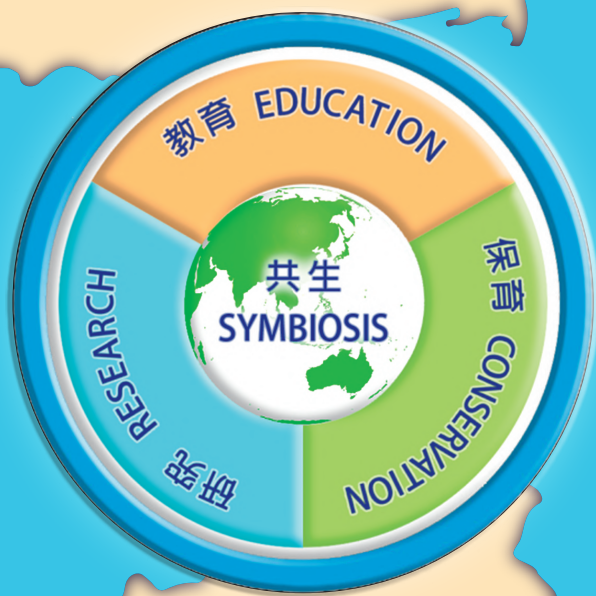


ECF

The Fish Kaleidoscope

Stream Explorer in Lantau



TEACHERS WORKBOOK

For Field Trip

Publishing Information

- Sponsor : Environment and Conservation Fund
- Author : Ichthyological Society of Hong Kong
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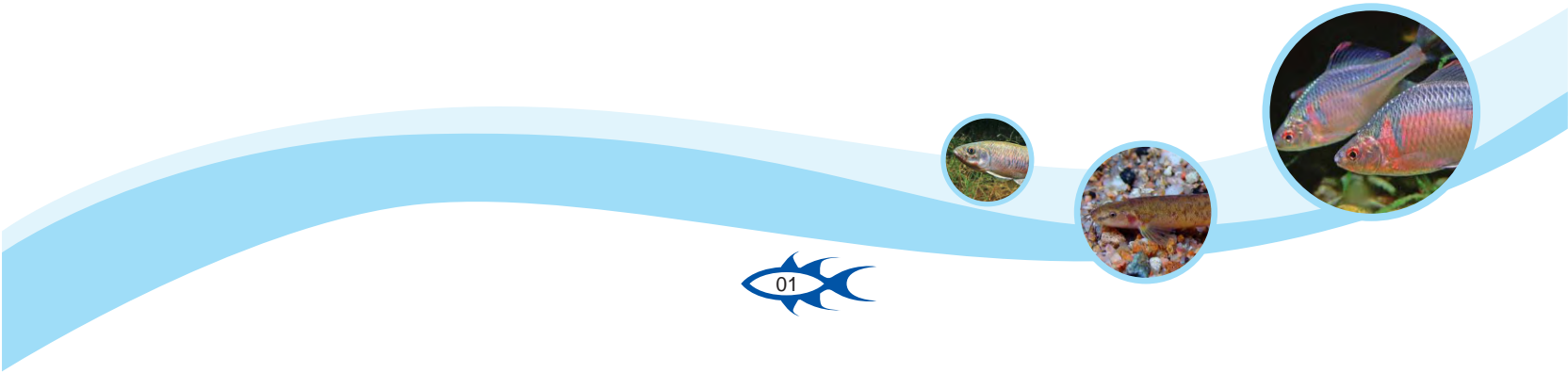
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“ECF The Fish Kaleidoscope – Stream Explorer in Lantau”

TEACHERS WORKBOOK for Field Trip

INTRODUCTION

Pui O River (貝澳河) is located in the southern part of Lantau Island. A section of its lower course of about 1 km long has been listed as one of the thirty-three Ecologically Important Streams in Hong Kong by the Agriculture, Fisheries and Conservation Department (AFCD). Pui O has also been designated as a Coastal Protection Area to advocate conservation and protection to its natural coastline.

ABOUT STREAM EXPLORER – FISH KALEIDOSCOPE

“ECF The Fish Kaleidoscope – Stream Explorer in Lantau” is an Environmental Education and Community Action (EECA) project funded by Environment and Conservation Fund (ECF) under Environmental Protection Department (EPD). The project aims to (a) enhance community awareness and knowledge of stream conservation issue; (b) cultivate public appreciation and positive attitude towards the unique environment and biodiversity of local streams and wetlands; and, (c) motivate individuals, communities and school groups to take positive action to conserve the natural stream environment in South Lantau.

HYPOTHESIS

Students are expected to make a prediction (hypothesis) about how healthy they think the stream is, and, to explore the geographical changes as well as the environmental impacts along different sections of the stream. This should be based on their observations of the stream location and the surrounding land uses of the study sites.

OBJECTIVES

- To explore the environmental changes from the upper course to the estuary of the stream.
- To learn how to collect geographical, biological and other environmental data in the field and interpret it in a meaningful way.
- To investigate the man-land interactions along the stream.
- To learn about the importance and basic techniques of fish fauna survey in environmental studies.



ABOUT ICHTHYOLOGICAL SOCIETY OF HONG KONG (ISHK)

ISHK is a non-profit organization founded in 2008 that aims at promoting ichthyology and its related knowledge. It is an academic platform comprised of research, education, and conservation. The Society enhances research on fishes, advocates ichthyological science and cultures to the general public, and promotes nature conservation.

WHO MAY USE THIS WORKBOOK ? (Teacher's version only)

This teacher's' workbook is a multidisciplinary teaching resources tailored to the need of teachers in the following subjects :

- **Geography**
 - * managing river and coastal environments
 - * building a sustainable city
- **Biology**
 - * biodiversity and ecosystems
 - * applied ecology
- **Liberal Studies**
 - * people and environment
 - * science and technology in everyday life
- **Tourism and Hospitality Studies**
 - * local tourism industry
 - * sustainable tourism development case studies
- **S.T.E.M. and O.L.E. activities, other relevant subjects / teaching units that educators may find useful**

While stream ecology is the major theme in this workbook, emphasis is put on Ichthyology (Study of Fish) as fishes can be an important indicator of the overall health of a stream ecosystem.

REQUIRED TIME (Teacher's version only) :

Depending on the need of your teaching, you may design a half-day, one-day or two-day field trips with the exercises provided in this workbook.



SAFETY NOTES & PREPARATIONS :

Preparations :

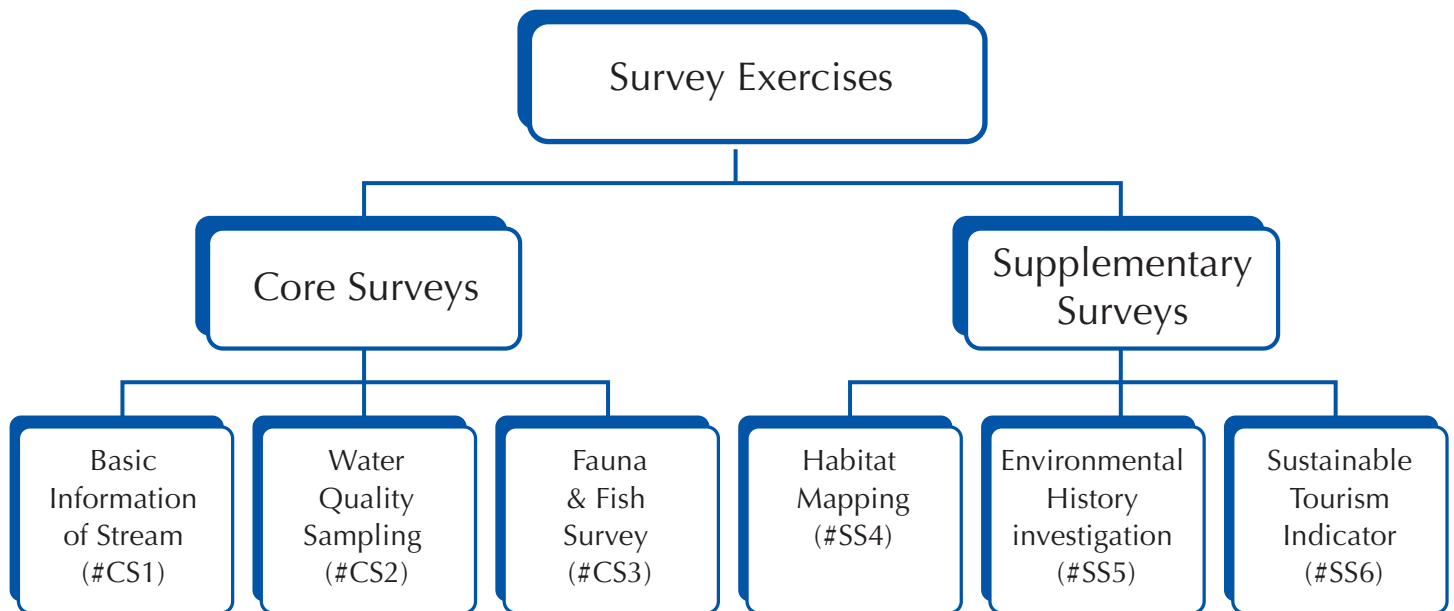
1. To avoid sunburn, insect bites and prickly plants, wear apparel in light colors with long sleeves.
2. Apply sunscreen and natural insect repellent when necessary.
3. Wear outdoor shoes with good grips. Slippers and sandals are not recommended.
4. Bring an extra pairs of pants & an extra shirt.
5. Bring enough water and back-up food.

In the Field

1. Students are not allowed step into water (stream, coast, swamp, etc.) without prior instruction from teachers and tutors.
2. Students are not allowed to leave for whatever reason without prior notice to teachers and tutors.
3. Report to teachers and tutors immediately if you and your schoolmates are injured or not feeling well.
4. We are visitors of nature. Do not disturb wildlife and local residents.
5. Do not take away any living or dead organism (plant and animal), gravel, stone and other sediment.
6. Objects should be placed to the original position after observation.
7. Wear wading boots (covering the ankle) or similar kind of footwear when walking in shallow water, mudflat and wetland, etc.
8. When wading into the stream, only approach the area where stream bottom is visible. Avoid area with boulders and irregular bottoms.



Structure of the Field Trip



Introduction to Survey Exercises (For Teacher's Version Only)

There are 6 survey exercises which are divided into two groups, core surveys and supplementary surveys. Core survey, focusing on physical science, is a micro-observation of a river channel (aquatic and riparian zone). Physical, chemical and biological aspects of contemporary river channel will be observed and studied with the help of various measurements and observation equipment. On the other hand, supplementary survey, focusing on social science, is a macro-observation of a river basin (catchment or drainage area). Students will explore time element and human impact of a river basin by studying both long-term and short-term historical changes. Teachers can make their own choice of survey combination by considering teaching and learning requirements.



List of tools / equipment for each survey

| Core Survey | | |
|--|---|---|
| Survey # 1 Basic Information of the stream | Survey # 2 Water Quality Sampling | Survey # 3 Fauna & Fish Survey |
| <ul style="list-style-type: none">• Thermometer• Light Meter• A Smart Phone with HK Observatory App• Stopwatch• Light-floating material (e.g. leaf, orange)• Tape measure | <ul style="list-style-type: none">• Water Collection Bucket• Test Strips• DO Meter• pH Meter | <ul style="list-style-type: none">• Hand Nets• Gloves• Observation Boxes• Camera• Aqua Fauna Pictorial Guide• Measure Tape |

| Supplementary Survey | | |
|--|--|--|
| Survey # 4 Habitat Mapping | Survey # 5 Environmental History Investigation | Survey # 6 Sustainable Tourism Indicator |
| <ul style="list-style-type: none">• Base Map• A Smart Phone with Google Map• Color Pencils• Drone | <ul style="list-style-type: none">• Pen or Pencil• Camera | <ul style="list-style-type: none">• Pen or Pencil• Camera |



Study Sites



Source : Survey and Mapping Office, Lands Department

SITE 1

Mid-upper stream

This is the uppermost site of Pui O River which is easily accessible for study in a safe manner all year around. Despite its limited altitude, aquatic and riparian environment is a good representative of upper streams in Hong Kong.

SITE 2

Mid-lower stream

This study site exhibits typical mid-lower stream environment in Hong Kong where human activities start to affect the stream course and ecology.

SITE 3

Lower Course

This is a confluence between the mainstream and a major tributary of Pui O River. The heritage landmark, Wing On Bridge, marks the beginning of intertidal and brackish zone. (Note : condition of water may vary due to human disturbance / pollution; teachers are advised to check if condition is good for students to wade into the water)

SITE 4

Estuary

This is the opening of Pui O River where the eastern tip of Pui O Beach ends and formed the lagoon. A cultural feature - Tin Hau Temple, is visible at this study site.



Activity Plan (Teacher's version only)

Survey Sites

There are 4 survey sites along the stream. The freshwater section between Survey Site 1 and 2 represents a transition from upper course to lower course, and the brackish section between Survey Site 3 and 4 represents a transition from lower course to estuary. For a one-day trip, teachers are recommended to select a study site from the freshwater and brackish water section respectively.

Suggested General Itinerary for a One-Day Trip

09:30 – 10:30 Introduction

- Study Objectives and Hypothesis
- Rundown and Surveys
- Safety Issues

10:30 – 12:30 Exploring Site 1 or 2

12:30 – 13:30 Lunch Break

13:30 – 15:30 Exploring Site 3 or 4

15:30 – 16:30 Presentation and Conclusion



Site : _____

Basic Information of the stream (#CS1)

Name(s) of students/ Group : _____

Name of the Stream : _____ Date : _____

Survey Time : _____ : _____ to _____ : _____

Today's weather : _____ Air Temperature : _____ °C

Water Temperature : _____ °C Light Level (lux) _____

Stream Velocity/ Flow Rate : _____ m/s (Location : _____) ;

_____ m/s (Location : _____) ; _____ m/s (Location : _____)

(* Measure 3-5 times to take an average, correct by multiplying 0.8 as water flow faster at surface;
Location : side or middle of the stream, concave/convex bank)

Bottom Type (best estimate) : mud/silt _____ % sand _____ %

pebbles/cobbles _____ % boulders (diameter >25cm) _____ %

Water Condition :

| Water Odor | Water Color | Surface Coating |
|------------------|--------------------------|-----------------|
| Chlorine _____ | Green / blue-green _____ | Scum _____ |
| Fishy _____ | Muddy _____ | Foam _____ |
| Rotten Egg _____ | Tea _____ | Oily _____ |
| None _____ | Milky _____ | Black _____ |
| Other _____ | Clear _____ | None _____ |

Vegetation :

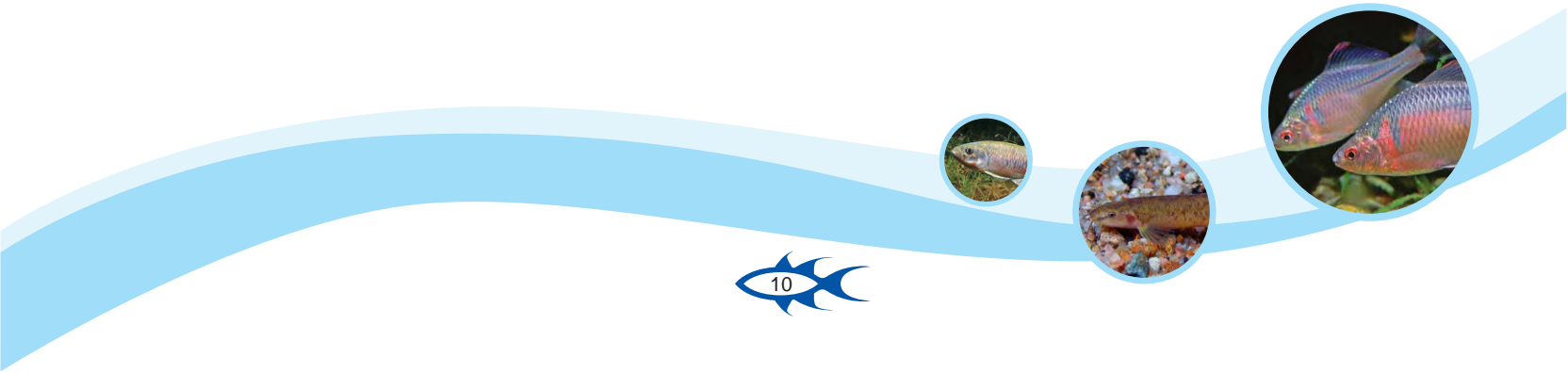
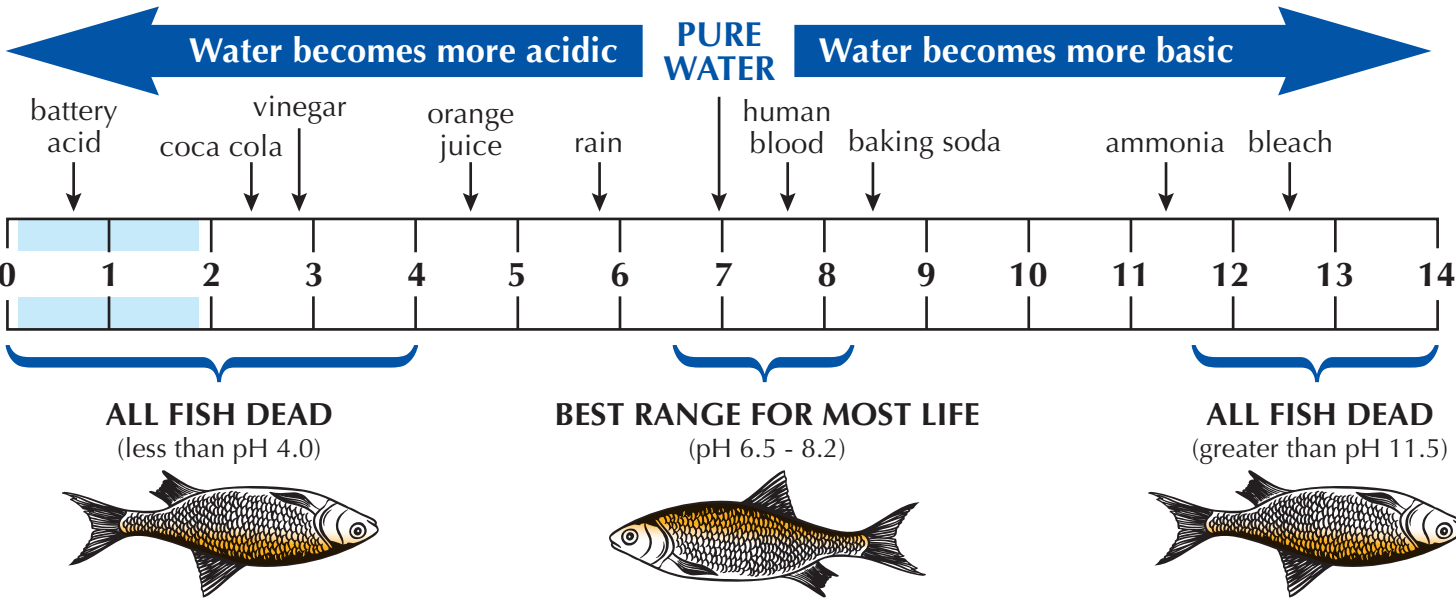
| Abundance of Aquatic Plants | Bank Cover | Algae Condition |
|--------------------------------|--------------------------------------|--|
| most places / patchy / none | Covering most / some / few / none | Color : light green / dark green / brown / _____ Abundance : most places / patchy / none Condition : thin film / medium film / thick mat / long filaments |

| Litter | Evidence of Erosion | Other Remarks |
|--------|---------------------|---------------|
| | | |

Water Quality Sampling (#CS2)

Water Quality Monitoring

Monitoring the quality of streams helps identifying changes or trends in water quality over time. In this exercise, we take samples of water to investigate water quality changes over various sections of a stream, which could be induced by the surrounding natural environment or human activities. By doing so, we could also identify existing water quality problem, gather information to enable better design stream work to avoid disturbance to the stream ecology.



Useful Parameters

1. pH The pH value is a measure of how acidic/basic a liquid is (in this case: stream water). The pH scale ranges from 0 (very acid) to 14 (very basic), with neutral at about 7. It can be affected by chemicals in the water. The pH of water determines the biological availability of chemical constituent such as nutrients (i.e. if a stream life can use it) & the toxicity of heavy metal (if there's any). Thus, a change in stream water pH can affect aquatic life indirectly by altering various aspects of water chemistry. Most freshwater fish and plants can only survive in the pH range of 6-8.

2. Nitrate (NO₃) Algae and other aquatic / riparian plants use nitrate as sources of food. Excess levels of nitrates in water can create conditions that make it difficult for aquatic insects or fish to survive (e.g. Algae bloom can cause extreme fluctuations in dissolved oxygen and hence affect aquatic lives; The excess plants and algae growth due to high level of nitrates can cause extreme changes in habitat - fish that needs to find a spawning ground may be hindered by mat of vegetation). Common source of nitrate including those from organic matter, fertilizers, animal waste and those occur naturally in soil and water.

3. Nitrite (NO₂) Nitrate up to a concentration of 200 mg/L does not harm fish, whereas low concentration of nitrite (over approx. 0.5 mg/L) is highly poisonous for fish. Increased nitrite levels can be an indication of a disturbance in the bacterial decomposition process or poisoning of the nitrifying bacteria in water. The possible causes include insufficient oxygen content and changes in the pH value.

4. Total Hardness (GH) The hardness of a stream or river tells us information about the geology and influence by human activities of the catchment area. For example, sites that have active or abandoned mines nearby often have higher concentrations of iron ions in the water resulting in a very high hardness degree. This test indicates the total of all alkaline earth ions dissolved in the water, i.e. calcium and magnesium ions.

5. Carbonate Hardness (KH) The quantity of alkaline earth ions present in the form of carbonate is called the carbonate hardness (e.g. Calcium carbonate). This parameter is related to alkalinity and relates to the "buffering capacity" of the water (its ability to resist pH changes). The organic functions of fish and plants can be affected by the hardness of the water. Fish and plants originating from soft water habitats do not thrive in hard water.

6. Chlorine (Cl₂) Fresh waters naturally contain both organic compounds derived from decaying biological materials, and, inorganic elements / chemicals dissolved from the soils and rocks over which they flow (e.g. calcium, magnesium, sodium, potassium, carbon, chlorine, and sulfur). In addition, there are also man-made compounds, such as pesticides and other industrial and consumer products. In this test, we measure the water sample against one of the active ingredients in household bleach and detergents - Chlorine. For the protection of most aquatic organisms, Chlorine level in water should not exceed 0.002 mg/litre. Chlorine can be absorbed into the bloodstream and causes burns throughout fish and invertebrates, who absorb it through their gills or surfaces. These burns can cause serious damage to aquatic organisms.

Water Quality Sampling (CS#2) : Data Sheet

| Parameter | Measurement | Indications (if any) |
|----------------------------|-------------|----------------------|
| Acidity (pH) | | |
| Nitrate (NO3) mg/l | | |
| Nitrite (NO2) mg/l | | |
| Total Hardness (GH)°d | | |
| Carbonate Hardness (KH)°d | | |
| Chlorine (Cl2) mg/l | | |
| Dissolved Oxygen (DO) mg/l | | |
| Salinity ppt | | |



Fauna & Fish Survey (CS # 3)

Aquatic Fauna and Fishes

Many kinds of living organisms can be found and observed along the stream. Species living their entire life in water are “Aquatic Organisms”, of those species belong to animals are called “Aquatic Fauna”.

What species ? (Species identification)

The first step of research on Fish Fauna Observation is to find out the species inhabiting study sites. There are various methods to conduct sampling :

1. Direct Observation (with eyes, equipment - underwater cameras, diving masks, etc.)
2. Recording (Photos / videos with underwater cameras.
 - * Unless you are already an expert, a pictorial guide can help you identify species captured in photos / videos.

How many species are there ? (Species diversity)

The number of species found in study sites (or specific habitats) may reflects “Species Diversity” of the sites. The more the species recorded, the higher in “Species Diversity”. In most cases, comparing with other same / similar habitat, lower “Species Diversity” may indicate the sites probably posses some unfavourite factors against those absent species, or having experienced some natural disasters or / and human disturbances. Therefore, A site / habitat with higher “Species Diversity” may be healthier or more natural, and the A site / habitat may more healthier or natural with more complicated / complete ecosystem.

3. Collect information on the number of species recorded in study sites.

How many individuals of a species are there ? (Population size)

The number of individuals found in sites reflects “Population Size” or the “Abundance” of species. If the number of individuals of specific species increases, competition on resources may lead to decline on individuals of other species. The species found most abundant (e.g. possesses largest population size or biomass) in sites is called “Dominant Species”. In most cases, despite each species may possess different population size, balanced ecosystems or more healthier habitats are comprised of relatively stable (e.g. periodic fluctuation) / specific population size in each species.

4. Calculate the number of individuals of each species recorded in study sites.
5. Think about “Common” and “Rare” species.

Any preferences ? (Behaviours, patterns)

Species evolved / survived in various ways, possessing unique characteristics on shapes and behaviors. Observations on behaviors enables us to understand the preference of the organisms, and patterns / modes of their occurrences in different habitats / environments.

Where do they live ?

(Distribution of species, habitat preferences)

The specific habitat(s) a species found occur may reflect the “Distribution” or “Habitat Preferences” of the species.

6. Describe the location / specific “Habitat Type” (e.g. muddy, sandy, cobble, rocky; riffle, pool; deep, shallow, etc.).

How do they live ?

(Solitary / gregatory, etc ; behavioural preferences)

The behaviour of a species closely related to their life-cycle and other habits of each species. For example, as a part of distribution patterns among species, a species may live “Solitary” or “Gregatory” in entire life or specific periods / stages, they may be a “Bottom Dwellers”, “Benthos”, “Epibenthos (Bottom surface)”, “Nektons (Free swimming)”, “Planktons”, or “Drifters”, etc.

More questions to consider

7. What do they feed on? (herbivorous / omnivorous / carnivorous; food preferences)

8. What is / are the role(s) of Fish in stream ecosystem(s) ?

9. Species of concern (e.g. Invasive species, indicator species, pioneer species)

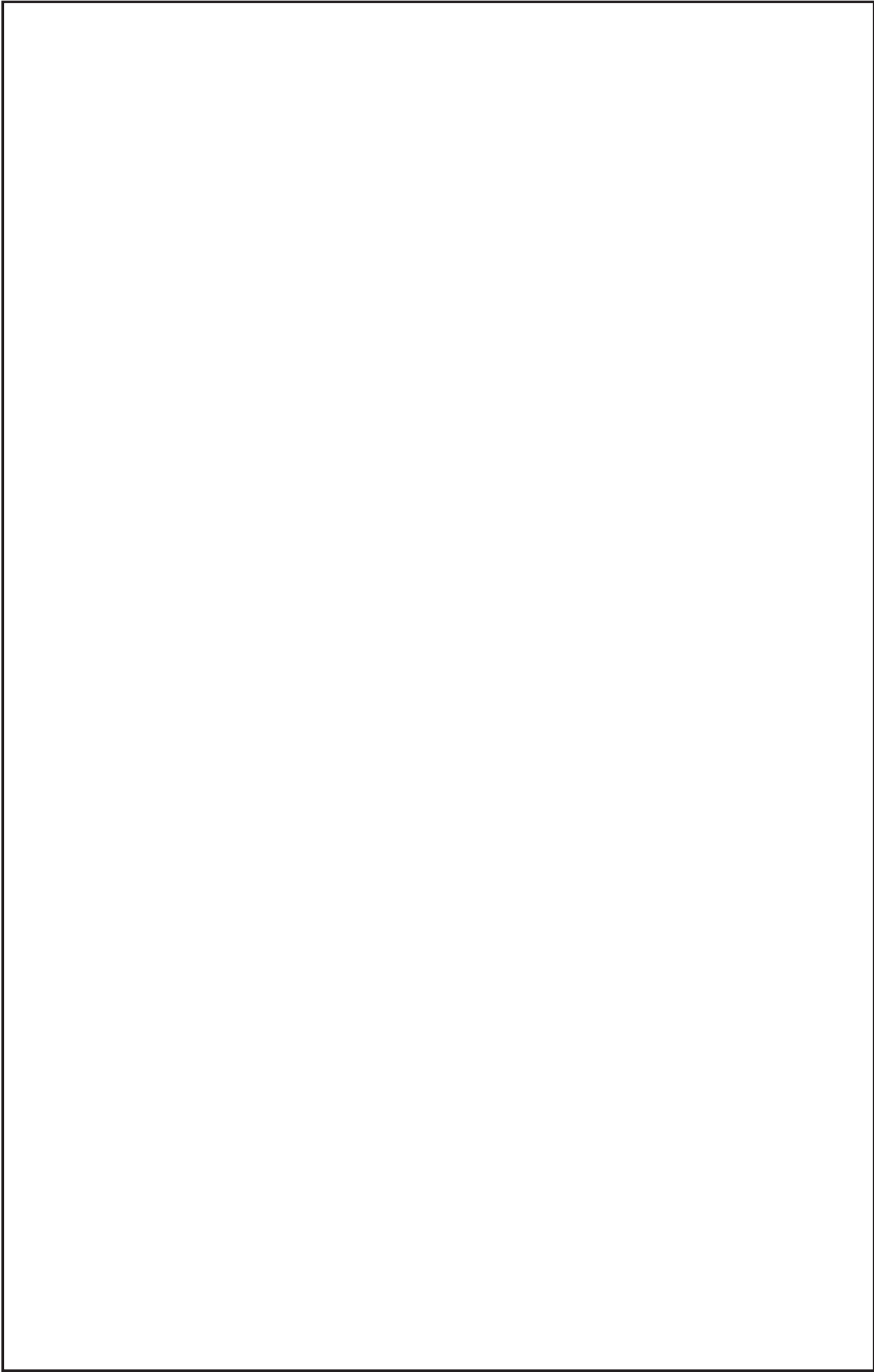
Conservation matters : What we can do to improve the environment of aquatic fauna ?
What are the current threats ?



Fauna & Fish Survey (CS # 3) : Data Sheet

| Site # | Names (Scientific / Common names) | Qty | Method(s) (Handnet / Direct Observation, etc.) | Micro-habitat(s) (e.g. riffles, pools, etc.) | Remark(s) (e.g. native, exotic, etc.) |
|------------------------------|--------------------------------------|-----|--|---|--|
| Species 1 | | | | | |
| Species 2 | | | | | |
| Species 3 | | | | | |
| Species 4 | | | | | |
| Species 5 | | | | | |
| Species 6 | | | | | |
| Species 7 | | | | | |
| Species 8 | | | | | |
| Species 9 | | | | | |
| Species 10 | | | | | |
| Total number of species : | | | | | |

Sketch of Stream Environment



Supplementary Survey (# SS4) : Habitat Mapping

Background of Exercise

1. What is a habitat & habitat mapping ?

Habitat is the type of natural environment in which a particular species of organism lives. In the scope of habitat mapping, habitats can be identified based on the vegetation composition and water availability.

Habitat mapping is a tool to study the habitats within an area. It can help understanding the baseline ecological condition and identifying if there is any important ecological resources present within the area. Typically, habitat mapping is used for land use zoning and ecological impact assessment of development project.

2. Basic steps in habitat mapping

- Identify areas for habitat mapping. (For example, the area of 500m buffer zone surrounding project site is mapped in Environmental Impact Assessment study.)
- Draft a habitat base map on basemap and aerial photos
- Verify the habitat type by field ground-truthing (onsite visit)

3. Why mapping habitat can help to evaluate how healthy the stream is ?

Habitat mapping help students to evaluate degree of human impact in an drainage area. For example,

- Village settlement and agriculture may transform landscape by removing vegetation.
- Developed area may imply discharge of human-induced chemicals, e.g. detergents into the stream.
- Woodland area implies protection from soil erosion by reducing surface runoff.

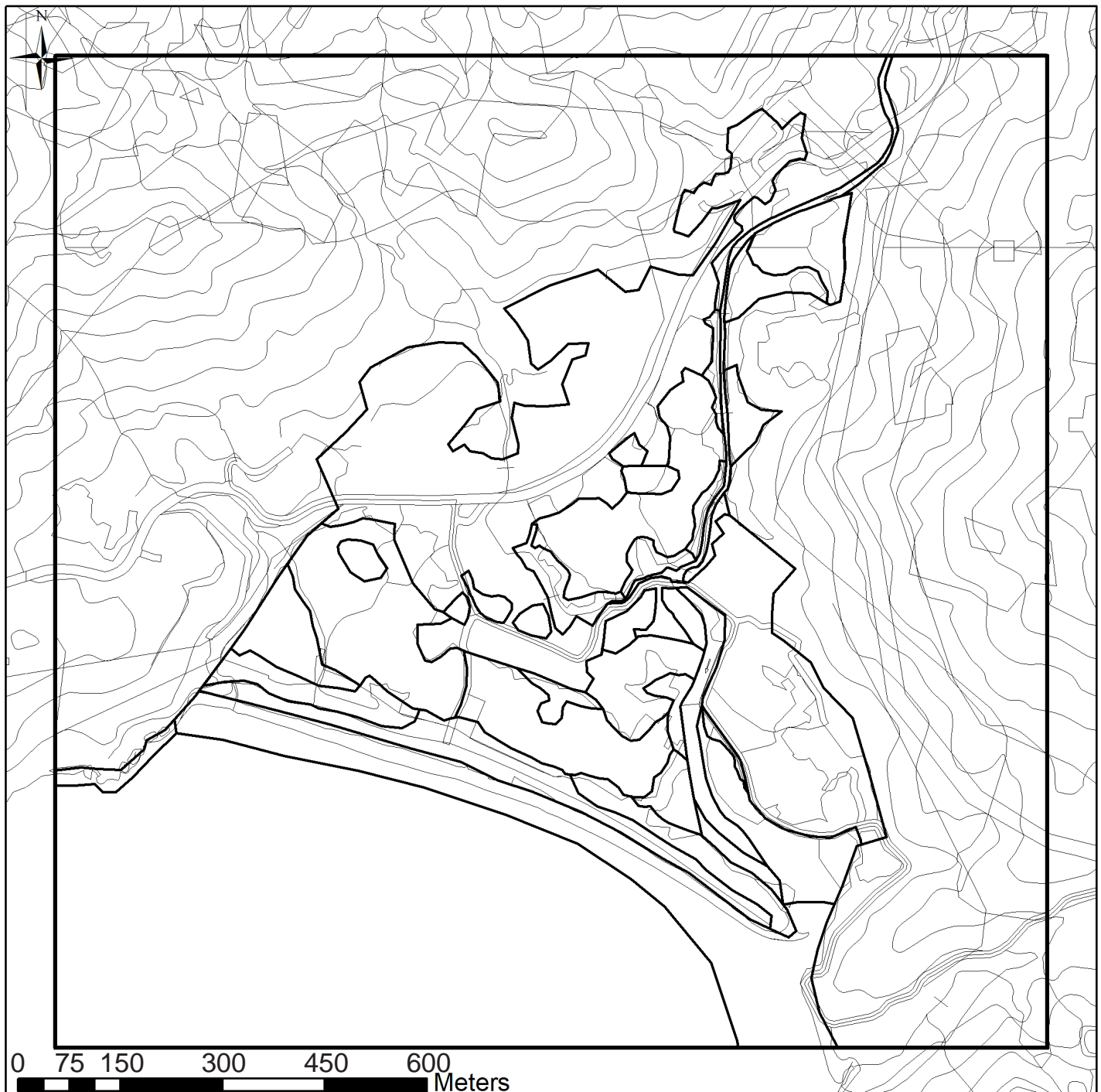


4. Brief descriptions on the habitats found on this map.

| Habitat | Description / Definition |
|---------------------|---|
| Agriculture land | Semi-natural habitat where the land is altered for agricultural use. The vegetation is basically composed of economically important plant species |
| Developed area | Man-made habitat where most natural habitats were disturbed due to human activities |
| Grassland | Habitat consisting herbaceous plants as dominant species |
| Intertidal Riverbed | A specific habitat used to describe the estuary of Pui O River |
| Intertidal Shore | Area that is subjected to tidal variation |
| Mangrove | Intertidal zone consisting mangrove species as dominant species |
| Marsh | Vegetated area with high water content. Wetland species can be found here |
| Mudflat | Intertidal zone composed of mud or fine sediment |
| Plantation | Man-made or semi-natural habitat where vegetation were planted mainly for greening purpose |
| Sandy Shore | Coastal shore composed of sand or fine sediment |
| Sea | A division of the ocean that is enclosed or partly enclosed by land. |
| Shrubland | Habitat consisting shrubs as dominant species |
| Watercourse | Natural streams or man-made channels |
| Woodland | Habitat consisting tree species as dominant species |















By exploring the surrounding area with the aid of google map satellite image, color the habitat map below accordingly :



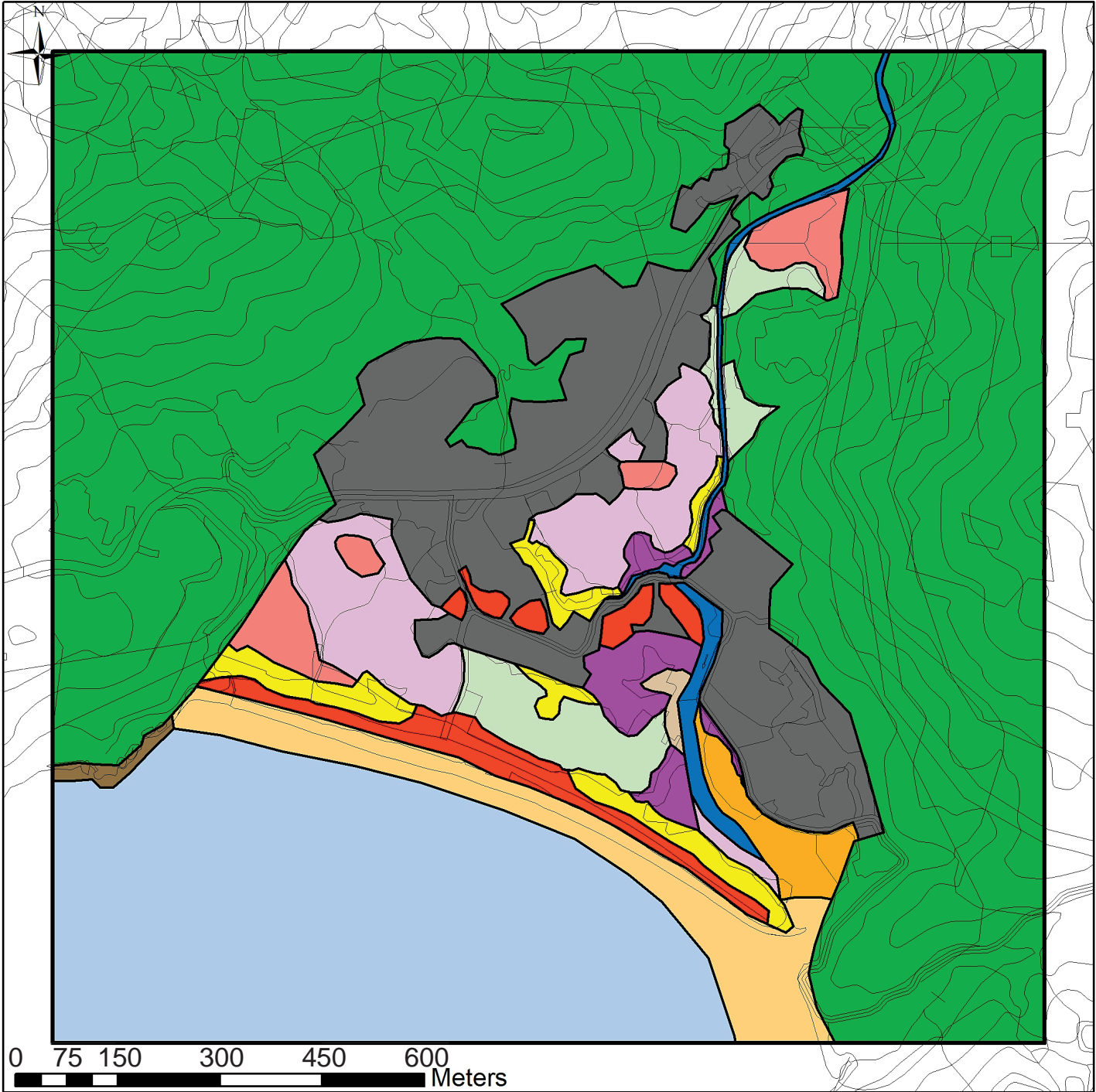
Source : Survey and Mapping Office, Lands Department

Habitat

| | | | |
|---|---|--|--|
|  Plantation |  Shrubland |  Sea |  Mudflat |
|  Agricultural Land |  Woodland |  Mangrove |  Developed Area |
|  Intertidal Riverbed |  Grassland |  Marsh | |
|  Sandy Shore |  Watercourse |  Intertidal Shore | |











Answer Key

(Teachers Version Only)



Source : Survey and Mapping Office, Lands Department

Habitat

| | | | |
|---|---|--|--|
|  Plantation |  Shrubland |  Sea |  Mudflat |
|  Agricultural Land |  Woodland |  Mangrove |  Developed Area |
|  Intertidal Riverbed |  Grassland |  Marsh | |
|  Sandy Shore |  Watercourse |  Intertidal Shore | |

Supplementary Survey (#SS5) : Environmental History Investigation

Introduction

Environment history exercise helps students to understand the interactions between man and the environment. A healthy drainage area attracts villagers as permanent residents. In return, village development also affect healthiness of stream and its drainage area.

There is a particular mission at each study site. i.e. to play the role of villagers and discuss in key moments or scenarios of village history. They will tackle the mission by on-site observation and analyzing historical sources, include the general map and habitat map provided in this workbook. By doing so, student will learn to evaluate how healthy the stream is in a cultural and historical perspective.

Working Steps (Suggested Time)

1. Understanding the mission (5 mins)
2. Reading Source (15 mins)
3. Summary & Discussion (5mins)
4. Presentation (5 mins)

(To enhance readability and information accuracy for learning purposes, slight grammatical / spelling corrections from original texts were made.)



Upper/Middle Course : Foundation of Lo Wai Village

Mission

Imagine you were the founding ancestor and his family members of Lo Wai Village (老圍), the earliest village of Pui O District, living in the late Ming Dynasty (late 16th century). After some preliminary observation of the current location, you decided to settle here. However, you had to go back to your home village in Tamshui (淡水) and persuade your fellow clansman to move to Pui O with you.

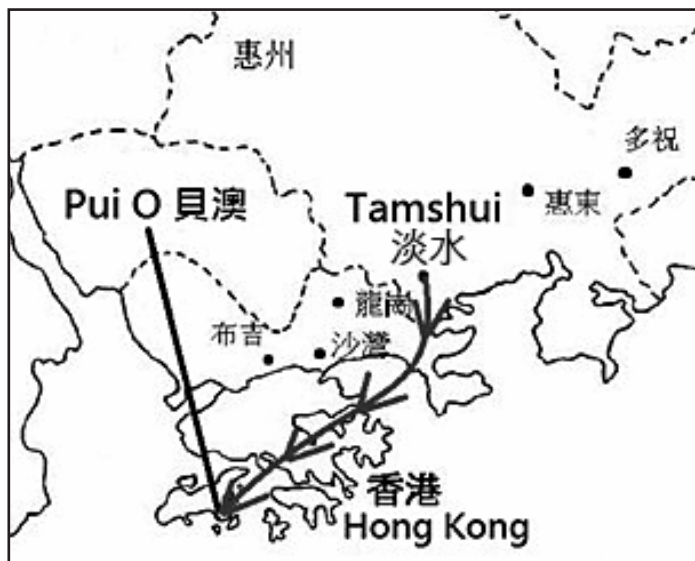
Hint : What are the locational advantages to settle at the current location? Was the Pui O River an attraction ? Why ?

Source 1

The Founding Story of Pui O Lo Wai Village (貝澳老圍村)

The Cheung family (張族) is the oldest in this part of Lantau Island. A man of 51 is of the 15th generation, giving a foundation date c.1580, or by 27-year period, 1550.

They came from Tamshui, and the story is that the founder came first alone, saw the land was good, but was afraid of bandits (土匪). He therefore returned to his village, collected some of his clansmen, and a group of them returned to Pui O (貝澳), where in the course of time they fathered a number of villages. The family tradition is that when they first arrived the area was uninhabited.



Source : John Strickland ed., Southern District Officer Reports: Islands and Villages in Rural Hong Kong, 1919-1960, Hong Kong University Press, 2010, p. 98.



Notes for Discussion / Presentation

Key Information and Idea :

The local name of Pui O River was Lo Wai Hang (老圍坑). The village is located in a transitional section between upper and middle stream. Water is clean for drinking, irrigation and other daily uses. The village was situated in an upland and inland position which was favorable for defense and surveillance against banditry. Nam Shan (南山) and Mau Yuen (茅園) offer shelter from cold and strong northeast monsoon. The natural environment of the current location is similar to villagers' ancestral homeland in Tamshui. Most Hakka villagers in Hong Kong settled in upland and inland areas of the eastern part of Guangdong province where they lived in upper reaches of river.

Site 2

Middle/Lower Course : Ancestral Tomb and Paddy Cultivation

Mission

Imagine you are paying tribute to your ancestors at the Ching Ming Festival. The three tombs are situated on a slope next to some abandoned fields. Your grandfather tests your knowledge about the history of your village and ancestors. You have to answer why the three tombs were built there. Otherwise, you won't get the pork and red pocket according to the tradition.

Hint : What did the tombs and abandoned fields tell us about the river ?



Source 1 : The Ancestral Tomb

Observe the tomb and answer the following questions :

1. What is the surname of the male ancestors ? When were the tombs built ?

The tombs belongs to Cheung Clan (張氏)

They were built in 1791 (乾隆五十五年)

2. Was it the first location of the tombs ? Why ?

No. The urns (金塔) suggest that secondary burial (二次葬) was taken place.

The present location is probably the second or third location of the tombs.

* **Reminder :** Visitors should respect local customs and ancestors of villagers. There are a few remarks during observation on ancestral tomb :

- 1 Keep your voice down during discussion.
2. Do not touch the gravestone (碑石) and urns (金塔).
3. Do not jump and run on the tombs.

Source 2 : Farmland in Pui O District

Pui O has a larger acreage of land than Ham Tin (鹹田村), but their land is less fertile. The produce of the salt fields of Ham Tin is superior both in quality and quantity than that obtainable from all land possessed by the Pui O people. Out of the total of 56 families in Pui O, 4 families possess no land, while 2 own more than 10 mu each (one owns 12 mu and one 20 mu). Half own less than 5 mu; the remainders own an average of 6 to 7 mu each. With the exception of 2 families who have sold their land to Cheung Chau people due to their failure in business, none of the remaining families have yet alienated (轉讓) their land to outsiders.

Source : John Strickland ed., Southern District Officer Reports: Islands and Villages in Rural Hong Kong, 1919-1960, Hong Kong University Press, 2010, p. 97.

Remarks:

- * 1 mu=660m² (1 Standard basketball court=420 m²)
- * “Pui O” mentioned in the source include Lo Wai (老圍村) and Sun Tsuen (新圍村).



Notes for Discussion / Presentation

Key Information and Idea :

The urns suggested that the present site is not the earliest location of the three tombs. The tombs were built in 1791, i.e. around 200 years after founding of Lo Wai. It implies that the villagers chose the present location after 200 years of observation. They had enough time to choose a secure location for ancestor burials.

The tombs were adjacent to the Pui O river (transitional section between middle and lower course). Flat and fertile land of the flood plain is favorable for farming (indicated by abandoned paddy fields). Hence, the biggest threat to farming and tombs is flooding, especially during summer monsoon (the wet and rainy season). The tomb site should avoid inundation (泛濫). The present tombs just stand outside the boundary of the flood plain.

- * This exercise requires students to analyze relation between location of ancestral tombs and extension of flood plain.

Lower Course / Estuary :

Mission

You were offsprings (子孫) of founding ancestors of Lo Wai Village. One night you had a dream and your ancestors asked you to start a new settlement called “Ham Tin” (鹹田) in the estuary of Pui O River to extend the territory of Cheung Clan. Now you have to investigate the surrounding environment and teach your clansmen how to settle there.

Hint : What are the advantages and disadvantages to settle in an estuarial region ?

1. What are the features of Wing On Bridge ? (**Hint** : Who built the bridge ?)

Wing On Bridge is a stone bridge made of granite. The two pillars (橋墩) were not identical and built in different ways . There is an earth god shrine (土地公神位) next to the bridge. These features suggested that the bridge was built by local residents or villagers themselves.

Source 1 :

Wing On Bridge 永安橋

Source 2 : Newspaper Clipping About Maintenance of Pui O's Sea Wall

Glossary of Keywords

海墘：seawall or breakwater
潮水湧入：seawater intrusion
南約理民府：Southern District Office
水利工程師：hydraulic engineer
禾田：paddy field
咸田 (鹹田)：Ham Tin
新村 (新圍村)：San Wai
羅屋村：Law Uk

【時代社】大嶼山具澳鄉近成田村之海墾，長一千四百尺，戰後十年來，鄉民逐年集資修葺，以禦潮水湧入；因該地居民以蠶爲生，經濟困難，對該陳舊海墾，實無力集資將其全部改葺，就羣予修理，亦視其損毀較重者而爲之。因於去年民政署長及南約理民府官巡視該地時，村民提出要求徹底協助修建，事後港府水利工程師曾親往視察，詳細查詢海墾有關實情，鄉民願照政府能於早日辦妥，事隔而今，詎料當局尚無任何表示，鄉民因感於前年之一大修建時，曾向鄧某借款一千元，鄉民負擔分期攤還，迄今仍欠二百元未清，而春耕期近，該墾又須檢查破漏，從本進行修理，鄉民鑒於所負負債未清，目前情形又需籌措修理費，實力有所不逮，因此衆議推派村代表，請求政府協助解決。據該地張姓鄉民稱：貝澳成田海墾，已有百多年歷史，爲貝澳鄉成田村、老圍村、新村、羅岸村等居民之不田防海水之唯一屏障，如海墾有漏洞，則該處之不田即被浸毀；戰前鄉民均有集資修葺，但因工程龐大，經濟所限，無法修妥。又因該海墾太狹，日常海水高漲，只餘一尺即過陂面，苟遇風雨，勢必潮水湧入，此時，則附近該墾之禾田，必受損毀，前年，該墾被風雨擊毀成一缺口，禾田過半被水淹浸。

，直至去年受害之田畝，僅能種植一造禾稻，比額損失，影響民生重大。該處鄉民又稱：彼等經年累月，在海邊修葺，已耗盡不少人力財力，就中以一九五一年曾一度獲得六千餘元，大事修理，只修出水口一處，已用去一半經費。嗣因海壓歷史過久，陳習非常，翌年另一地方又生破漏，致歷年不停修建，一九五四年之一次修理，鄉民已感筋疲力竭，特向鄧某借款一千元，現在仍未清還，尚欠二百元。今年春耕如果不一修，成本費，則又不能安心繼續耕作，目前鄉民固已生活困難，怎能再付出一筆消耗費用，有等去年負債仍未償還，今年購買仍未償還，去年購買仍未償還，仍待籌謀，對此不了之海壓修理負擔，農民惟賴政府協助，此屬公共安全，地方大眾福利，甚盼政府早日解決云。

Source: 《香港工商日報》，1956年2月17日。

Observe the surrounding environment of the site and answer the following questions :

1. The newspaper clipping mentioned about maintenance of seawall in the 1950s. Nowadays, do you find similar facilities around the site ?

Yes, there were artificial river banks (人工河堤) and water gates (水閘) at the downstream side of Wing On Bridge. (students should explore area around the bridge depending on time limit)

2. When was the seawall built ? Answer : C

A. Around 1600 **B.** Around 1700 **C.** Around 1800 **D.** Around 1900

3. What are the difficulties of settling in the estuarial region ?

Flooding (caused by seawater and freshwater), Daily Fluctuation of Tide (Tidal Change), Intrusion of Salt water, etc.



Notes for Discussion / Presentation

Key Information and Idea :

In order to settle successfully in the estuarial region, villagers should consider the following essential measures :

- Building a Bridge --- Water flow / discharge (流量) increases at the estuary because more and more tributaries (支流) flow into the mainstream. It is dangerous and inconvenient to cross the stream on foot.
- Building a Seawall --- To prevent coastal flooding due to seawater intrusion, building a seawall can save life and human development such as farmlands.
- Recruitment of Enough Manpower --- For regular and emergency maintenance of bridge and seawall
- Farming at the Estuary --- Extensive flat and fertile soil favorable for farming is available at the estuary. However, as salinity (鹽度) is higher at brackish water zone (鹹淡水區), villagers should grow salt-resistant crops (e.g. saline-alkali tolerant rice 鹹水稻).

Site 4

Estuary/Pui O Bay : Tin Hau Temple and Village Fisheries

Mission

After your ancestors reclaimed the estuary to start salt paddy fields, the Pui O Cheung Clan became populous. To cope with growing population pressure, fishing was required to supplement food demand. However, you didn't have the technique of inshore fishing (近岸漁業). The boat people (水上人) nearby were fishing experts. You have to persuade them to anchor (停泊) in Pui O and teach your fellow villagers.

Hint : What are the basic requirements to develop a fishing base ?



Source 1 : Location of Tin Hau Temple

Observe the site and answer the following questions :

1. When did the temple build ?

As suggested by the bronze bell (the oldest artifact of the temple) the Tin Hau Temple was built in 1799 (嘉慶四年) or earlier.

2. Describe the location of the temple site ?

The temple is located at the month of Pui O River (出海口). It faces towards (southward) the Pui O Bay (杯澳灣).

3. What do the age and location of temple tell us about man-land interaction in the coastal area ?

The building and location of the Tin Hau Temple suggested that there were fishing activities at Pui O Bay during the end of 18th Century.

Source 2 : Fishing Industry of Pui O

Like the inhabitants of Ham Tin, villagers in Pui O live partly on cultivating the land and partly on fishing at sea. The Pui O community owns one big boat (30 picul size) and 10 small sampans. The sampans are used mainly for catching pomfret (鰳魚) and cuttlefish (墨魚), but they also serve for other odd jobs. All men are trained to handle boats, nets as well as fishing lines, but women restrict themselves to agricultural works in the fields as well as firewood collection on the hills. Rearing of pigs and other domestic work are the duties of women.



Source : John Strickland ed., Southern District Officer Reports: Islands and Villages in Rural Hong Kong, 1919-1960, Hong Kong University Press, 2010, p. 97.

1. Do you find any sampan (舢舨) nearby ?

To be reported by students.

2. Where is the ideal site for sampan anchorage (停泊舢舨) ? Why ?

Free answer supported by sound reasons. The area behind the sand spit was traditional anchorage of boat people's sampan



Notes for Discussion / Presentation

Key Information and Idea :

To persuade boat people to anchor at Pui O, students should consider favorable factors for fishing activities such as

- Availability of fishing resources---such as brackish & marine fish and other crustaceans
- Availability of freshwater (Pui O river)--- for cleaning, cooking, and other daily uses
- Availability of shelter--- for protection from strong wind and typhoon
- Availability of market---for selling fish and buying daily necessities
- Availability of temple and shrine ---for worship and other religious purpose

Supplementary Survey (SS #6) : Sustainable Tourism Indicator

Introduction

A healthy stream attracts tourists and tourist activities also affect healthiness of stream. Since the late 1970s, Pui O had become a popular tourist attraction. Local residents gradually gave up their traditional means of living by switching to tourism-related businesses. Pui O Campsite, administered by Leisure and Cultural Services Department, attracted waves of local and non-local tourists during major holidays. Besides, Pui O is largely within Coastal Protection Area (CPA), and Pui O River is also listed as one of the Ecological Important Streams / Rivers (EIS) in Hong Kong. The influx of tourists implied tremendous impact to the local community and environment.

After conducting a case study in Pui O, student will learn about sustainable tourism in this exercise. They will carry out a qualitative observation on designated sites in Pui O with the aid of table below. Adopting research guideline from World Tourism Organization (WTO), United Nation, students will evaluate tourist resource, tourism activities and sustainability indicators of recent development of Pui O's tourism.

Examples

Tourist Resources : Resources that contribute to tourism in Pui O

- Geographical / Landscape : e.g. river, beach, coast...
- Biological / Ecological : e.g. mudskipper, buffalo...
- Cultural / Heritage Site : e.g. ancient temple, tomb and bridge...
- Amenities : e.g. restaurant, convenient stores, sitting-out area...
- Safety Issue : e.g. road, wild animals...

Activities : Popular tourist activities, e.g. camping, hiking, water sport...

Sustainability Indicators : Factors evaluating sustainability of Pui O's tourism

- Biological Sustainability :
e.g. any disturbance to plants and animals from visitors...
- Cultural Sustainability : e.g. any disturbance to local customs and traditions...
- Carrying Capacity : e.g. adequacy of facilities...
- Local Community View : e.g. attitude to holiday tourists...
- Tourist Satisfaction : e.g. feedback on Pui O trip...



| Assessment Criteria | | Contents | Rating (0-10) |
|--------------------------|---------------------------|----------|---------------|
| | Geographical/Landscape | | |
| | Biological/Ecological | | |
| Tourist Resources | Cultural/Heritage Site | | |
| | Amenities | | |
| | Safety Issue | | |
| Activities | | | N/A |
| | Biological Sustainability | | |
| | Cultural Sustainability | | |
| Sustainability Indicator | Carrying Capacity | | |
| | Local Community View | | |
| | Tourist Satisfaction | | |
| | | Total | |

*Grading : Scale 1 - 10 (1: lowest and 10 : highest), highest score : 100