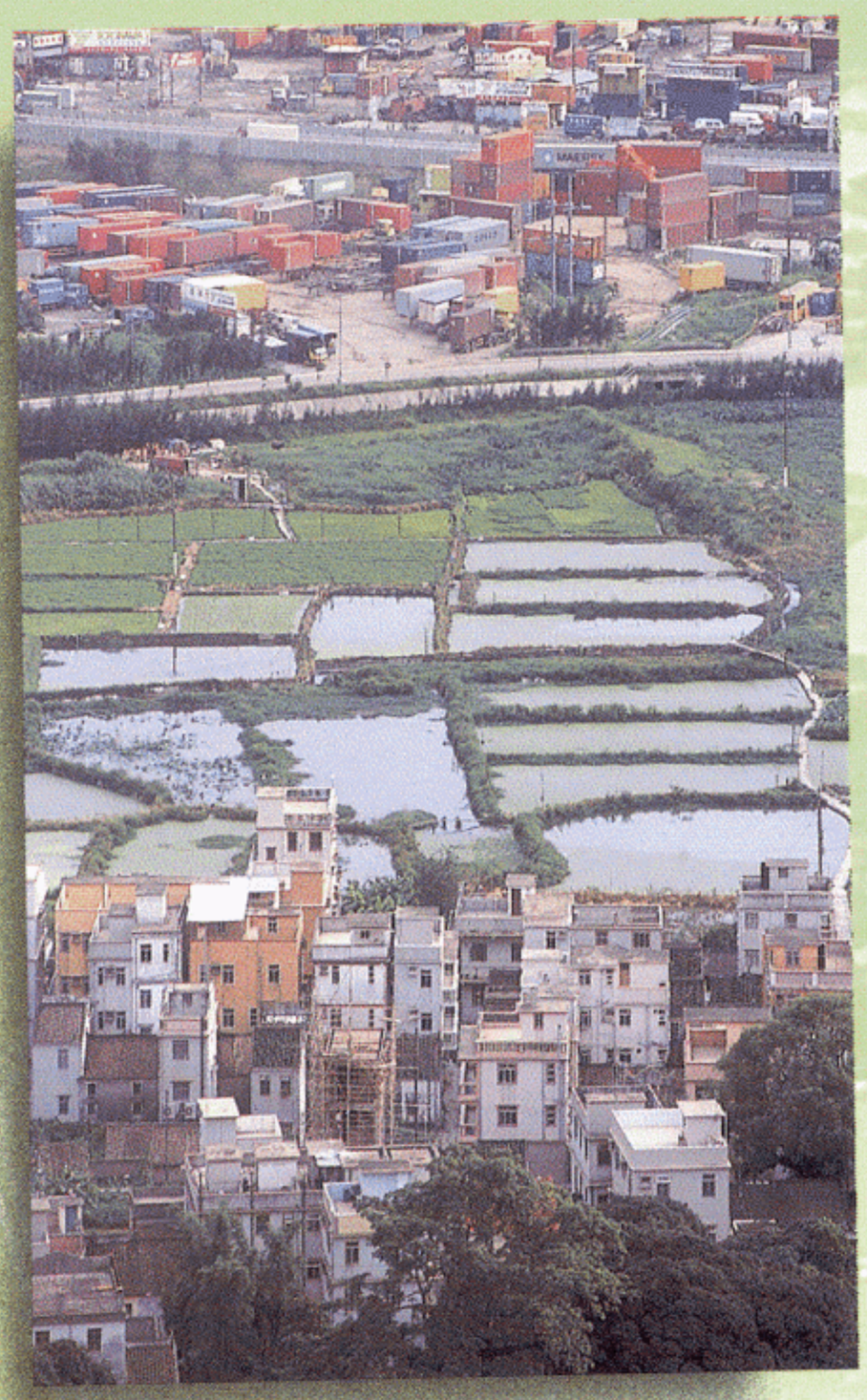
世界自然（香港）基金會

World Wide Fund For Nature Hong Kong

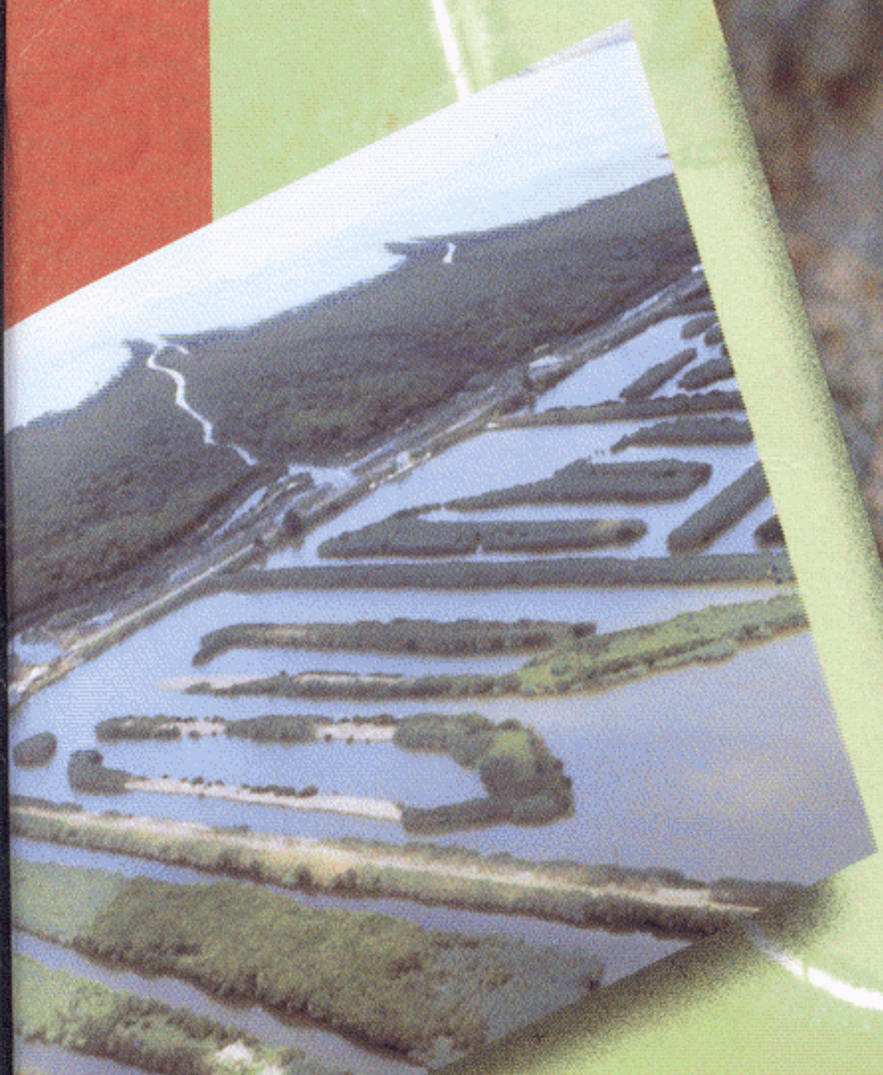


米埔中學老師教材套

Mai Po Secondary Teachers' Pack

教師手冊

Teachers' Guide Book



贊助 Sponsor:

CONTENTS

PREFACE

The Mai Po Marshes Wildlife Education Centre and Nature Reserve is managed by the World Wide Fund For Nature Hong Kong for the people of Hong Kong. Every year, over 40,000 visitors, many in school groups, tour the reserve and its educational facilities. As information about the reserve grows, this is translated into educational packs which help teachers to understand and to explain to their students, the important and interesting features of Mai Po.

This is the educational pack and it provides teachers and students with new information on and ideas for how to interpret the unique ecosystem of Mai Po, both there and in the classroom. In the pack are five worksheets each with different exercises. They include ideas for a general visit to the reserve, the ecology of Mai Po's mangroves, Land use around the reserve, Water pollution of Mai Po and the Diversity of life to be seen there. The pack also has explanation as to how to undertake the exercises and there are also teacher's notes to help understand and discuss the answers given by the students to the various question asked.

Hong Kong needs such informative and questioning worksheets and the World Wide Fund For Nature Hong Kong is committed to producing such materials for local schools. This pack has been produced with the generous assistance of a grant from the DFS Charitable Trust and for this WWF HK is extremely grateful.

The pack will be distributed to all secondary schools in Hong Kong free, and with the continued support of the Education Department of the Hong Kong Government. Again, WWF HK is grateful for this department's support of its educational programme and objectives.

I hope the pack will be used, in conjunction with the increasing volume of information about Mai Po, by teachers and students so as to broaden their understanding of and appreciation for this unique Hong Kong wetland.

Professor Brian Morton

Chairman

WWF HK Education Committee

1 July 1997

INTRODUCTION

Environmental education is a process concerned with understanding the environment, enhancing skills and developing values and attitudes necessary for participation in improving the quality of the environment.

Environmental education consists of, in various degrees, three inter-related components:

1. Education about the environment

Education about the environment chiefly focuses on cognitive aspects. It is concerned with the acquisition of skills, knowledge and understanding of the environment. It is crucial to perception and judgement and is a necessary facet of environment education.

2. Education in the environment

Education in the environment refers to the processes of education conducted outside the classroom in the environment. It provides direct contact with the environment which is a stimulating and relevant situation for acquiring knowledge developing skills and stimulating interest.

3. Education for the environment

Education for the environment stresses the development of an informed concern for the environment. It goes beyond the acquisition of skills and knowledge, and involves the values and judgement which lead to a personal environmental ethic. Through education for the environment we seek to educate pupils so that their actions will be directed positively to the development of a sustainable earth and the considerate use of the environment, now and in the future.

Although Hong Kong has one of the strongest economies in Asia, the SAR suffers from serious environmental problems, e.g., air and water pollution, and loss of countryside through un-coordinated developments. There is, therefore, an urgent need to increase the awareness of the general public and the primary and secondary school students in Hong Kong about the value of the countryside and coastal waters and to protect these areas before they are lost.

WWF Hong Kong recognised the need for promoting environmental education when first planning the Mai Po Marshes Wildlife Education and Nature Reserve in 1983. The education programme at Mai Po is designed to fit in with the schools' biology and geography syllabuses, and allows students to learn in the open air and develop their observational skills.

The Mai Po Secondary School Educational Study Visit programmes aim to use the Mai Po Marshes Nature Reserve to enhance students' INTEREST IN, UNDERSTANDING OF and CONCERN FOR their environment. The aim of this pack is to add value to the visit programme by helping teachers to provide activities before and after the field trip to Mai Po.

WHAT ARE THE OBJECTIVES OF THE TEACHING PACK?

- Use Mai Po as a case-study to arouse student's awareness of the need for habitat conservation in Hong Kong.
- To provide useful reference materials and facilitate teachers to integrate environmental education into the school curriculum.
- To help teachers organize pre-visit preparation and/or follow up teaching activities before and/or after bringing their students to the Mai Po Marshes.
- To enhance students' interest in, understanding of and concern for their environment.
- To provide reference information about the Mai Po Marshes Nature Reserve.
- To provide reference information about the WWF Hong Kong Secondary School Visit Programme at the Mai Po Marshes.

WHAT IS INSIDE THE PACK?

- One folder with five sets of factsheets and worksheets on different themes
- One Teachers' Guide Book

HOW TO USE THE PACK

Read all the five sections. Choose the topic which best fits your students.

If you would like to apply for Mai Po visit

If you have no plan to join the Mai Po visit

Telephone to our Centre Assistant on 2471 8272 to confirm the visit date.

If you would like to apply for Mai Po visit

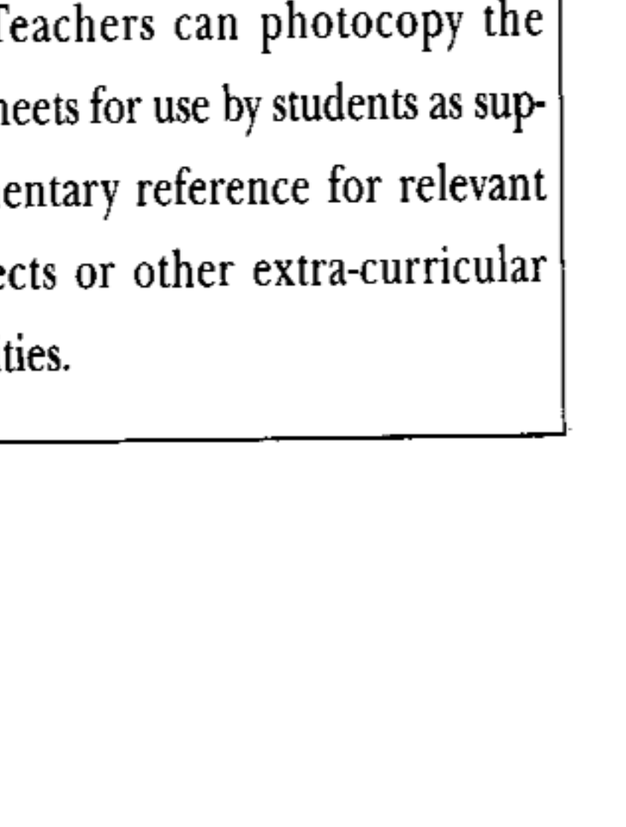
If application is unsuccessful

Fill in the application form for the Mai Po secondary school visit programme.

Teachers can photocopy the factsheets for use by students as supplementary reference for relevant subjects or other extra-curricular activities.

1. Copy the factsheets and worksheets for your students.
2. Give a brief introduction to your students before the field trip.

Join the educational study visit which will be guided by experienced WWF HK Education Officers. Encourage your students to fill in the worksheets during the field trip.



1. Discuss the questions posed in the worksheets with your students on the basis of the suggested answers.
2. Carry out follow-up activities at school.

BOOKING PROCEDURE

Application forms for the Mai Po visit are normally sent to schools through the Hong Kong Government Education Department school circular at the start of each academic year.

Teacher gives a phone call* to WWF HK staff to arrange the date for the visit.

If application is successful

Teacher sends in the completed application form by fax** or by mail***.

Teacher receives:

1. Notification letter
2. Confirmation letter
3. Waiver and Indemnity Form
4. Acknowledgement Form

Teacher returns:

1. Completed Confirmation letter
2. Waiver and Indemnity Form
3. Acknowledgement Form

Teacher receives:

1. Reminder letter
2. Name lists form
3. Student visitor guidelines

* Telephone number: 2471 8272

** Fax number: 2471 0325

*** Address: WWF Hong Kong,
Peter Scott Field Studies Centre,
Mai Po Marshes Nature Reserve,
Mai Po, Yuen Long, N.T.

Teacher brings along the two completed name list forms on the visit date.

- **Owing to the limited annual school visit quota, all Mai Po school visit application will be handed in a first-come-first-serve basis.**
- **Please note that the application procedures and application form are subject to review annually. Please refer to the new circulated at the start of each academic year for updated visit information.**

BACKGROUND INFORMATION

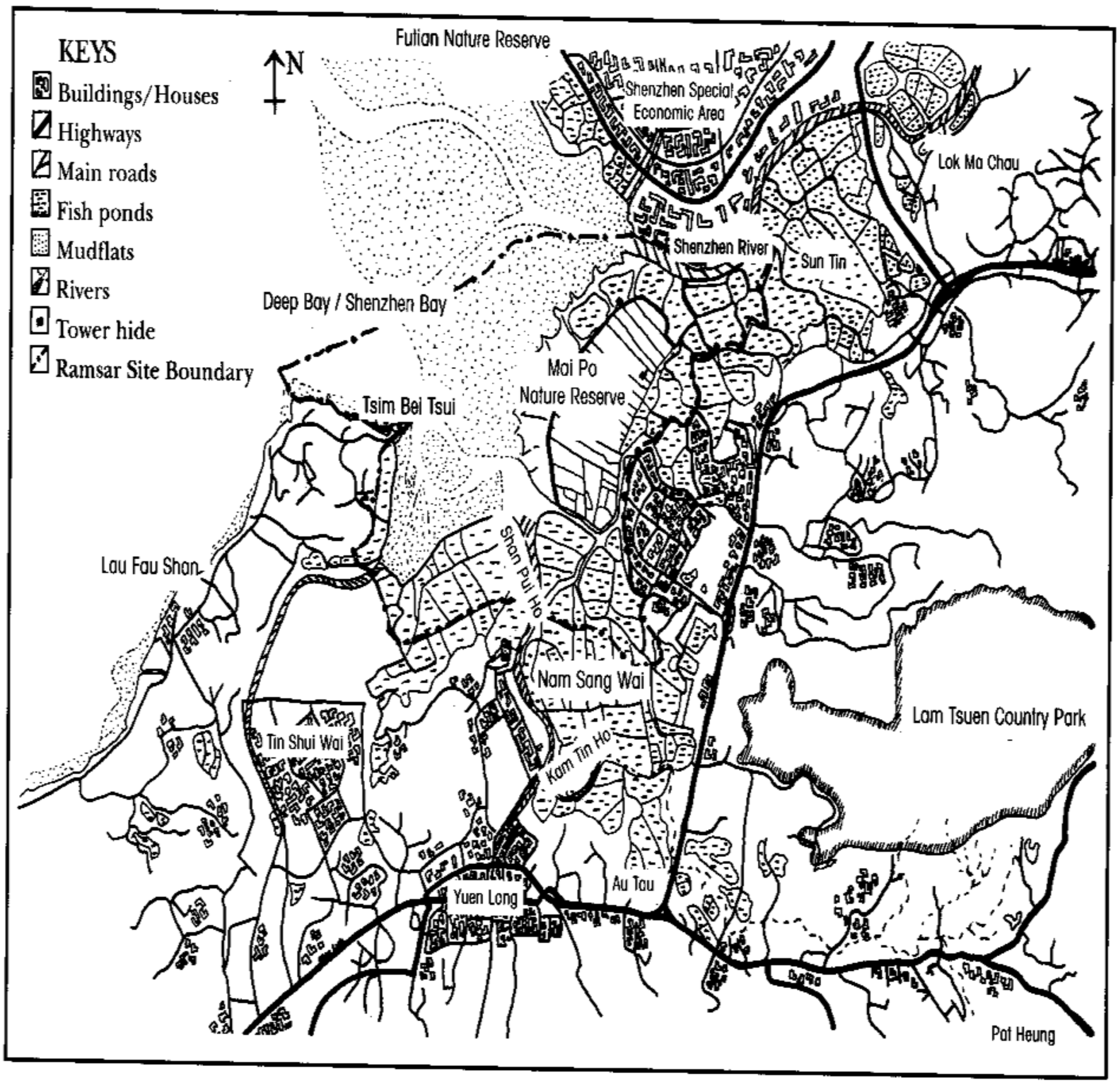
1. MAI PO MARSHES NATURE RESERVE

The Mai Po Marshes, together with the mudflat around Inner Deep Bay make up the largest area of wetland remaining in Hong Kong. The marshes comprise an extensive area of mudflat, mangroves, *Gei wais* (traditional shrimp ponds) and fish ponds.

The marshes support a rich diversity of plants and animals. At least 336 species of birds, 400 species of insects, 90 species of marine invertebrates, some of which are new to science and over 50 species of butterflies have been recorded. Mammals like Otters and Leopard Cats also occur there.

Seven out of the eight local species of mangrove grow around the edge of Deep Bay covering an area of 400 ha.. This is the largest stand in Hong Kong and the sixth largest in China.

Every winter over 65,000 waterbirds visit Deep Bay, including globally endangered species such as the Black-faced Spoonbill, Saunders' Gull and Dalmatian Pelican. With only an estimated 500 Black-faced Spoonbills remaining in the world, Mai Po is the wintering home for about 25% of its world population.



2. MAI PO SECONDARY SCHOOL VISIT PROGRAMME

"Studying in the environment" is an effective way of conducting environmental education. As the poem says, "You listen, you forget. You see, you remember." We make use of the Mai Po Marshes as an open-air classroom. It is an interesting place for students to find out more about the environment and is an ideal place for spreading the message of conservation.

The Mai Po secondary school visit programme aims to enhance students' INTEREST IN, UNDERSTANDING OF and CONCERN FOR the environment by using the Mai Po Marshes for case study.

Guidance:

The full educational study visit will be guided by an experienced WWF HK Education Officer.

Programme contents:

Our education officer will make use many inter-active teaching techniques to arouse the students' interest in and concern about the wetland through interpretation, discussion, observation, filling in worksheets, role play games or activities. Students will also have a chance to watch birds in the Mai Po bird watching hides and visit our Education Centre.

The duration of the trip is four hours.

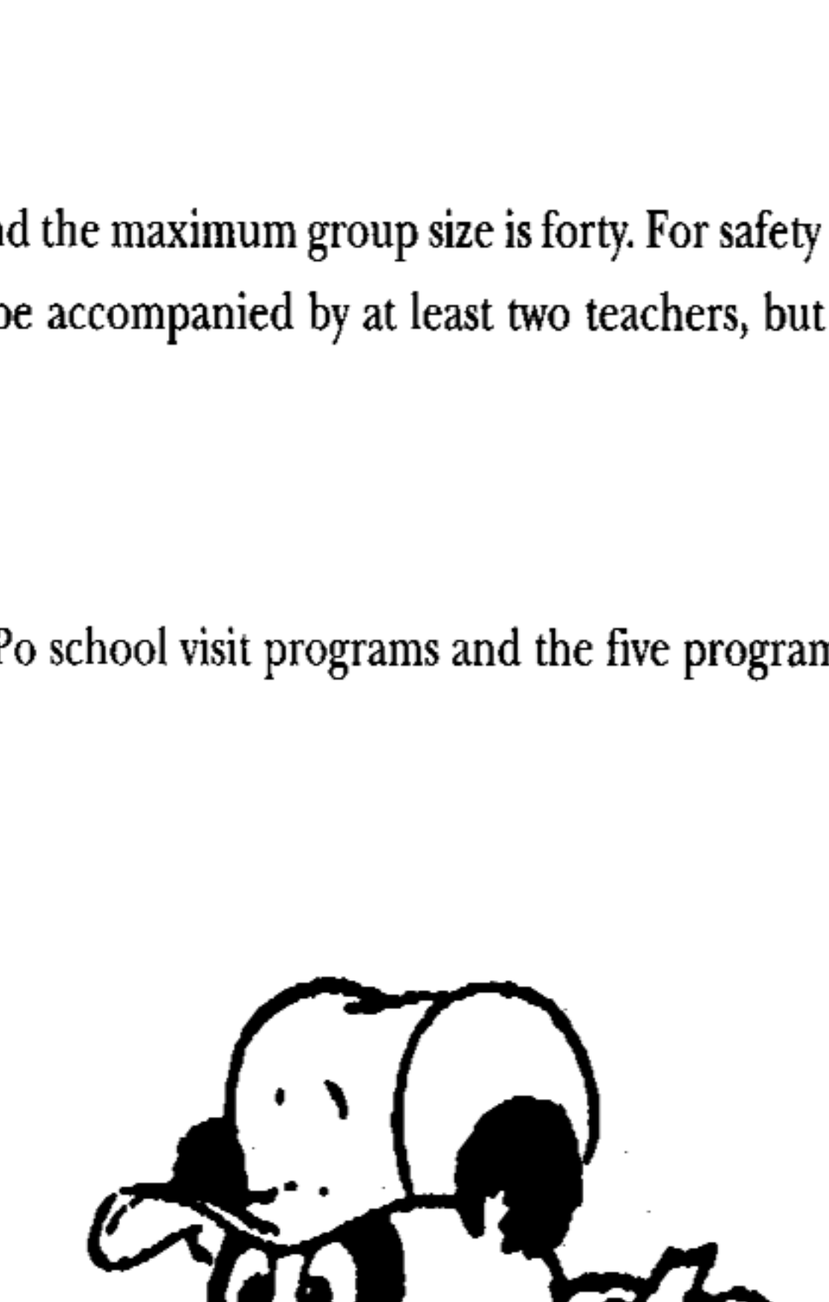
Group size:

Thirty students per group is recommended and the maximum group size is forty. For safety and discipline reasons, each group of students must be accompanied by at least two teachers, but not more than four.

Topics:

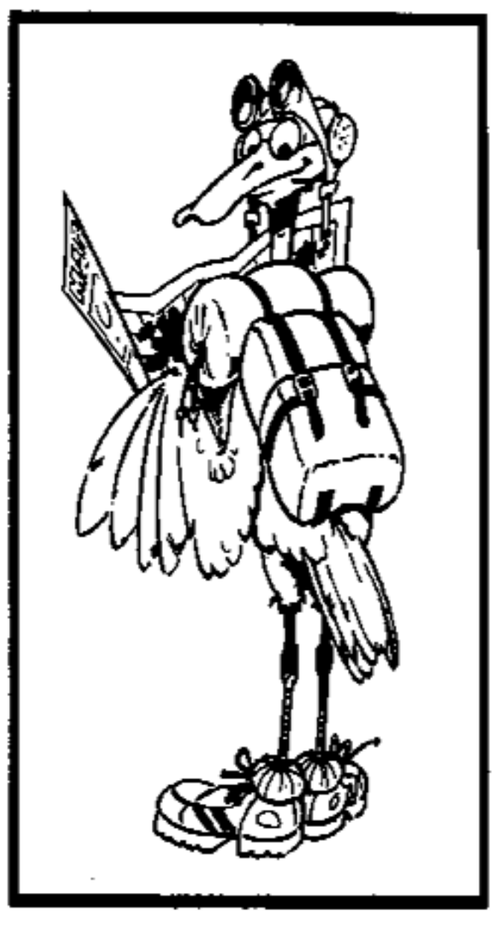
A thematic approach is adopted for the Mai Po school visit programs and the five programme main themes are:

1. **General Visit**
2. **Ecology of Mangroves**
3. **Land Use around Mai Po**
4. **Water Pollution in Mai Po**
5. **Diversity of Life**



ACTIVITY

GENERAL VISIT

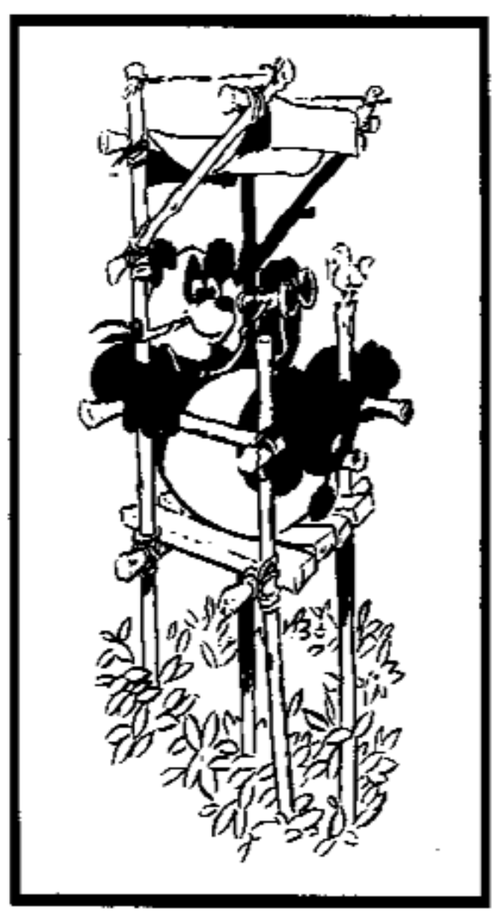


Level: Secondary One to Seven

Subject: Any subject

- To understand what wetlands are and that Mai Po and Deep Bay is a wetland.
- To understand the geographical and historical characteristics of the Mai Po Marshes and the surrounding areas.
- To understand that marshes support a variety of wildlife and how this is dependent upon the Marshes as well as upon each other.
- To understand how man benefits from, but threatens, the Marshes.
- To understand the existing measures being taken to conserve the Marshes.

ECOLOGY OF MANGROVES



Level: Secondary Four to Seven

Subject: Biology and Geography

- To understand what mangroves are and their ecological and economic importance.
- To study different species of mangrove plants at Mai Po.
- To study the adaptations of mangroves to conditions in tidal estuaries.
- To understand the effects of human activities on the mangroves at Mai Po.
- To promote awareness of and concern towards the conservation of mangrove forests worldwide.

LAND USE AROUND MAI PO

Level: Secondary Four to Seven

Subject: Geography

- To understand the different types of land uses in and around Mai Po, particularly the historical changes, the present situation and the current conflicts over land use in this region.
- To understand how people interact with the environment and their dependence upon it through the mechanism of land-use planning. This is Man-Land Relationships, as well as the specific problems that humans cause and the effects of these problems.
- To evaluate the possible benefits and harmful effects of different land uses upon Inner Deep Bay and to consider the efforts of Government in developing a policy with regard to land-use planning and enforcement of land-use regulations.
- To understand the importance of land-use planning.

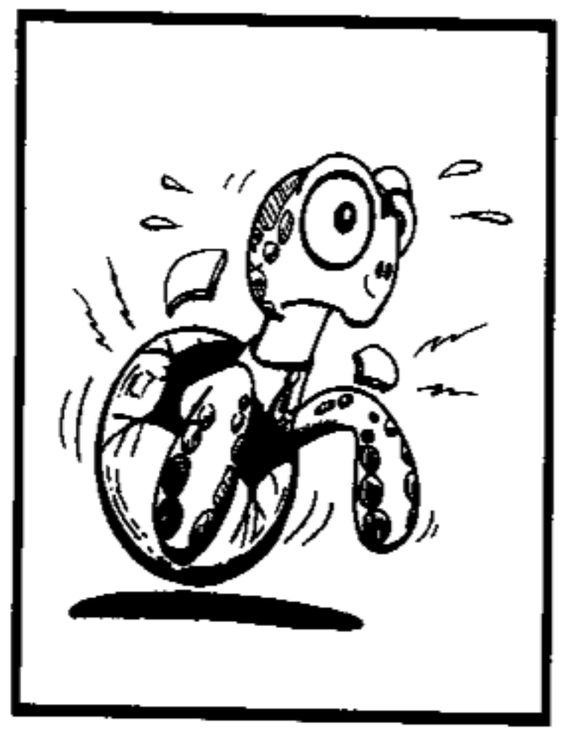
WATER POLLUTION IN MAI PO

Level: Secondary Six to Seven

Subject: Biology

- To understand the types and the sources of water pollution affecting the Deep Bay wetlands.
- To understand how water pollution affects the Deep Bay wetlands, the associated wildlife and people.
- To understand through demonstrations, some of the possible methods for monitoring the degree of water pollution.
- To understand possible methods for improving water quality and justify the existing measures of controlling water pollution in Deep Bay.

DIVERSITY OF LIFE



Level: Secondary One to Seven

Subject: Integrated Science and Biology

- To understand what biodiversity is and its value.
- To understand that the Mai Po and Deep Bay wetlands support a variety of habitats and wildlife.
- To understand how the wildlife in the Deep Bay wetlands are dependent upon the habitats and, in turn, upon each other.
- To understand that human activities are now affecting this biodiversity.
- To promote an understanding of the principles for conserving biodiversity.

GUIDELINES FOR SECONDARY SCHOOL VISITORS

TO ENSURE A FRUITFUL TRIP TO THE MAI PO MARSHES NATURE RESERVE, PLEASE NOTE THE FOLLOWING:

1. Please meet our Education Officer at 9:00 a.m. (morning session) / 1:00p.m. (afternoon session) at the Mai Po Peter Scott Field Studies Centre. If for some reason your group cannot arrive on time, please telephone us in advance on 2471 8272.
2. Two copies of the name list, with the students' and teachers' names and ID card numbers filled-in should be handed to our Education Officer on arrival.
3. The teacher(s) in-charge should photocopy the worksheets and the factsheets for the students before the visit.
4. Equip yourself properly. Please
   - Do not wear bright clothes.
   - Try to bring your own binoculars.
   - Put on walking shoes.
   - Bring waterproof clothing if rain is expected.
5. Follow the instructions of the Education Officer and other reserve staff so that your group will learn more during your visit:
   - As the Nature Reserve is a restricted area, please keep your group together and follow the WWF HK Education Officer. Early departure is only possible with prior notice.
   - It is forbidden to hurt wild animals or pick plants in the Nature Reserve.
   - Keep quiet in the Nature Reserve.
   - No smoking, littering, starting fires, fishing and swimming in the Nature Reserve.
   - Do not interfere with private property.
   - In the birdwatching hides, please keep quiet so as not to disturb the wildlife. Doors and windows should be closed when you leave.
6. Only soft drinks and souvenirs are sold in the Nature Reserve.
7. Group Size:
   30 students and teachers per group is recommended and the maximum group size is 40. For safety and discipline reasons, each group must be accompanied by at least 2 teachers (but not more than 4).
8. The Mai Po school visit programme is sponsored by the Hong Kong Government Education Department for school teachers and students only. Any people out of these designation should not join the visit to the reserve without prior permission granted from the reserve staff.

If your group does not comply with any of the above conditions, WWF HK reserves the right to cancel your Entry Permit so that your group will have to leave the area immediately.

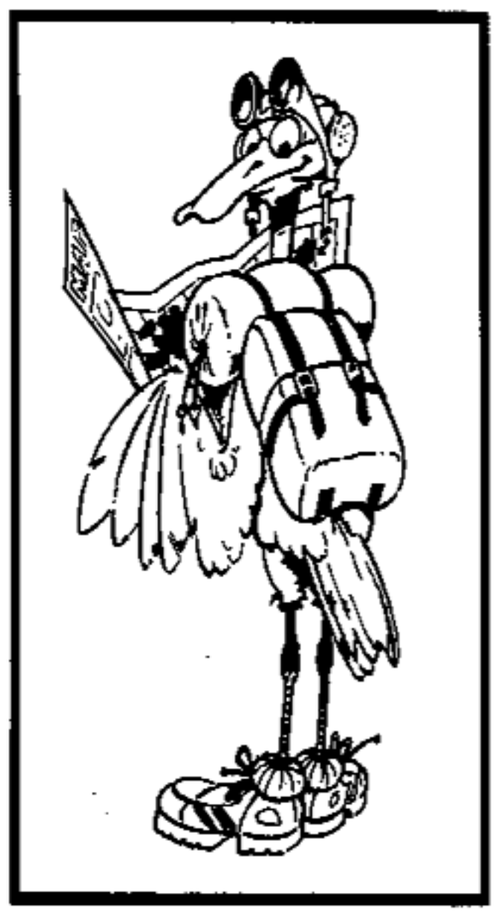
*** **Teacher(s) in-charge of the scheduled educational study visit should read these guidelines before the visit. For further enquiries, please contact our Centre Assistant on 2471 8272 (ENQUIRY TIME: Mondays to Fridays except public holidays; 12:00 noon to 1:00 pm and 2:00 pm to 4:00 pm daily).**

USEFUL TABLES

RECOMMENDED FOLLOW-UP ACTIVITIES FOR DIFFERENT TOPIC

GENERAL VISIT

Activity 1	Web of life
Activity 2	Recycle waste into toys
Activity 4	Newspaper clipping
Activity 7	Exhibition about Mai Po
Activity 8	Bark Autographs
Activity 9	Seed Bank
Activity 10	School campaign
Activity 11	Mai Po Volunteer



ECOLOGY OF MANGROVES

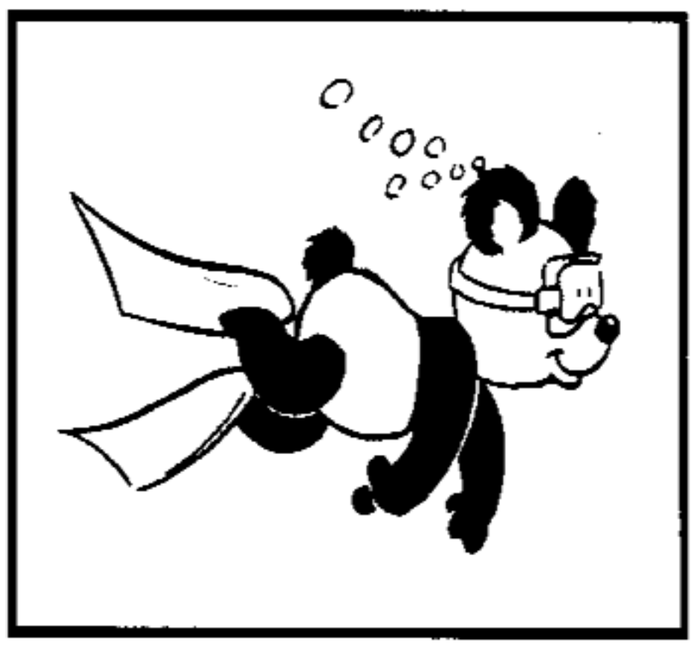
Activity 1	Web of life
Activity 3	Mangrove field visit
Activity 4	Newspaper clipping
Activity 7	Exhibition about Mai Po
Activity 10	School campaign
Activity 11	Mai Po Volunteer

LAND USE AROUND MAI PO

Activity 4	Newspaper clipping and essay writing
Activity 5	New and old town field visit
Activity 7	Exhibition about Mai Po
Activity 10	School campaign
Activity 11	Mai Po Volunteer

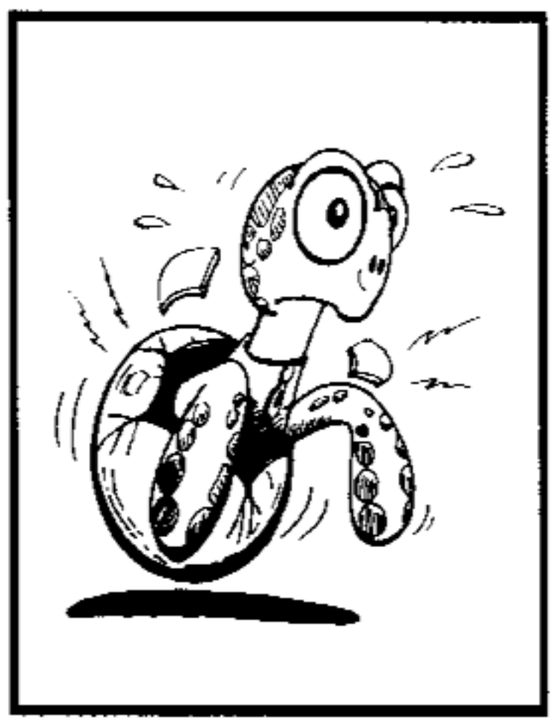
WATER POLLUTION IN MAI PO

Activity 4	Newspaper clipping
Activity 6	Debate
Activity 7	Exhibition about Mai Po
Activity 10	School campaign
Activity 11	Mai Po Volunteer



DIVERSITY OF LIFE

Activity 1	Web of life
Activity 4	Newspaper clipping
Activity 7	Exhibition about Mai Po
Activity 10	School campaign
Activity 11	Mai Po Volunteer



ACTIVITY	1	2	3	4	5	6	7	8	9	10	11
 GENERAL VISIT	✔	✔		✔			✔	✔	✔	✔	✔
 ECOLOGY OF MANGROVE	✔		✔	✔			✔			✔	✔
 LAND USE AROUND MAI PO			✔	✔			✔			✔	✔
WATER POLLUTION IN MAI PO			✔	✔			✔			✔	✔
DIVERSITY OF LIFE	✔		✔	✔			✔			✔	✔

FOLLOW-UP ACTIVITIES

ACTIVITY 1: WEB OF LIFE

Subjects: Integrated Science, Biology, Human Biology

Place: Indoors or outdoor

Group size: Entire class

Duration: 45 minutes

Materials: Chart paper, colour pencils, scissors, a ball of string

Objective: To demonstrate the interrelationship of various elements in the environment.

Preparation work:

1. Based on the list provided below, make a set of cards with the names of the animal / bird / plant / resource, etc.

1. Sun	2. Air	3. Water	4. Soil	5. Tree
6. Fruit	7. Algae	8. Fish	9. Eagle	10. Turtle
11. Insect	12. Frog	13. Mosquito	14. Leaf	15. Rat
16. Butterfly	17. Ant	18. Human	19. Grass	20. Earthworm
21. Seed	22. Fungus	23. Dragonfly	24. Spider	25. Snake
26. Mongoose	27. Kingfisher	28. Mangrove	29. Otter	30. Reedgrass
31. Egret	32. Bat	33. Shrimp	34. Duck	35. Crab
36. Oyster	37. Mudskipper	38. Root	39. Honeybee	40. Flower

2. The number of cards should be equal to the number of students. Cards can be made of chart paper cut into rectangular pieces of about 5 x 8 cm.

Activity:

1. Make the students sit in a circle and ask them to role play the element of the card.
2. Take a ball of string and give it to the student who holds the card of "Sun".
3. Let the Sun wind one end of the string around his/her finger and throw the ball to any aspect of nature he/she feels is related to her/him. For example, the "Sun" may pass it on to "Tree" because the "Sun" gives energy to plants or trees.
4. Let the student state the reason why he/she feels the sun is related to this element. The "Tree" then winds the string once around his/her finger after ensuring that it is not loose between the "Sun" and him/her. He/she then passes it to another aspect he feels related to, for example, "Fruit". The line of relationships continues as the string unwinds and begins to form a pattern which the students hold together.
5. Ask the students to see the web-like effect of the string. Then ask them to raise the web chest high. Let them hold it tightly so that if the web is pressed down it does not touch the ground.
6. Ask the students who play the role of a particular element, e.g. mangrove, to let go of the string. The other students then try to tighten the string. Then ask another role to let go of the string. Carry on this procedure until the whole web collapses.
7. Based on the game experience, ask the students what would happen if one of the elements was disturbed. Conclude the game by explaining to the students how inter-relationships exist and why they are important.

ACTIVITY 2: RECYCLE WASTE INTO TOYS

Subject: Art

Place: Classroom, home

Group size: Individual

Materials: A variety of used objects and materials normally thrown away.

Objectives: To demonstrate how waste material can be used to create new things and introduce the concept of waste recycling.

Activity:

1. A lot of materials that we throw away can be saved and used to make a variety of things. Such materials include newspapers, matchboxes, paper boxes, buttons, broken bangles, coconut shells, cardboard from old notebooks, waste cotton, bent nails, paper pins, clips, safety pins, dry leaves, used ballpen refills, sawdust, medicine bottles and caps.
2. Ask the students to bring some such materials for this activity. The students may be asked to make objects that they might find useful in their daily lives out of these used materials.

- ***Green art is just one way to reuse the refuse. However, green art cannot save the environment unless if we try to reduce waste.***

ACTIVITY 3: MANGROVE FIELD VISIT

Subjects: Integrated Science, Biology, Human Biology

Place: Outdoors

Group size: Entire class

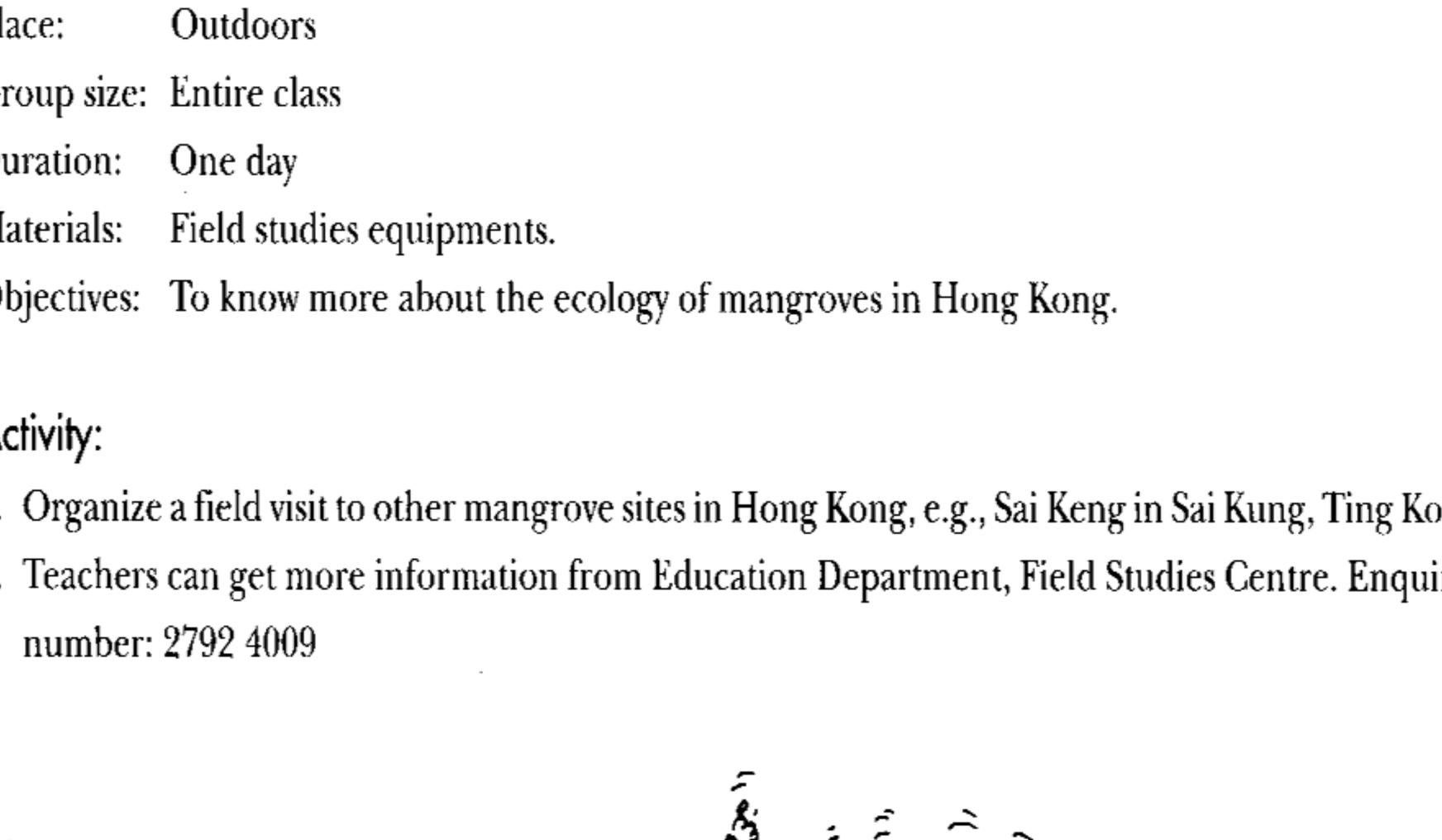
Duration: One day

Materials: Field studies equipments.

Objectives: To know more about the ecology of mangroves in Hong Kong.

Activity:

1. Organize a field visit to other mangrove sites in Hong Kong, e.g., Sai Keng in Sai Kung, Ting Kok.
2. Teachers can get more information from Education Department, Field Studies Centre. Enquiry number: 2792 4009



ACTIVITY 4: NEWSPAPER CLIPPING AND ESSAY WRITING

Subjects: Integrated Science, Language, Liberal study

Place: Classroom, Home

Group size: Individual or in groups

Duration: Flexible

Materials: Scrapbook, scissors, daily newspapers.

Objectives: To make a scrapbook of news items related to the environment.

Activity:

1. Ask students to start a scrapbook of clippings from local newspapers on reports related to environmental issues.
2. Set a time period to prepare the scrapbook.
3. Instruct students on how to maintain a scrapbook. Each report should be pasted neatly on a separate page. The name of the newspaper and the date of the report should be neatly written on the page. The book could be organized into sections such as wildlife, health, pollution, weather, population, natural disasters.
4. Scrapbooks could be exchanged. A display of the scrapbooks could be arranged.
5. Weekly discussions by students may be organized to discuss the newspaper reports and to select highlights.
6. Write an essay on selected environmental issue.

ACTIVITY 5: NEW AND OLD TOWN FIELD VISIT

Subjects: Geography

Place: Yuen Long , Tai Po, or any District with new and old town

Group size: Entire class

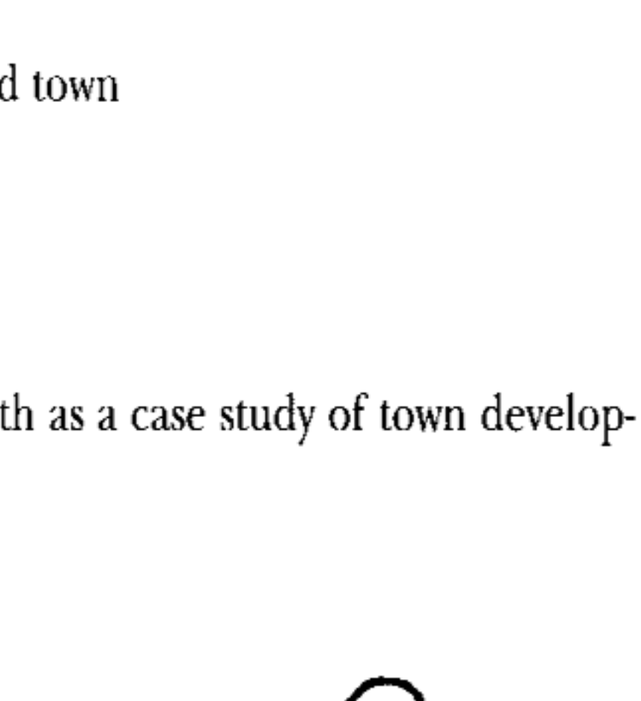
Duration: Half day

Materials: None

Objectives: Take a new town or any district you are familiar with as a case study of town development in Hong Kong and environmental quality.

Activity:

1. Organize a trip to a new town or any district you are familiar with, to study the developmental changes and environmental quality.



Reference: WWF HK Island House Field Studies trip in Tai Po Worksheets.

Remark: You may join the Tai Po New Town field study visit programme of the WWF HK Island House Conservation Studies Centre. Please telephone 2652 0285 for details.

ACTIVITY 6: DEBATE

Subjects: Geography, Biology

Place: Classroom

Group size: Entire class

Duration: One hour

Materials: None

Objectives: Let the students think about the land use development from different viewpoints.

Activity:

1. Divide the students into five groups.
2. Ask them to think of different viewpoints. They may be environmentalists, developers, local citizens, fishermen or Government.

   Teachers can refer to the *Wetland Conservation Discussion Pack* produced by WWF HK.
3. At the end, you can also ask for their own views.

ACTIVITY 7: EXHIBITION ABOUT MAI PO

Subjects: Extra-curricula activity

Place: In school

Group size: Entire class

Duration: Flexible

Materials: Information of Mai Po; exhibit panels

Objectives: To let more students in school recognize the importance of Mai Po.

Activity:

1. Those students who have visited Mai Po could play the role of pioneers to arouse the other students' concern to Mai Po. Ask this group of students to co-ordinate a one-week exhibition in the school ground.
2. The students can prepare the exhibition by themselves or you may borrow a set of exhibition panels about Mai Po Conservation from World Wide Fund For Nature Hong Kong. Please telephone WWF HK Island House Conservation Studies Centre on 2652 0285 for enquiries.

ACTIVITY 8: BARK AUTOGRAPHS

Subjects: Integrated Science, Art, Biology

Place: Outdoors where there are trees

Group size: Individual

Duration: One hour

Materials: Paper, crayons

Objectives: To learn that different trees have distinctive bark characteristics.

To use the senses of smell and touch, as well as observations, to study trees.

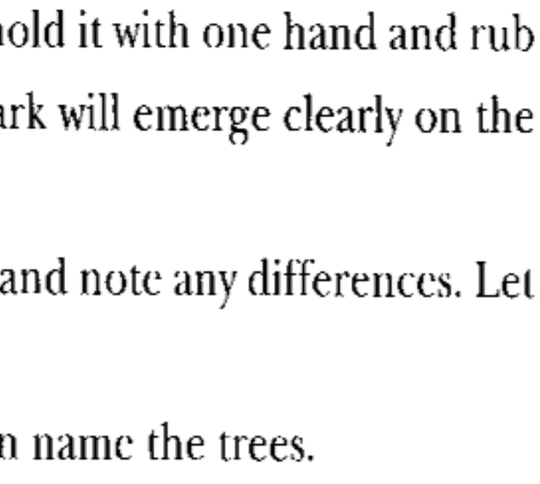
Activity:

1. Take the students to a place where a variety of trees grow. Let each student select a different tree.
2. Ask the students to feel the bark of the different trees and note differences. Barks of certain trees have characteristic smells and these may also help to differentiate between them. Ask the students to describe the smell of each bark, if any. It is not necessary to know the names of the trees at the beginning.
3. Now tell the students to place a sheet of blank paper on the bark, hold it with one hand and rub a soft pencil or a crayon on it with the other. The pattern of the bark will emerge clearly on the paper.
4. Ask the students to compare two or more prints prepared by them and note any differences. Let them find out the names of the trees.
5. Let them see prints made by other students and find out if they can name the trees.

Refernce

Teachers can refer to the *Tree Trunk Microhabitat* slide pack produced by WWF HK.

ACTIVITY 9: SEED BANK



Subject: Integrated Science, Biology

Place: Outdoors, indoors

Group size: Entire class

Duration: One hour

Materials: None

Objectives: To familiarize students with the large variety of seeds.

Activity:

1. Ask the students to collect different types of seeds (fruits, flowers, vegetables as well as cereals and pulses).
2. Ask the students to observe, study and classify the seeds according to shape, size, colour and the location from where the seeds were collected.
3. Initiate a discussion on the ways in which the classification can be done.
4. Students could create a "display corner" of the seeds after they properly classify and catalogue them.
5. Teacher also can ask the students to sow some of the seeds in small suitable containers with soil in the classroom itself. Observe seed germination. Compare how different seeds germinate, for example, time taken by different varieties of seeds to germinate, how the leaves and the roots develop.

ACTIVITY 10: SCHOOL CAMPAIGN

Subjects: Extra-curriculum activities

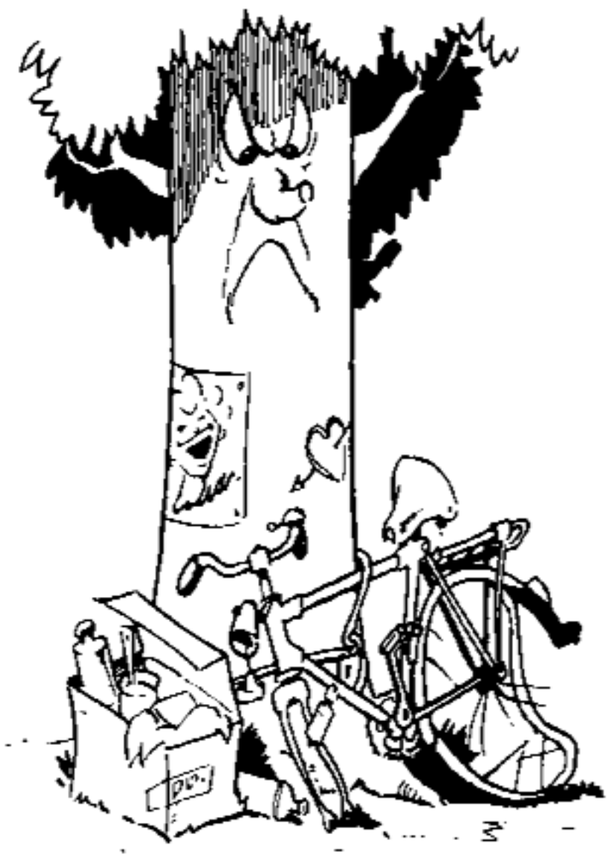
Place: In school

Group size: Entire class

Duration: One month

Materials: None

Objective: To understand the concept of recycling and sustainable use through participating in relevant activities. The rubbish can be used again to illustrate sustainable use of existing resources.



Activity:

1. To organize a campaign about recycling either aluminium cans or paper in school.
2. Telephone the Environmental Protection Department Recycling Hotline on 2755 2750 for information.

ACTIVITY 11: MAI PO VOLUNTEER

Subjects: Extra-curriculum activities

Place: Mai Po Marshes Nature Reserve

Group size: Individuals or a group

Duration: One day

Materials: None

Objective: Let the students participate in environmental protection work to help in conserving the environment and also to understand more about the Mai Po Marshes Nature Reserve.

Activity:

1. Obtain information on the Mai Po Volunteer work scheme by reading WWF HK publication - *About Life* or *Panda Club Post.*
2. Join the volunteer work scheme by calling the Mai Po Co-ordinator on 2471 6306.

WORKSHEET: SUGGESTED ANSWERS

GENERAL VISIT WORKSHEET

Exercise 1 – Fish pond and *Gei wai*

FISH POND	*GEI WAI*
Dragonfly	Dragonfly
Shrimp	*Gei wai* shrimp
Grey Mullet	Grey Mullet
Tilapia	Tilapia
Grass Carp	Cerbera
Guinea Grass	Mangrove
Reedgrass	Reedgrass
Egret	Egret
Cormorant	Cormorant
Kingfisher	Duck
Magpie	Kingfisher
Wagtail	Magpie

How do these organisms interrelate with each other to create the Mai Po and Deep Bay environment?

Plants, such as reedgrass and mangrove, provide the food source for organisms in the *Gei wai.* The leaves of these plants form detritus which is an important food source for shrimps, crabs and fishes. Other wildlife also feeds on the shrimps, crabs and fishes. The fishermen in Deep Bay can make money by fishing. These plants also provide feeding, resting and breeding places for the birds at Mai Po. For example, around 68,000 migratory birds wintered around the wetlands of Mai Po and Inner Dep Bay in 1996. At least 336 species of birds, over 50 species of butterflies, 44 species of dragonflies and over 140 species of plants can be found at Mai Po.

Exercise 2 – Where is Mai Po?

A. Shenzhen Special Economic Zone

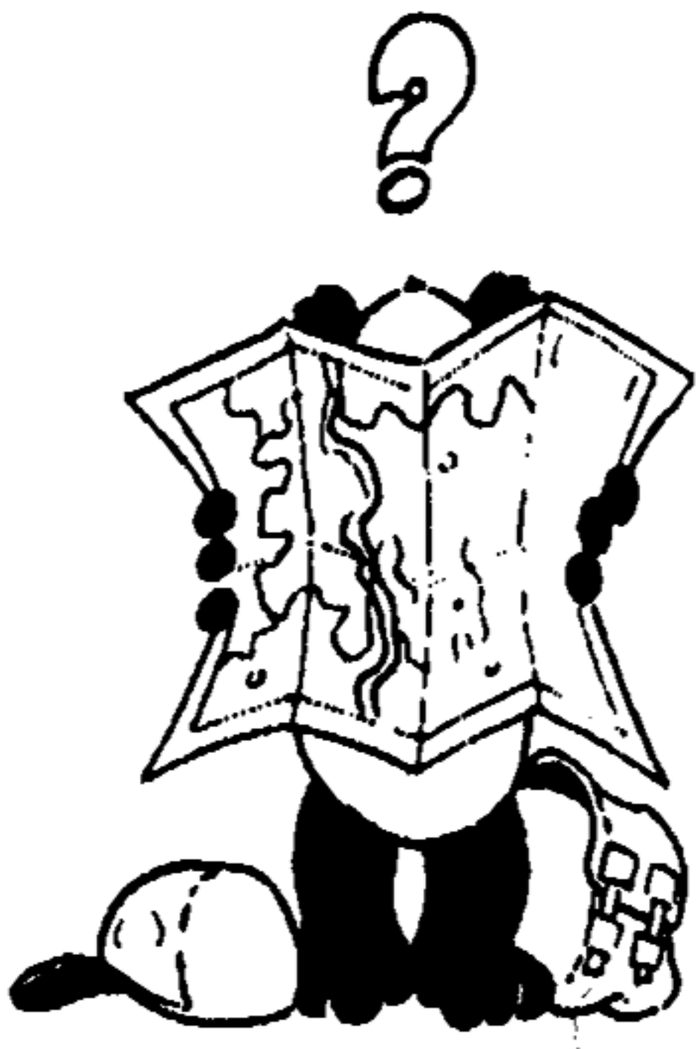
B. Mai Po Marshes Nature Reserve

C. Palm Springs

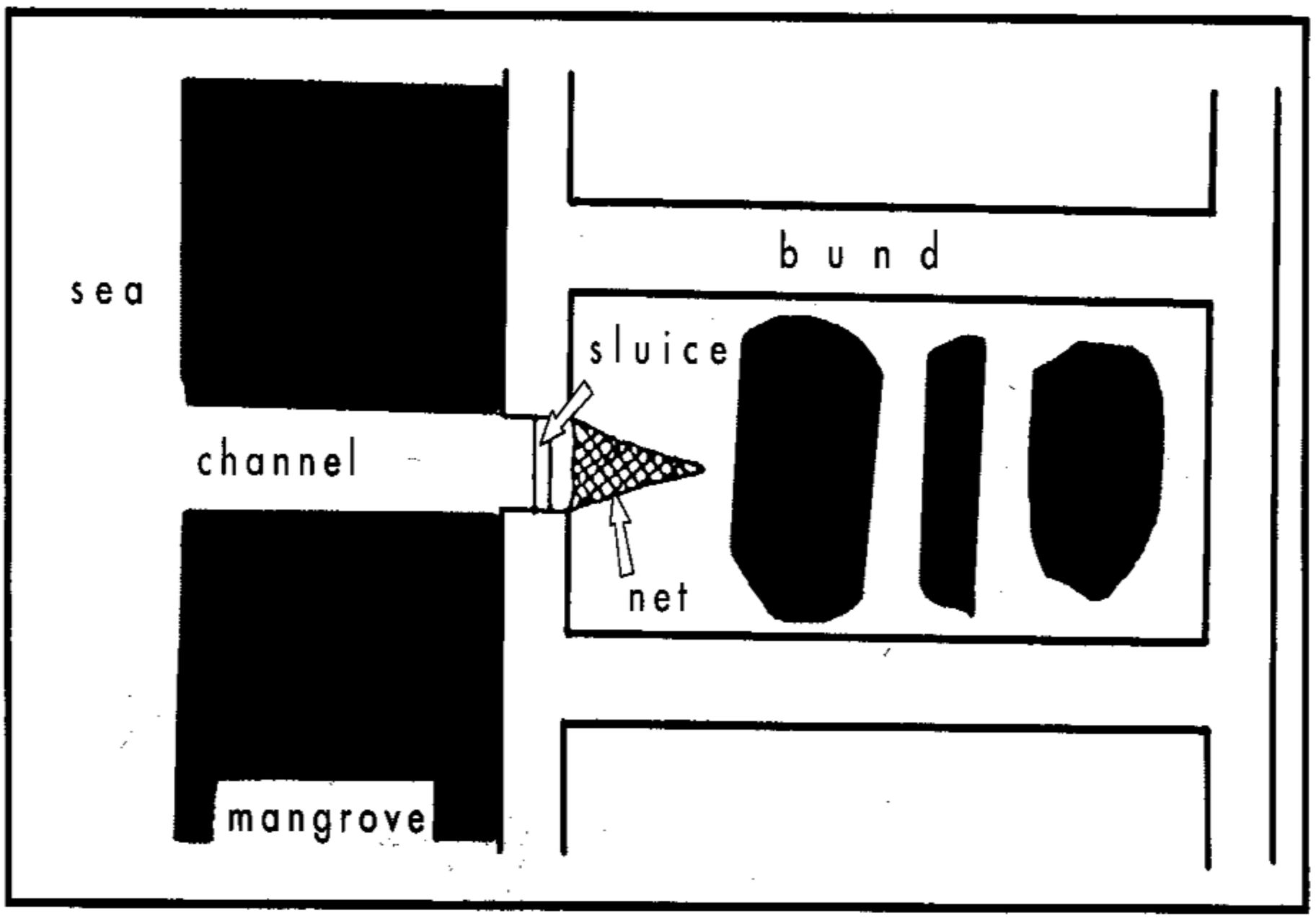
D. Kam Tin

E. Yuen Long

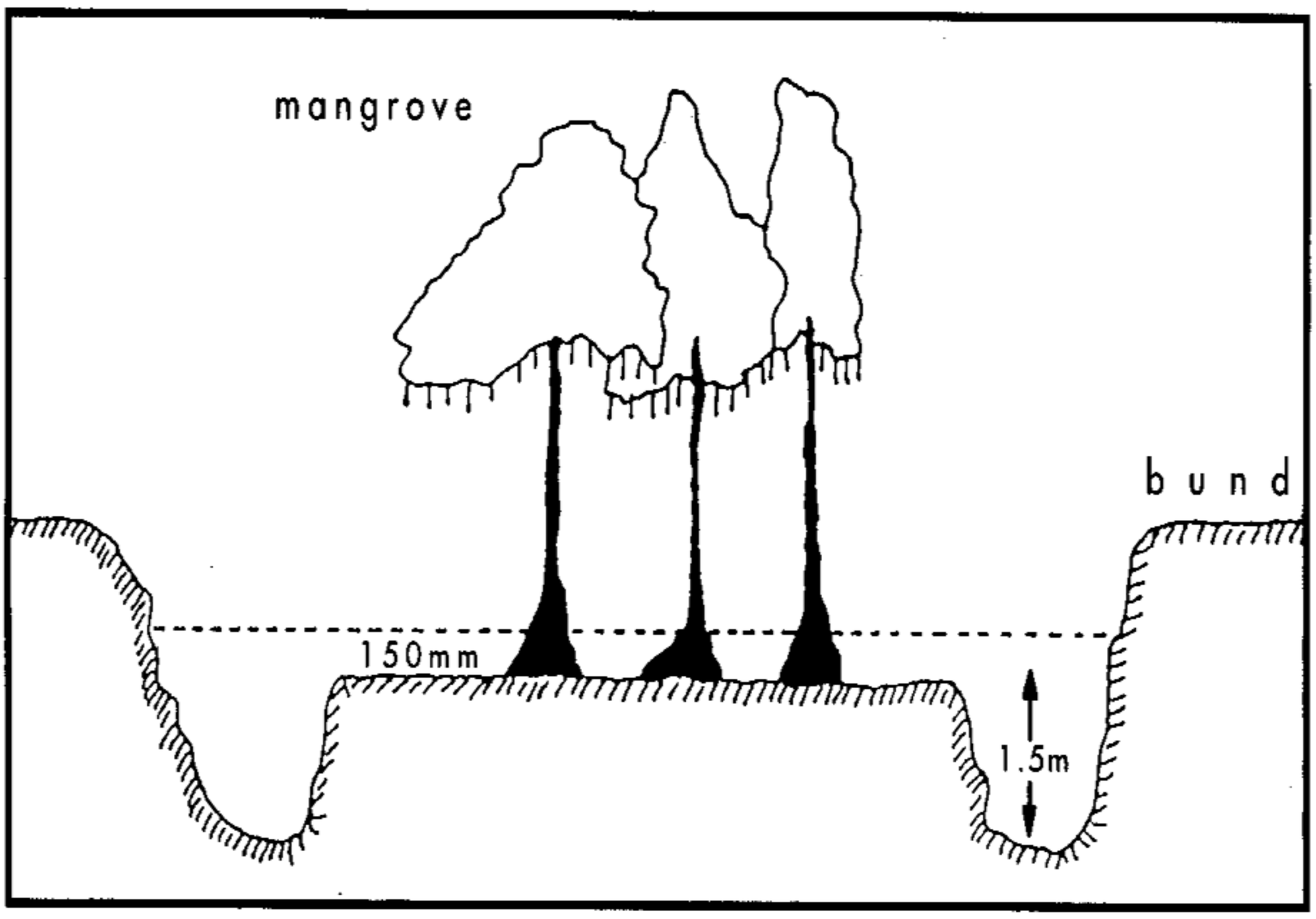
F. Tin Shui Wai



Exercise 3 – *Gei wai* - the tidal shrimp pond

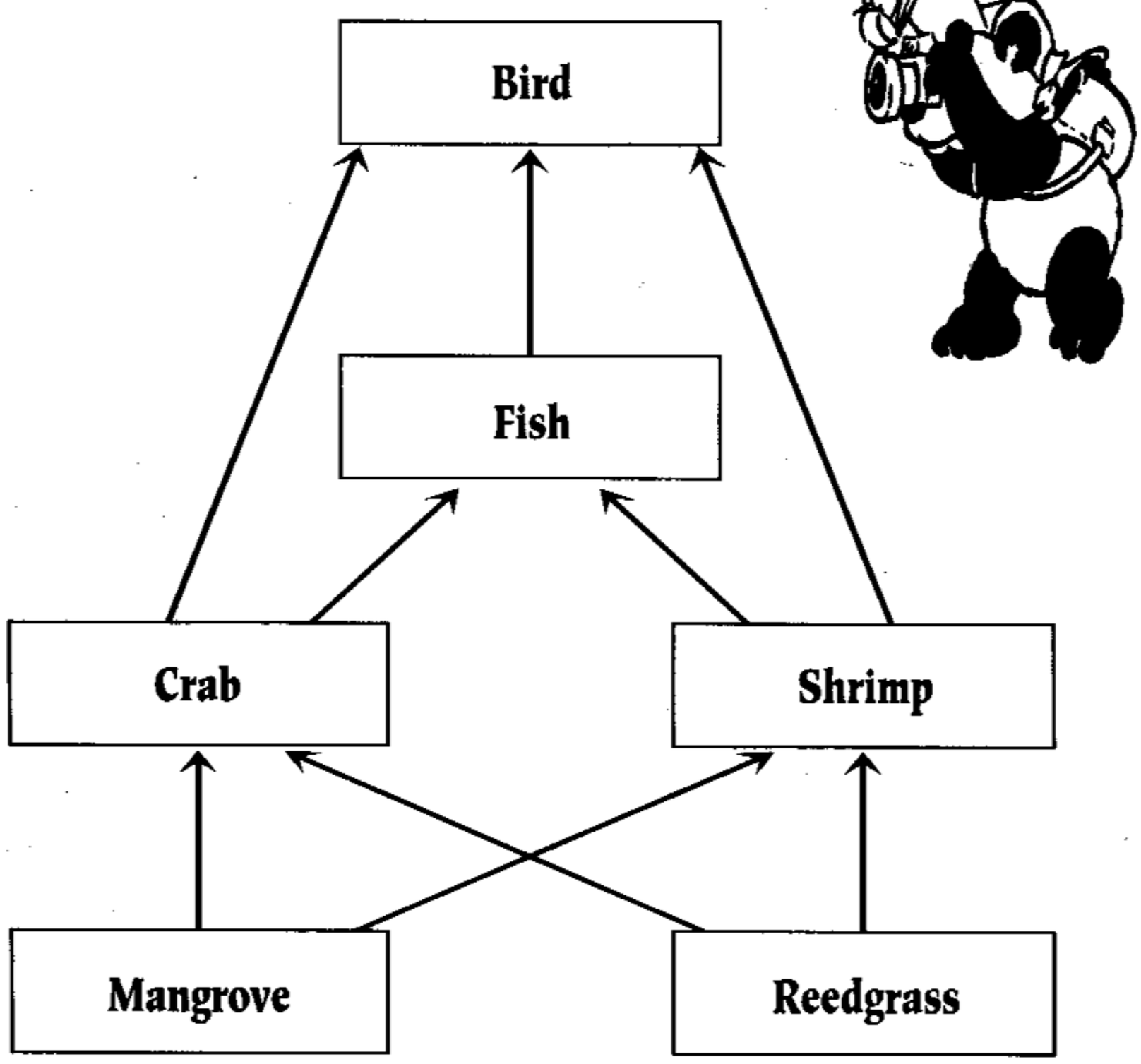


Top View



Cross-section

Exercise 4 – *Gei wai* food web



Question : If the water in Deep Bay is seriously polluted from surrounding human developments, which organism(s) in the food chain will be affected?

Ecosystems are intricate structures in which the existence of one species directly affects many others. For example, an animal's droppings may provide food for other species, and fertilize the soil for plants to grow. Birds and animals are often carriers of seeds, helping plants to take root in new places. Insects like bees and butterflies obtain food from flowers and pollinate them, enabling plants to reproduce.

Some industrial effluents like toxins and heavy metals, can accumulate along the food chain. Therefore, if the water in Deep Bay is seriously polluted, although only some of the organisms will be affected at first the effect will ultimately spread to other organisms throughout the food web. All organism in the ecosystem, including human will suffer.

Conclusion

Conserve the environment in your daily life by:

1. "3Rs" concept: Reduce, Recycle and Reuse

   Reduce: reduce the use of paper, plastic bags, electricity, water and any resources

   Recycle: recycle paper and aluminium cans and use recycled paper and containers

   Reuse: reuse containers such as envelopes
2. Join some volunteer work related to environmental protection, for example planting mangroves at Mai Po
3. Spreading the message of environmental protection to your friends and relatives.
4. Support the work of conservation organisations and become a member.

ECOLOGY OF MANGROVES WORKSHEET

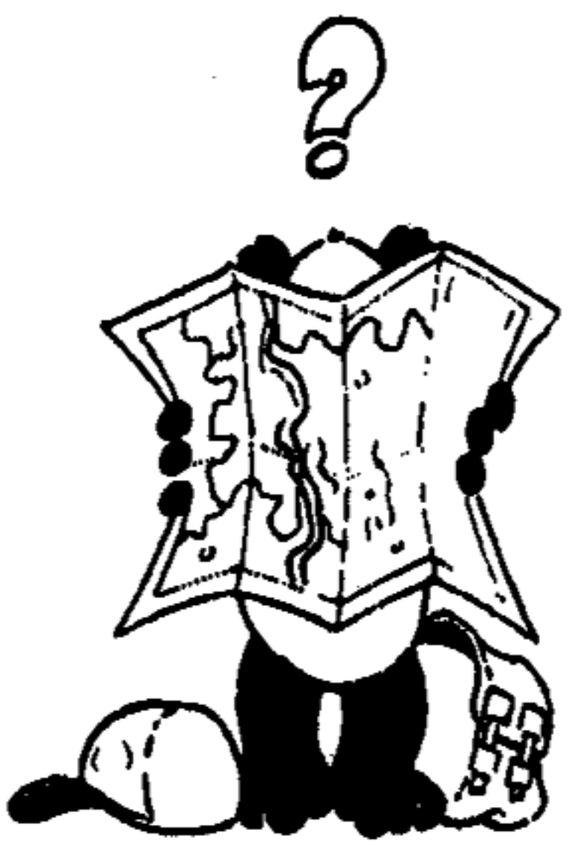
Exercise 1 – Identify the land use type

A. Fish ponds

B. *Gei wais* / traditional shrimp ponds

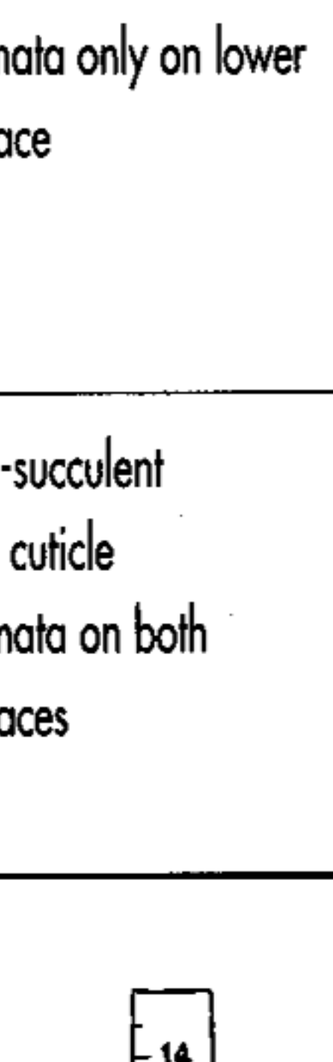
C. Mangroves

D. Mudflat



Exercise 2 – Observe the differences

	Characteristics of root	Characteristics of leaves	Fruits	Habitat type
Kandelia candel	• grows above and below ground • prop / stilt roots and buttress roots for support and anchorage and gaseous exchange	• succulent, leathery • thick cuticle • stomata only on lower surface	• germinates on parent plant • disperses by water	• coastal • estuarine
Lantana camara	• grows deep under-ground • cannot be seen above ground	• non-succulent • thin cuticle • stomata on both surfaces	• germinates on soil • dispersed by birds	• terrestrial • woodland margins • disturbed land • scrubland



Exercise 3 – Mangrove adaptations

	Anaerobic soil	Salty / Brackish water	Instability on soft mud and tidal effect
Roots	• specialized root system for anchoring and aeration 1. finger-like pneumatophores in *Avicennia* 2. knee-roots in *Bruguiera* and *Lumnitzera* 3. buttress roots in *Heritiera* 4. prop roots in *Acanthus*	• salt exclusion: roots as an ultra-filter to take up water and exclude salts (up to 80 - 90% of salt in seawater)	• stilt roots, buttress roots and spreading cable root system to stabilize the plant
Leaves	Nil	• salt glands on leaves to secrete salt e.g. *Acanthus, Aegiceras, Avicennia* • salt accumulate in older leaves so that a large amount of salt can be removed during leaf fall e.g. *Excoecaria, Lumnitzera* • thick leathery or waxy surfaces reflect light from sun and sea wave surface in order to reduce transpiration • thick waxy cuticle with succulent tissues to retain more water	Nil
Dropper (or) Propagule	Nil	• thick cuticle against rotting and dehydration when soaked in seawater	• with spongy cells so that it can float on water e.g. *Kandelia* • heavy bottom to help it float in an up-right position. e.g. *Kandelia* • seed germinates when still attached to parent plant. e.g. *Acanthus, Aegiceras, Avicennia, Bruguiera, Kandelia* • pointed end for firm anchorage when it falls into the substratum e.g. *Kandelia*

Exercise 4 – Discussion

1. The significance of mangroves to man:

a. as a source of timber
b. as a source of fuel wood
c. as medicine
d. to provide nectar for honey production
e. as a source of natural dye (tannin)
f. help natural land formation
g. protection of coastlines and prevention of coastal erosion
h. absorbing some pollutants from coastal waters
i. provision of food and shelter for wildlife
j. acts as a nursery for the juveniles of many coastal and offshore fishes and shrimps.

2. Human activities that lead to the destruction of mangroves:

a. change in land use
   e.g. land reclamation, intensive shrimp / fish cultivation, rice cultivation, salt pans.
b. over-use of timber, chopping down of mangrove trees to convert to charcoal
c. Climate change leading to a sea level rise.

Conclusion

(Refer to the suggested answers for the General Visit Worksheet.)

LAND USE AROUND MAI PO WORKSHEET

Exercise 1 – Compare fish pond and *Gei wai*

	Water depth (estimated)	Shape	Names of plant	Names of birds and other animals	Sources of food for living organism in the pond
Gei wai	10 cm - 2 m	Rectangular	• Mangrove • Reedgrass • Mangrove associate	• *Gei wai* shrimp • Egret	• Organic matter from Deep Bay and Pearl River • Leaves from mangrove and reedgrass
Fish pond	2 - 3 m	Irregular	• Lantana • Hairy Burmarigold • Guinea Grass	• Cultivated fish • Egret • Cormorant	• Supplied by fisherman (Soya bean meal, Peanut meal) • Chicken manure

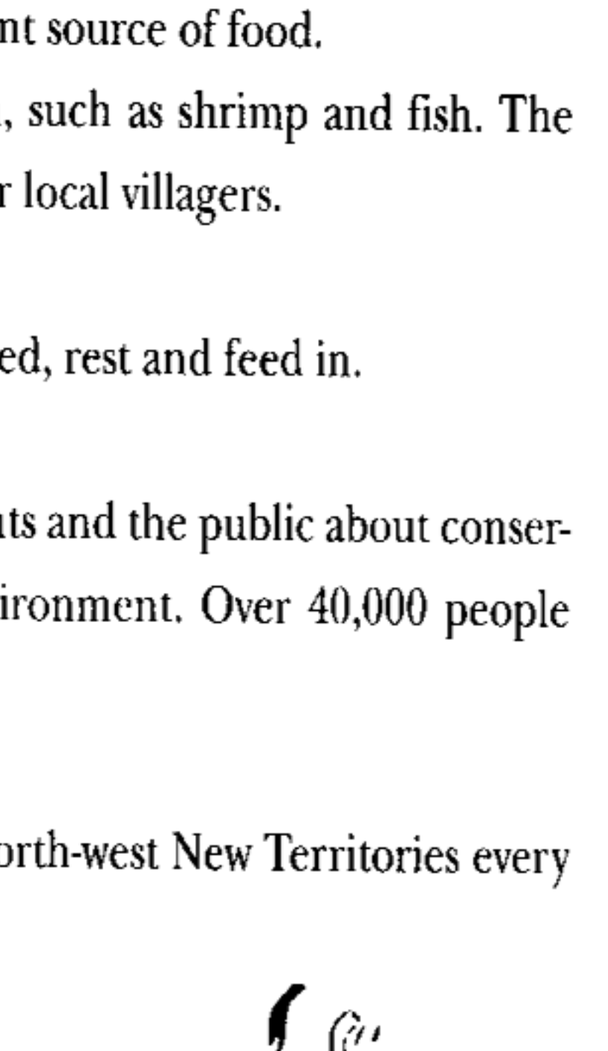
Do you think it is worth conserving *Gei wais* and fish ponds? Why or why not?

Yes.

1. *Gei wais* and fish ponds have high economic value as an important source of food.
   The products in *Gei wais* and fish ponds are sources of protein, such as shrimp and fish. The mangroves in the *Gei wais* used to be a source of the firewood for local villagers.
2. Important habitat for conserving biodiversity
   Gei wais and fish ponds are important habitats for wildlife to breed, rest and feed in.
3. Important educational and recreational value
   Gei wais and fish ponds are an important place to educate students and the public about conservation. They also are a place for people to appreciate the environment. Over 40,000 people visited Mai Po in 1996.
4. Prevent flooding
   Gei wais and fish ponds can store 25 % of the total rainfall in North-west New Territories every year and so can help reduce the risk of flooding.

Exercise 2 – Identify land use types

A. Futian, Shenzhen (Special Economic Zone)
B. Palm Springs and Fairview Park (Low Density Residential Area)
C. Yuen Long (Industrial Area)
D. Tin Shui Wai (High Density Residential Area)



Exercise 3 – Land planning

1. Yes.

   The signs of pollution include oil, high turbidity, garbage, black water and a bad smell. The possible sources of pollutants are the development sites in Shenzhen, Yuen Long and Tin Shui Wai, pig farming effluent and human sewage discharge around Deep Bay.

2. Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. To sustain human survival, the relationship between humans and nature has to be a balanced one in which people use resources in a manner consistent with nature's capacity to continue to support the lives of people and other species, indefinitely.

Exercise 4 – Role play and debate

Land owner:

Most farmers will choose to sell their fish ponds to a developer and find more stable jobs in the city because:

1. <u>Fluctuating fish farming income</u>

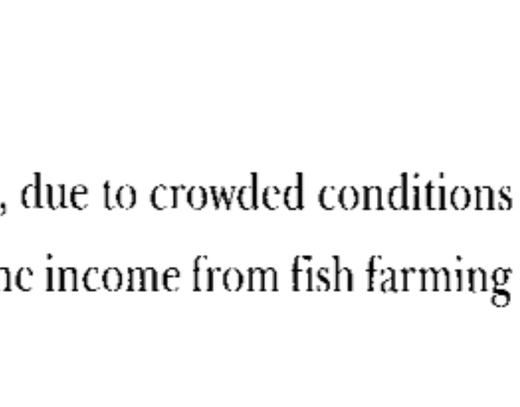
   There are many uncertainties in operating fish ponds. For example, due to crowded conditions in the ponds, fish disease is more frequent and will spread quickly. The income from fish farming is not, therefore, stable.

2. <u>Difficult to control the water conditions</u>

   The dissolved oxygen will decrease after heavy rain so that the fishes die due to inadequate oxygen.

3. <u>Profit margin is affected by China fish market</u>

   The supply of live freshwater fish from China is responsible for depressed local wholesale prices. Coupled with low market prices, profits are further reduced due to inflation and increases in the operating costs of local fish farms.



Developers:

1. <u>Population pressure</u>

   The human population in Hong Kong continues to increase and the population density in the cities is already very high. The only large pieces of flat land left in Hong Kong, which are still not yet developed are, the corridor between Yuen Long and Tuen Mun, the Kam Tin / Shek Kong area and the wetlands around Mai Po.

2. <u>Simple ownership of the fish ponds</u>

   The relatively simple ownership of the fishponds in the Northwest New Territories also enhances the development process. As the ownership of lands in the Kam Tin / Shek Kong area and Tuen Mun / Yuen Long corridor are scattered, developers have to spend a long time gathering a large enough parcel of land for profitable development.

Government:

1. Buffer zone

   In order to provide better protection to Mai Po and Inner Deep Bay, two Buffer Zones were designated around Mai Po in 1992 and guidelines were set for development control. Within Buffer Zone 1, which is located immediately around Inner Deep Bay, no new development is allowed unless it is required to support the conservation of the area's natural features and scenic qualities. Within Buffer Zone 2, new development will not be allowed unless it could be demonstrated that it would have no adverse effect on the environment, traffic and drainage of the area.

2. Stricter land use planning

   In response to the pressure to build large-scale residential projects in the area, stricter guidelines have been adopted when considering development applications. After mid-1994 when more detailed plans for the Northwest New Territories began to be effective, no large-scale development proposal to build adjacent of near to Mai Po and Inner Deep Bay will be considered by the Hong Kong Government.

Green groups:

1. Ecological value of fish ponds

   Fish ponds support a number of protected species, notably medium-sized mammals such as Otters and Leopard Cats and are habitats for regionally important populations of egrets and herons and other waterbirds.

2. Reduce flooding

   Fish ponds are an integral part of the Inner Deep Bay wetland system and serve as a water storage facility to help reduce flooding.

3. Ramsar Site

   The health of a wetland ecosystem is closely dependent on the well-being of its surrounding area. If the developments around the Mai Po and Inner Deep Bay Ramsar Site* are not guided and controlled it will become an island surrounded by a sea of urban development.

* Ramsar site

Wetlands around the world are being destroyed at an alarming rate. In order to protect them for the benefit of man and wildlife, an international treaty - the Ramsar Convention - was adopted in 1971.The aim of the Ramsar Convention is to give recognition to internationally important wetlands and to promote their conservation and wise use.We should use wetlands sustainably, so that they can also benefit future generations. One example is the traditional use of *Gei wai* (inter-tidal shrimp ponds) at Mai Po and using the international wetland for education purpose.

Mai Po/ Deep Bay was declared a Wetland of International Importance (Ramsar Site) because:

- The mangrove forest around Deep Bay / Mai Po is the sixth largest remaining along the coast of China, and the reedbed is one of the largest in Guangdong.
- 12 species of endangered waterbirds occur in Mai Po. Nearly 20 species of invertebrates new to science have been discovered.
- Mai Po regularly holds over 60,000 wintering waterbirds. In January 1996, over 68,000 waterbirds were recorded in the Deep Bay wetlands.
- Deep Bay holds over 1% of the world population of 3 species of waterbirds.

Conclusion

(Refer to the suggested answers for the General Visit Worksheet.)

For further ideas and information see WWF HK's *Wetland Conservation Discussion Pack.*

WATER POLLUTION IN MAI PO WORKSHEET

Exercise 1 – Where are the potential source of pollution?

A. Shenzhen Special Economic Zone (Residential and industrial areas)

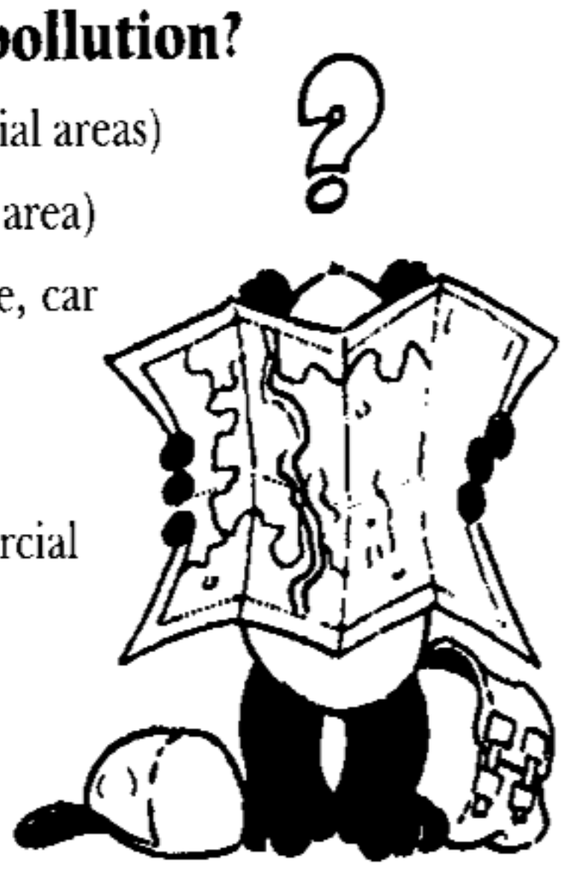
B. Palm Springs (Low density residential area)

C. Kam Tin (Open container storage, car dumps and pig farms)

D. Yuen Long Industrial Estate (Industrial area)

E. Yuen Long (Residential and commercial areas)

F. Tin Shui Wai (High density residential area)



Exercise 2 – Mai Po habitats

1. Fish ponds - fish farming, habitat for wildlife and storage of rainwater, reduces the risk of flooding.

   Gei wai - Shrimp and fish farming and wildlife habitat.

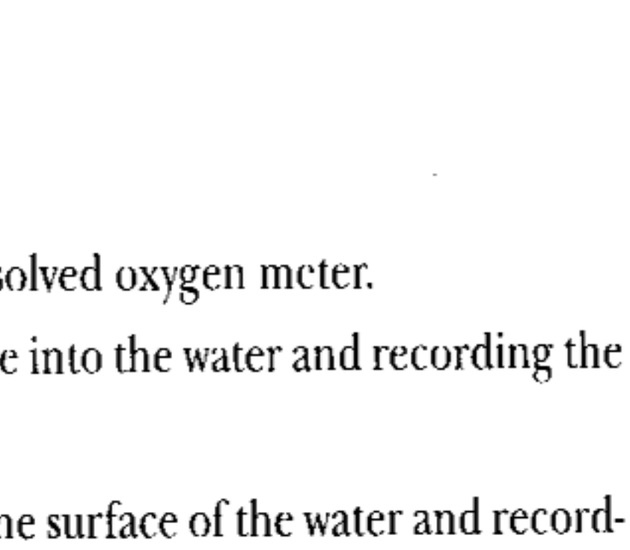
   Mangrove - habitat for wildlife, natural plant formations, feeding habitat for wildlife and protects the coast from typhoons.

   Mudflat - habitat for wildlife, especially as a feeding ground for waterbirds, food for people, mudskippers, oysters and other molluscs.

2. Garbage, oil and seawater black.

Exercise 3 – Demonstration

1. **WATER TEMPERATURE** measured by thermometer or a dissolved oxygen meter.
2. **WATER LEVEL** measured by putting a graduated bamboo pole into the water and recording the water level on it.
3. **FLOW SPEED** measured by putting a piece of grass leaf onto the surface of the water and recording its speed.
4. **OFFENSIVE SMELL** measured by half-filling a vial with water and smelling it.
5. **FLOATING MATTER** measured by half-filling a vial with water and observing the type of floating matter: scum, litter, foam, slime and others.
6. **COLOUR** observed by half-filling a vial with water and comparing it with the distilled water provided against a white background.
7. **SUSPENDED SEDIMENTS** measured by using a sheet of filter paper to filter 50 cm^3 of water and allowing the filter paper to dry. Observe any suspended sediments on it.
8. **TURBIDITY** of water measured by Secchi disc.
9. **SALINITY** measured using a refractometer.



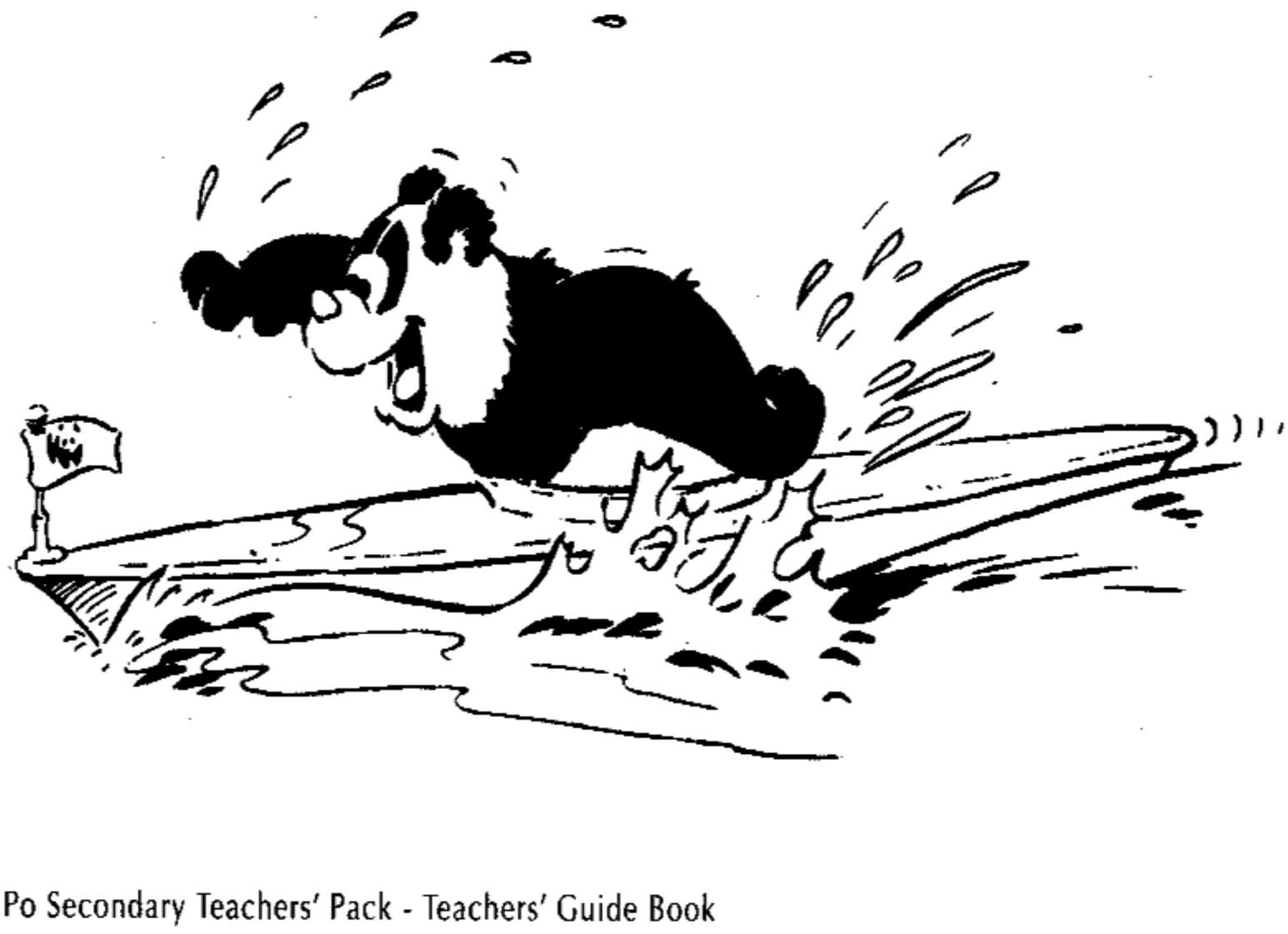
10. **DISSOLVED OXYGEN** measured by dissolved oxygen meter.
11. **pH** measured using a pH meter or pH paper.
12. **PHOSPHATE** measured by mixing the test sample with phosphate acid reagent (6282) and phosphate reducing reagent (6283). Mix well and wait for 5 minutes. A blue colour complex, named antimony-phosphomolybdate, will be formed. Measure the concentration of the blue colour using a colorimeter with the 640 nm filter. After some calculations, you will know the concentration of phosphate in the water sample.
13. **NITRATE** measured by mixing the test sample with mixed acid reagent (V-6278-H) and nitrate reducing reagent (V-6279-D). Mix well and wait for 10 minutes for a colour complex to form, which is a highly coloured azo dye. Measure the concentration of the complex using a colorimeter with the 535 nm filter. After some calculations, you will know the concentration of nitrate in the water sample.

Exercise 4 - Discussion

1. Domestic and agricultured sewage and industrial effluents from the developing area pollute the water in Deep Bay and Mai Po. There is also frequent water exchange between Deep Bay and the Mai Po g*ei wai*. Some organic pollutants such as phosphate and nitrate increase the nutrient levels in the *gei wai* and algal blooms can occur. Algae consume large amounts of oxygen, thereby jeopardizing aquatic life in the *gei wai*. Some toxic substances like heavy metals can spread in the ecosystem through the food web.
2. The diversity and quantity of *gei wai* shrimp decreases. Some g*ei wai* have water which has a brown foam and is black. Occasionally, a bad smell can be detected.
3. EIA (Environmental Impact Assessment)
   Legislation
   Law enforcement
   Environmental education

Conclusion

(Refer to the suggested answers for the General Visit Worksheet.)



DIVERSITY OF LIFE WORKSHEET

Exercise 1 – Nature detective

PLANTS

Lantana
Cerebra
Horsetail Tree
Reedgrass
Elephant's Ear
Tallow Tree
China Berry
Fig Tree
Mangrove

BIRDS

Egret
Heron
Kingfisher
Magpie
Warbler
Swift
Duck

INSECTS

Dragonfly
Butterfly
Moth
Grasshopper
Black Tree Ant
Wasp

FISHES

Grey Mullet
Grass Carp
Common Carp
Tilapia
Mud Carp

CRUSTACEANS

Shrimp
Crab

OTHERS

?

Otter
Leopard Cat
Bat
Mongoose
Snake

Exercise 2 – Webbing game

1. If an ecosystem is more diverse, it will be more sustainable and durable. Biodiversity is, therefore, important for the ecosystem. If we maintain a high diversity in an ecosystem, it will be more sustainable.
2. Food web

   These organisms relate to each other:

   Mangrove is a good feeding, breeding and resting place for birds and insects. Birds, mammals and insects assist in a plant's seed and pollen dispersal.

   Plants act as the primary producer to provide food for these animals and detritus is a food resource for shrimps, crabs and fishes.

   Crustaceans, like shrimps and crabs, are detritus consumers and also are the food of higher organisms such as birds.

   Insects help plants to disperse the pollen and insects are also the food sources of bats and birds.

   Wasps and Ficus, the fig tree, have a special relationship called "mutualism"**.

   Fishes are an important food source for people and birds.

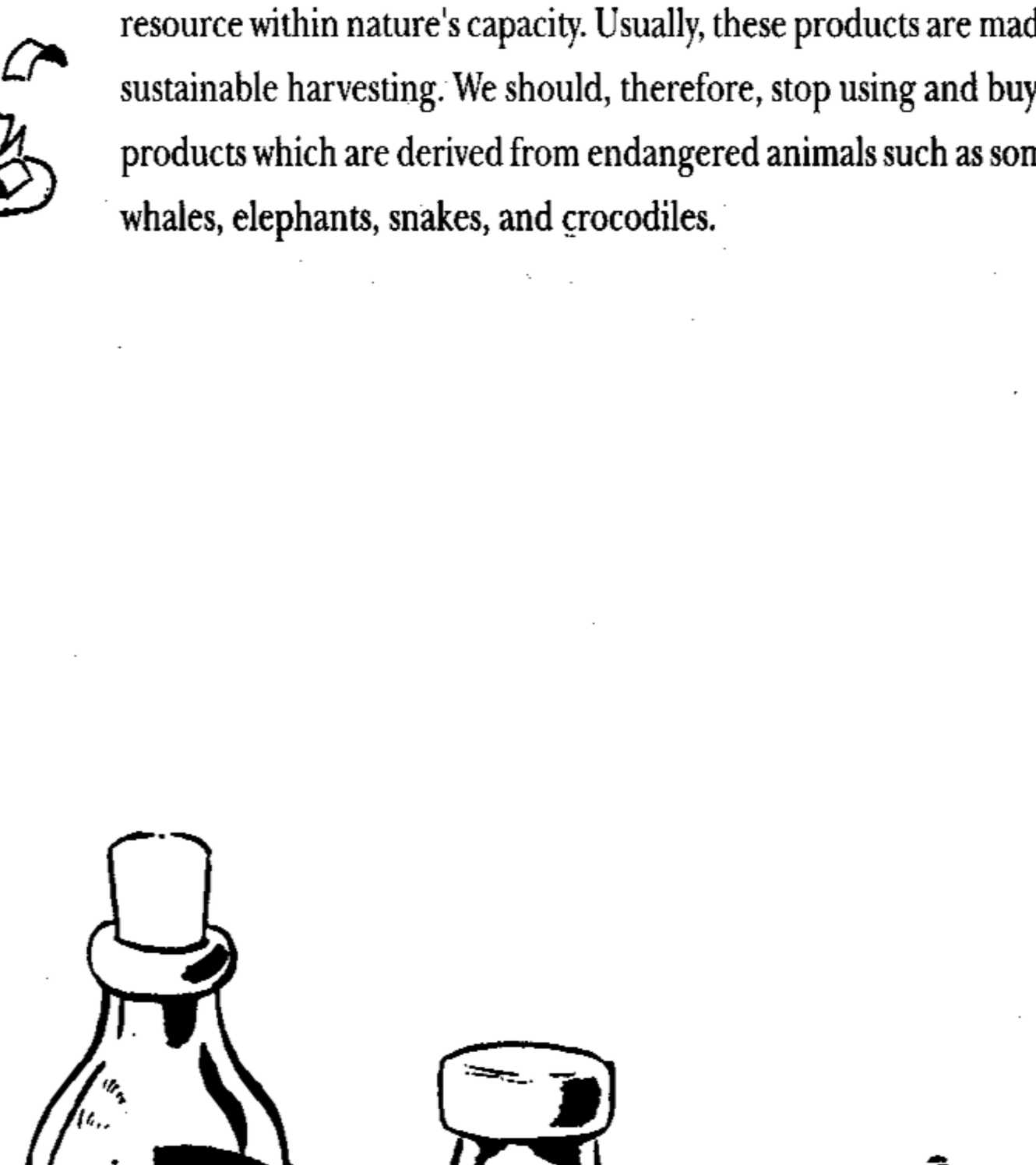
** *"Mutualism: a relationship between dissimilar organisms in which both partners benefit."*

Exercise 3 - Discussion

When biodiversity is maintained, the ecosystem becomes more sustainable, the quantity of food, timber and medicines for people will also be sustainable. For example, in Mai Po, the root of the Reedgrass is one of the components of a Chinese medicine called "24-tastes". The seed of the China Berry can be used as an insecticide. Fishes and shrimps are food resources for people.

Conclusion

To maintain biodiversity, we must keep our consumption of natural resource within nature's capacity. Usually, these products are made by non-sustainable harvesting. We should, therefore, stop using and buying those products which are derived from endangered animals such as some sharks, whales, elephants, snakes, and crocodiles.



鳴謝 ACKNOWLEDGEMENTS

世界自然(香港)基金會謹向所有參與構思及製作此米埔中學老師教材套之人士致以衷心謝意，並感謝陳承彥、朱永興、徐潔瑜、夏詠廉、梅偉義、南生圍發展有限公司、羅艷雲、K.B. Pun、談秀鴻、韋敬輝、野鳥及濕地基金會、世界自然基金會英國分會、楊華興及楊路年提供相片。

World Wide Fund For Nature Hong Kong wishes to express our deepest gratitude to everyone who provided assistance in the development and production of this Mai Po Secondary Teachers' Pack. Photographs were kindly provided by Simba Chan, Ken Chu, Margaret K.Y. Chui, William Heering, D.S. Melville, Nam Sang Wai Development Company Limited, Annie Y.M. Nicholson, K.B. Pun, Terence S.H. Tam, Keith Wilson, Wildfowl and Wetlands Trust, WWF UK, Yeung Wah Hing and Lew Young.

本米埔中學老師教材套蒙以下機構及人士協助製作，特此鳴謝：

This Mai Po Secondary Teachers' Pack was made possible with the assistance of the following:

香港特別行政區教育署

Education Department, Government of the Hong Kong SAR

世界自然(香港)基金會教育委員會主席莫雅頓教授

Professor Brian Morton, Chairman, WWF HK Education Committee

本教材套由DFS國際集團慈善基金會贊助製作。

Sponsorship by Duty Free Shoppers Charitable Trust.