► Environmental Groups

• Collaborative Research

- To understand the global impacts of plastic pollution, the 5 Gyres Institute studies the five subtropical gyres by sailing through them. The Institute organizes research expeditions, inviting scientists, journalists and other sailors to work with them to conduct experiments before returning to their communities, inspired and engaged in the promotion of solutions. For more information please visit: <http://www.5gyres.org/what-we-do/>

- In Hong Kong in 2014, several environmental groups joined forces to form a two-year collaborative citizen science conservation project called Coastal Watch. The project saw participants conduct marine litter and ecological surveys on seashores, in coastal waters and underwater. The data collected was then analysed and used to help develop long-term solutions to the marine litter problem, educate a broad segment of the Hong Kong public about our marine environment and inspire and mobilize these people to take positive action to shape the future of the marine environment.

• Education

A number of environmental groups have developed a wide variety of educational materials, programmes, infographics, leaflets, exhibitions, seminars and more with the aim of educating people from all ages and backgrounds about the marine litter issue, and how we can prevent it by tackling the problem at its source.

• Organizing clean-up activities

Globally, there are many environmental groups that organize shoreline clean-up activities. These provide an immediate positive effect by taking litter off coastlines and out of marine ecosystems. For example: Ocean Conservancy mobilizes the annual International Coastal Cleanup – the world's largest volunteer effort to clean waterways and oceans. This event is also held in Hong Kong.

• Engaging everyone in solutions and promoting best practices

- The 5 Gyres Institute is urging 16 major cosmetic companies to remove microbeads from their products.

- The Trash Free Seas Alliance® by Ocean Conservancy is focused on achieving tangible conservation benefits in the effort to reduce the impact of marine debris on our ocean by working with a diverse group of stakeholders.

► The Inter-departmental Working Group on Clean Shorelines

• Monitoring In Hong Kong

- The AFCD (Agriculture, Fisheries and Conservation Department) deploys wardens on a daily basis who patrol marine parks and marine reserves – both by land and by sea – and provide advice to visitors and take law enforcement action when needed.

- The cleanliness of the sea is rated on a scale with five levels – Good, Satisfactory, Fair, Unsatisfactory and Poor – based on the appearance of the area. Contractors appointed by the Marine Department are required to maintain their service areas above the Satisfactory level between 0800 and 1800 hours.

- In November 2012, the Inter-departmental Working Group on Clean Shorelines was set up to review and formulate measures which would improve the cleanliness of Hong Kong shorelines.

For more information please visit: http://www.epd.gov.hk/epd/clean_shorelines/node/39.html

• In Europe

- A piece of European legislation called the Marine Strategy Framework Directive is a legally binding instrument through which EU member states can assess, monitor, set targets and achieve an acceptable environmental status with regard to marine litter. An assessment of the Directive's progress and a list of improvements to be made will be carried out in 2020.

For more information please visit: http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm

• Banning (microbead legislation)

An increase in the number of published pieces of research and reports has raised awareness of the effects of microbeads at the highest levels. Recently, this resulted in the U.S. government introducing the Microbead Free Waters Act (2015), which bans the sale of personal care products containing plastic microbeads. Other countries (including Canada, Australia, and several European countries) are also on track to phase out or ban plastic microbeads. In the U.S., this ban gives a specific timeframe for manufacturers to phase out microbeads from their products – between 2017 and 2019. In Canada, microbeads will be added to the List of Toxic Substances, allowing the government to regulate microbeads under the Canadian Environmental Protection Act.

For more information please visit: <http://www.theguardian.com/us-news/2015/dec/08/us-to-ban-soaps-other-products-containing-microbeads>

*Microbeads: tiny plastic particles that are added to personal care products sold around the world. These plastics are barely visible to the naked eye and will flow straight from the bathroom drain to the sewer system, and then into the sea.

• Cleaning up (in Hong Kong)

On average, the Hong Kong government collects more than 15,000 tonnes of marine refuse every year (including natural debris). The LCSD (Leisure and Cultural Services Department) is responsible for the cleanliness of all gazetted beaches in Hong Kong; the MD (Marine Department) collects floating refuse from Hong Kong waters and keep the cleanliness of the sea above the Satisfactory level; the AFCD (Agriculture, Fisheries and Conservation Department) is responsible for marine parks and reserves; and the FEHD (Food and Environmental Hygiene Department) is responsible for litter collection in the remaining coastal areas.

For more information please visit: http://www.epd.gov.hk/epd/clean_shorelines/node/39.html

Name: _____

Date: _____

Marine Litter Introduction Worksheet

Please circle the correct answer.

- Q1. Humans can introduce marine litter into the marine environment intentionally or unintentionally, and this litter can be transported thousands of miles away from its original starting point. How is the litter transported?
- A. Ocean currents B. Wind C. Both
- Q2. Is marine litter mainly sourced from land-based or sea-based activities?
- A. Land-based B. Sea-based C. Half and half
- Q3. Which of the following objects takes the longest amount of time to decompose in nature?
- A. Fishing line B. Plastic bottles
C. Aluminum cans D. Plastic bags
- Q4. Which item or items of marine litter have been mistakenly eaten by marine animals?
- A. Fishing net B. Shoe
C. Cigarette lighter D. All of the above
- Q5. According to scientists, how many out of 135 sea bird species were reported to have ingested plastic between 1962 and 2012?
- A. 60 B. 80
C. 120 D. 130

Marine Litter Introduction Worksheet (Teacher version)

| Questions | Facts |
|---|---|
| <p>Q1. Humans can introduce marine litter into the marine environment intentionally or unintentionally, and this litter can be transported thousands of miles away from its original starting point. How is the litter transported?</p> <p>A. Ocean currents B. Wind C. Both</p> | <p>Refer to Chapter 1 – Affected Areas</p> |
| <p>Q2. Is marine litter mainly sourced from land-based or sea-based activities?</p> <p>A. Land-based B. Sea-based C. Half and half</p> | <p>Refer to Chapter 1 – Sources of Marine Litter</p> |
| <p>Q3. Which of the following objects takes the longest amount of time to decompose in nature?</p> <p>A. Fishing line B. Plastic bottles C. Aluminum cans D. Plastic bags</p> | <p>Refer to Chapter 1 – Decomposition Rates of Marine Litter diagram</p> |
| <p>Q4. Which item or items of marine litter have been mistakenly eaten by marine animals?</p> <p>A. Fishing net B. Shoe C. Cigarette lighter D. All of the above</p> | <p>It is possible for any marine litter item to be mistakenly eaten by marine animals.</p> <ul style="list-style-type: none"> • Plastic fragments and nylon ropes – Sea turtle (A dead sea turtle was discovered in Pak Lap in October 2015) • Micro-plastics, cigarette lighters – Sea birds • Food packaging, fishing nets, car engine parts, plastic buckets – Sperm whales • Pots, shoes – Killer whales |
| <p>Q5. According to scientists, how many out of 135 sea bird species were reported to have ingested plastic between 1962 and 2012?</p> <p>A. 60 B. 80 C. 120 D. 130</p> | <p>A group of scientists performed a spatial risk analysis using predicted debris distributions and the ranges of 186 seabird species to model the potential marine debris exposure for these birds. After using published data on plastic ingestion by seabirds, they adjusted the model and found that eighty of 135 (59%) bird species reported in studies conducted between 1962 and 2012 had ingested plastic. Within those studies, an average of 29% of the individual birds had plastic in their gut. Scientists also used the model to predict levels of risk across seabird species on a global scale. The highest area of expected impact occurred in the Southern Ocean, on the boundary with the Tasman Sea between Australia and New Zealand. They predicted that plastic ingestion will increase in seabirds, and that it will reach 99% of all species by 2050.</p> <p>http://www.pnas.org/content/112/38/11899</p> |

► Scientists

• Invention of environmentally friendly materials

- Agar-derived Plastic

A new Japanese design company, AMAM, is developing a more eco-friendly way of packaging goods instead of using plastic. Agar Plasticity is derived from agar (a gelatinous material found in red marine algae), and this material can provide cushioning for any packaged item. As agar plastics originate from the marine environment, if these plastics end up back in the oceans, they will break down easily and cause no harm to the marine environment.

For more information please visit : <https://www.good.is/articles/agar-plasticity-amam-araki-maetani-muraoka-packaging>



©AMAM

- Edible Cutlery

The founder and Managing Director of Bakey's Food Private Limited, Narayana Peesapati has developed edible cutlery in the hopes that it will replace plastic cutlery. Made from a mix of jowar (sorghum), rice and wheat flour, this cutlery does not get soggy – even if placed in water or liquid food products. The cutlery items begin to soften only after around 10-15 minutes – and they can even be eaten at the end of a meal. They also decompose in a very short time – within five or six days.

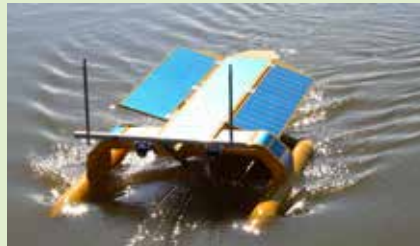
For more information please visit : <http://www.thebetterindia.com/30465/edible-cutlery-in-india/>



©Bakey's Food Private Limited

• Invent devices to help clean our seas

Created by a team of inventors in Sussex, England, the SeaVax is a solar and wind powered ship that can suck up plastic waste. This invention is currently in the prototype phase, and once built, the vessel will be around 144 feet long and fully autonomous. For more information please visit : <http://ecowatch.com/2016/02/19/seavax-vacuum-ocean-plastic/>



©seavax

• Research on the sources and impacts of marine litter

In recent years, more literature and research studies related to marine litter have begun to emerge. Further and more comprehensive scientific research will allow us to understand the sources and impacts of marine litter more clearly.

► The Fishing Community

• European initiative involving the fishing industry (“Fishing for Litter”)

KIMO's Fishing for Litter is a simple initiative that aims to reduce marine litter in the North Sea by involving one of key stakeholder – the fishing industry. KIMO provides fishing boats with large rubbish bags in which to put any marine litter that fishing boat workers might accidentally collect in their nets. When full, these bags are then transported back to the land and deposited safely on the quayside where they are then collected for disposal, rather than simply throwing the litter back over the side.

To find out more about this initiative please visit : <http://www.kimointernational.org/FishingforLitter.aspx>

► The General Public

- “10 ways to Reduce Marine Litter in Hong Kong” infographic poster.

Recommended sources

• Introduction on Marine litter problem

- Two Minutes on Oceans with Jim Toomey: Marine Litter- <https://www.youtube.com/watch?v=qReyBmjIT90>
- Preventing our Oceans from Becoming Dumps, UNEP- <https://www.youtube.com/watch?v=uCXEHrmEYpM>
- TRASH TALK Special Feature, NOAA- <https://marinedebris.noaa.gov/discover-issue/trash-talk>
- The Dangers of Marine Debris to the Albatross- Hawaii: Message in the Waves, BBC- <https://www.youtube.com/watch?v=g6gaAjAEkog>
- Gyre: Creating Art from a Plastic Ocean, National Geographic- <https://www.youtube.com/watch?v=cr5m8b28eqA>
- 鏗鏘集：近看海洋, RTHK- https://www.youtube.com/watch?v=3qkgEp4_dBo

• Microbeads

- Story of Microbeads (塑膠微粒的故事), The Story of Stuff Project- <https://www.youtube.com/watch?v=pmWip62E1b0>
- How plastic microbeads are causing big problems- <http://www.5gyres.org/microbeads>

• Coastal Watch Project

- Coastal Watch Project YouTube Channel- <https://www.youtube.com/channel/UC87crBCM7HsDnGu4m-gwdVA>
- Full report of “Coastal Watch - Turning the Tide Against Marine Litter” survey report- <https://wwf.hk/cowfinalreport-eng>

• Lap Sap Wan

- Government press-release- <http://www.info.gov.hk/gia/general/201507/28/P201507280729.htm>
- Coastal Watch (Chi)- <https://wwf.hk/lapsapwansurvey-chi/>
- Coastal Watch (Eng)- <https://wwf.hk/lapsapwansurvey-eng/>
- Apple Daily- <http://hk.apple.nextmedia.com/news/art/20150504/19135042>
- Go Green- <http://www.weekend.com/tag/垃圾灣>
- Wenweipo- <http://news.wenweipo.com/2015/05/03/IN1505030054.htm>

• Global Flows of plastic packaging materials in 2013 diagram

- The new plastics economy- Rethinking the future of plastic, Ellen MacArthur Foundation (Figure 4)

• Plastic Oceans

<http://www.plasticoceans.org>

For data submission and support, please contact coastalwatch@wwf.org.hk