
世界自然(香港)基金會製作
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INSECT
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小學及青少年中心
環境教育教材
Primary school
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environmental
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環境保護運動委員會及環境及自然保育基金贊助
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序

據說，摩西喚來大群蝗蟲到埃及法老王的領土吃盡一草一木；時至今日，在時間巨輪進入第三個千禧年之始，蝗蟲的威力再次得到印證。澳洲預期難逃同一命運，儘管農民竭力防範蝗禍，仍難免殃及幅員廣闊的農田。昆蟲在個人層面的影響力也絕不遜色，由晚上在身旁纏擾不休的蚊子，以至在廚房急竄的蟑螂，昆蟲的確無處不在。無疑，部份昆蟲到處為禍，但也有不少昆蟲是美感的化身和靈感的來源，如婀娜的蝴蝶、辛勤的螞蟻和忙碌的蜜蜂。

以生物量計算，螞蟻的總重量比地球所有人類的重量總和還要多，對土壤生態的貢獻更遠勝人類。地球生物多不勝數，但從數量和多樣化而言，昆蟲無疑稱冠 (達爾文不是說過「上帝定必對甲蟲有無比的鍾愛！」嗎？)，昆蟲對聯繫地球生態結構方面尤其居功至偉。然而，我們對昆蟲的認識貧乏，相信經著述的昆蟲品種不到百分之十，詳細研究的更寥寥可數，且多屬於商業價值品種。

本教材套由環境保護運動委員會及環境及自然保育基金贊助製作，旨在帶領兒童探索昆蟲世界，認識何謂昆蟲，其功用及重要價值。我們也要汲取昆蟲知識，否則難以體會牠們維繫地球生態及棲身其中的生物的重要價值，最終惠及人類的福祉。

Brian Morton

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世界自然(香港)基金會教育委員會主席

簡介

昆蟲是地球數量最龐大的動物類別，與人類的生活息息相關。牠們無處不在，不論陸上、上天或下水也可找到牠們的蹤影。昆蟲最適宜作為環境教育的課題，讓兒童可以在輕鬆有趣的氣氛中認識人類和野生生物之間相互的密切關係。

製作「齊來點蟲蟲」教材套的目標

本教材套旨在推廣昆蟲觀察活動，藉此：

- 增進兒童認識和了解人類和自然環境的密切關係；
- 提高公眾和兒童研究自然環境的興趣；
- 提倡在自然環境中學習，令學習內容更豐富充實；
- 鼓勵公眾善用公園和郊野公園推行環境教育。

「齊來點蟲蟲」教材套的對象

本教材套特別為協助教師、家長或社工向小學學童推行環境教育而設。教材套的活動建議可作為學校和青少年中心的活動參考。推行昆蟲觀察活動和環境遊戲時，師長能與兒童一同認識昆蟲世界的奧妙和令人嘖嘖稱奇的獨特之處。同時，觀察昆蟲的過程亦可體現人類與大自然唇齒相依的連繫，讓我們學習如何與所有生物和諧共處。

如何使用本教材套？

「齊來點蟲蟲」教材套由五個章節和附錄組成。章節內容詳細闡述昆蟲的資料、觀察昆蟲的守則和技巧。附錄提供跟進活動的參考資料。

步驟一　細讀教材資料，掌握昆蟲和觀察技巧的基本知識。

步驟二　參考第四章的建議，選定適合進行昆蟲觀察活動的地點。

步驟三　根據選擇地點的優點和限制，選擇最合適的地點進行昆蟲觀察活動。

步驟四　選擇和籌備準備活動，向兒童簡介活動詳情，加深他們對昆蟲和觀察昆蟲的環保守則的認識。

步驟五　在選定的地點進行昆蟲觀察活動後，舉行跟進活動，加強兒童對環境保護概念的認識。

查詢：

如欲查詢「齊來點蟲蟲」教材套內容或昆蟲觀察活動，請致電2652 0285或以電郵ihcsc@wwf.org.hk與自然基金教育主任聯絡。

請支持自然基金改善本會的教育項目

你的寶貴意見有助本會提高教育項目的質素！請填妥第81頁的問卷傳真至2651 0276或寄回新界大埔元洲仔里，元洲仔自然環境保護研究中心，自然基金教育主任收。

第一章

奇妙的昆蟲世界

昆蟲與人類

人類生活的四週皆可發現昆蟲的蹤影，昆蟲不但是製造食物、衣料和藥物的原材料，亦與人類文化和思想有著緊密的關係。

昆蟲傳說

基於人類與昆蟲的關係密切，很多文化、節日慶典和傳統思想也提及昆蟲的生長週期。

在中國.....

- 春回大地，氣候變得溫暖，昆蟲也活躍起來。中國傳統節氣「驚蟄」便是指昆蟲在春天從冬眠甦醒。
- 中國傳統亦有不少以昆蟲為題的故事，其中「梁山伯與祝英台」的故事更是家傳戶曉，中外聞名。故事講述兩個主角死後化為蝴蝶，擺脫家庭的枷鎖，有情人終成眷屬。
- 古時中國人相信蟬是輪迴再生或靈魂不滅的象徵，因此在古墓中常發現死者口中含有蟬型玉佩，象徵死者得以早日投胎轉世。

在西方.....

- 一種名為Sacred Beetle的甲蟲是古埃及人的重要宗教象徵，他們同樣把甲蟲作陪葬品，與中國的玉蟬具異曲同工之妙。
- 古代的女士以瓢蟲來占卜婚姻，她們先把瓢蟲放在掌上，瓢蟲往哪方飛走便代表未來的丈夫來自哪一方。

是敵是友？

昆蟲與人類的生活息息相關，亦敵亦友。

友好伙伴

昆蟲是自然界傳播花粉的重要媒介。蝴蝶、蜂、胡蜂、螞蟻和其他昆蟲在花間留連，吸食花蜜和花粉，間接為植物傳播花粉。野生蘭花等植物的結構特別，方便其獨特的昆蟲伙伴吸食花蜜。

昆蟲亦是野生世界的清道夫，螞蟻、白蟻和部份甲蟲以死去的有機物為食糧，種類包括落葉、朽木，以至動物的糞便，再把這些物質重新引入食物鏈。

部份昆蟲如蠶蟲結繭吐絲，為人類提供珍貴的製衣材料。

昆蟲製造的食物亦為人類提供營養豐富的食糧，美味的蜂蜜便是從蜂巢中抽取。昆蟲也是食虫生物的捕獵目標，亦是人類的美味佳餚，蝗蟲、螞蟻、白蟻、甲蟲和草蜢等昆蟲是非洲和阿拉伯國家，以及多個亞洲地區的常見食物。

部份昆蟲是天生的殺滅害蟲專家，瓢蟲是廣受農民歡迎的昆蟲，能消滅蛀食植物的蚜蟲。

天然敵人

- 昆蟲是疾病的傳播媒介，瘧疾、黃熱病和腺鼠疫經雌蚊或蝨傳播。人類被蜂和胡蜂刺傷，往往會出現紅腫敏感的反應，情況嚴重更可能致命。
- 昆蟲常見寄生在家畜身上，影響動物的健康和食慾。
- 部份昆蟲如定期遷徙的蝗蟲以植物纖維為食糧，因此對農作物和農戶造成嚴重的破壞，被視為害蟲。

知多一點點

改善環境衛生有助防治大部份由昆蟲傳播的疾病，如瘧疾、黃熱病和腺鼠疫等。

觀察昆蟲的環保守則

眼看手勿動

提及觀察昆蟲，往往聯想到捕捉昆蟲作標本，其實這個概念並不正確。觀察昆蟲與觀鳥一樣，應以愛護環境的方式進行，儘量減少對野生生物造成滋擾。

昆蟲標本一般用於科學研究或存放在博物館作研教用途。但近年供商業銷售的昆蟲標本日趨普遍，旅遊業的蓬勃發展亦促使昆蟲標本成為遊客採購的紀念品或收藏品。這些供商業買賣的昆蟲標本往往採集自野生生境，導致昆蟲種群下降，破壞整個生態系統。昆蟲在自然環境擔任多個重要功能，由傳播花粉、分解腐肉和糞便、控制害蟲以至作為複雜的食物網中其他生物的食糧，因此昆蟲的數量一旦下降，便會影響整個生態系統的運作。

飛蛾標本

觀察昆蟲不一定需要製作昆蟲標本。在野外觀察昆蟲，不但可認識昆蟲的特徵，還可了解牠們與其他生物的關係和適應環境的方法。縱使有時需要捕捉昆蟲作近距離觀察，也應遵守合乎環保的原則，減低對野生生物造成滋擾。這些技巧將在第三章詳述。

觀察昆蟲的注意事項

遵守事項：

- 只在必須時才捕捉昆蟲，觀察完畢後把牠們放回捕獲的地方。
- 設置陷阱活捉昆蟲，不要採用殺死昆蟲的陷阱。
- 捕捉昆蟲的技巧必須恰當，收集昆蟲的膠瓶或器皿應大小合宜。
- 捕捉和釋放昆蟲時應加倍小心，以免傷害昆蟲。
- 把捕獲的昆蟲放在收集昆蟲的膠瓶，用小巧的放大鏡加以細心觀察。
- 每隻昆蟲應放在獨立的膠瓶。
- 進行觀察昆蟲活動時，應避免影響自然環境。
- 離開野外時，緊記把所有捕獲的昆蟲放回自然環境。
- 完成池塘探索後，緊記用清水和肥皂清潔雙手。

禁止事項：

- 觀察時切勿用手捕捉或緊握昆蟲。
- 不要捕捉昆蟲作標本。
- 不要以身體任何部份接觸昆蟲。
- 不要搖晃盛有昆蟲的膠瓶。
- 不要把昆蟲留在膠瓶超過十五分鐘。
- 不要把盛有昆蟲的膠瓶放置在猛烈陽光下或浸在水中。
- 不要在膠瓶放置超過一隻昆蟲。
- 捕捉昆蟲時，不要干擾自然環境。
- 尋找水生昆蟲時，不要涉足陡斜的池塘邊或踐踏池塘兩旁的土地。

舉行昆蟲觀察活動的程序

戶外觀察前：

- 介定活動目標（科學概念、環境教育原則、康樂）。
- 正式進行活動前，前往可行的地點考察，選出最合適進行昆蟲觀察活動的地點（小組人數、交通安排、安全問題）。
- 了解選定的觀察地點的地理環境，並找出該處最常見的昆蟲。
- 準備所需用具，以便情況許可時供捕捉昆蟲之用；並向參加者簡介昆蟲觀察活動應注意的事項。
- 參考教育署或其他組織的指引為戶外觀察做好準備。
- 向香港天文台查詢活動當日的天氣預測。

舉行戶外觀察時：

- 提醒參加者注意安全和遵守環保守則。
- 留意活動的進行情況。
- 不時召集參加者匯報發現的昆蟲種類，一起分享觀察昆蟲的樂趣。
- 緊記把所有捕獲的昆蟲放回所屬的地方。

完成戶外觀察後：

- 建議進行觀察後跟進活動，加深參加者對昆蟲的認識。
- 進行活動後匯報，加強參加者的環境保護概念。
- 鼓勵參加者在學校或青少年中心的一角設立昆蟲專區，張貼有關昆蟲的剪報和海報，也可放置有關昆蟲的書籍和參考資料，培養青少年對昆蟲的興趣。

昆蟲世界

昆蟲面面觀

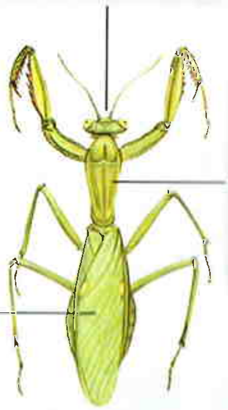
昆蟲世界多姿多采，蘊藏很多有趣的事物讓我們發掘。每種昆蟲都有其獨特的本領適應不同的環境。研究昆蟲的習性和生境，觀察牠們與其他生物的相互關係，有助我們了解生態系統的運作模式和認識生物多樣化的重要價值。

昆蟲「3+3方程式」

昆蟲屬昆蟲綱動物，運用「3+3方程式」可鑑別昆蟲和貌似昆蟲的生物。昆蟲成蟲的軀體可分為頭、胸、腹三部份和三對腳。昆蟲沒有脊骨，屬無脊椎動物。身體主要靠外骨骼支撐，

頭　部

- 一對複眼(可見於大部份昆蟲)
- 觸角一對，是昆蟲靈敏的探測器，位於兩眼之間和口器上方。
- 口器(不同昆蟲的口器包括：成舌狀便於體外消化食物之用；吸管狀作吸食之用；大顎作咀嚼用)。



胸　部

- 三對腳
- 成蟲沒有翅膀，或胸部長有一對或兩對翅膀。

腹　部

- 位於昆蟲身體的後部，內藏重要的消化和繁殖器官。

快速小測試

試運用「3+3方程式」分辨出哪些是昆蟲。

千足蟲　蜘蛛　草蜢　蝽象　蝸牛

[illegible]

這個保護外層除了發揮保護的功用外，也是昆蟲活動的支架。

牠們是昆蟲嗎？

多個蜘蛛綱的動物如蜘蛛、蠍子和壁虱的外型與昆蟲十分相似，運用「3+3方程式」能分辨牠們的差異。

百足和千足蟲的外貌與昆蟲幼蟲十分相似，但同樣可運用「3+3方程式」加以區別。從中文名稱中的「百足」和「千足」可見牠們的腳的數目較昆蟲為多，同時，身體亦分成多節，與昆蟲只有三個身體部份不同。

覓食工具

昆蟲以葉、花蜜、花粉、木料、甚至腐爛的有機物質為食物。不同的口器能與進食的食物類型配合得天衣無縫。細心觀察昆蟲的口器便可得知牠們的攝食和生活習慣。以下為主要的口器類型：

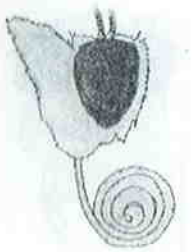
咀嚼型口器

咀嚼型口器

這是最普遍的昆蟲口器，擁有這類口器的昆蟲主要以固體食物為食糧。口中有類似顎骨的構造，稱為大顎，用作切斷、擠壓和磨碎食物。蜻蜓、草蜢、蝗蟲和蟋蟀是擁有這類口器的典型昆蟲。蜂也有咀嚼型口器，但結構修長，方便吸啜花蜜。

吸啜型口器

長有吸啜型口器的昆蟲主要吸啜血液、花蜜和植物汁液。這類昆蟲的口器進化為長型的吸管，稱為口吻，方便吸啜汁液。半翅目、血虱和蚊長有吸啜型口器。蝴蝶和蛾把口吻伸入花朵吸啜花蜜。



吸啜型口器

舐吸型口器

舐吸型口器

除蒼蠅外，很少昆蟲擁有這類型的口器。蒼蠅的口吻成海綿狀，進食時像海綿般吸取汁液和食物微粒。

接收信息的觸角

昆蟲頭部的一對觸角是識別身分的主要特徵之一。大部份昆蟲的觸角是味覺、觸覺、聽覺和溝通的感覺器官。以部份雄蛾為例，觸角可探測遠至數千米外雌蛾發出的化學氣味。

蝴蝶桿狀的觸角和蛾的羽毛狀觸角是分辨兩者的主要特徵。

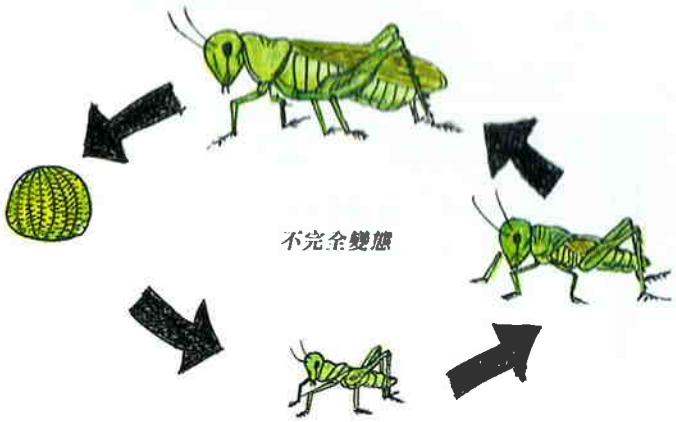
有翅昆蟲與無翅昆蟲

部份昆蟲長有翅膀，部份則沒有。不同昆蟲的翅膀在形狀、大小和圖案也各有不同之處，因此翅膀是識別有翅昆蟲的另一種重要特徵。昆蟲的翅膀亦發揮了保護作用，幫助牠們在野外求生。

蝴蝶翅膀上的眼型圖案

蛾擁有羽毛狀觸角

以蝴蝶為例，鉤翅眼蛺蝶的深褐色翅膀貌似枯葉，這種天然的保護色有利牠逃過捕食者的耳目；美眼蛺蝶翅膀上的眼型圖案具有嚇阻敵人的功用；其他蝴蝶如銀線灰蝶，在後翅端長有類似觸角般的細小翅尾，藉此混淆捕食者的注意力。



不完全變態

昆蟲的生命週期

大部份昆蟲由幼蟲長至成蟲階段時身體都會經歷數次明顯的轉變，名為變態過程。所有昆蟲也需經過不完全變態或完全變態過程才會蛻變為成蟲。

不完全變態

經歷不完全變態的昆蟲，其成蟲與若蟲的外型十分相似，較明顯的分別在於體型不同和若蟲沒有翅膀。若蟲需經過多次蛻皮，每次身體會長出新的角質層，舊的外層則會脫落。蜻蜓、豆娘、草蜢和蟑螂等都屬於不完全變態的昆蟲。

完全變態

此類昆蟲的成長過程包括卵、幼蟲、蛹和成蟲四個階段。卵孵化出幼蟲後，繼而在蛹的階段蛻皮，在此期間幼蟲不會覓食和活動，待蛹中的幼蟲長成後便會破蛹而出。昆蟲在幼蟲和蛹兩個階段的形態和食物類型都與成蟲截然不同。蝴蝶、蛾和蜂是經歷完全變態過程的昆蟲。

完全變態

進攻和防禦

昆蟲有多個防禦敵人和自衛的方法，除了細小的身型有助逃過捕獵者的追捕外，尚有其他自保的方法：

保護色

部份昆蟲的外骨骼、翅膀的顏色和圖案與四周環境十分相似，部份昆蟲的體型和附屬物則模擬其他自然景物的模樣。竹節蟲是其中的佼佼者，外型與四周的植物相似。紅衽蝶的幼蟲模仿侵略成性的蛇，以阻嚇敵人的襲擊。其他昆蟲則以身上奪目的圖案來威嚇或擾亂敵人的注意力。

攻取型

部份昆蟲長有有毒的螫針、刺、能發出厭惡氣味的腺體或堅硬的剛毛作自衛。蜂和胡蜂是典型的例子，常組成上千的蜂群抗敵。

身體活動

昆蟲依賴腳或翅膀活動，不同的腳關詳和構造進化至能進行不同類型的身體活動，包括行走、跳躍、游泳和運送食物。以大牛糞金龜為例，運用後腳滾動糞土，推回泥土中的繁殖地道，而蜜蜂則以後腳收集花粉。有時昆蟲會舞動身體作溝通。群居昆蟲如蜜蜂透過舞動向其他工蜂示意採集花蜜的地點。螞蟻以觸角相碰交換信息；歐洲築墩蟻通過口器傳遞信息，有如互相親吻。

聆聽昆蟲的聲音

很多昆蟲也會發出聲音，因此聆聽牠們發出的聲音是尋找其蹤影的方法。昆蟲發出聲音的主要目的是與同類溝通或求偶。不同的昆蟲各有其獨特的發聲器官，如蟋蟀把翅膀擦向兩旁而發出聲音；蝗蟲把一對後腳快速升降，讓後腳內側的距(腳後突出如腳趾的部份)與翅膀上堅硬的翅脈互相磨擦，便能「高歌」起來。

昆蟲氣味

很多昆蟲會發出獨特的氣味，這些味道或釋放的化學物質是昆蟲用作溝通的工具和嚇阻敵人的武器。蝽象長有發達的基詳腺，能排出令人厭惡的氣味。雌性的帝皇娥釋放出的化學物質雖然不為人類察覺，但長有發達的羽毛狀觸角的雄性帝皇娥在遠至數千米以外的地方也可偵測到。

知多一點點

只有雄性的蟬才會尖聲鳴叫，其發音器官長有一片緊脹膜，被一組特別的肌肉曲扯後會發出「喀嚓」聲，像把鐵罐蓋子按下的聲音。聲音經緊脹膜旁的特別共鳴室所擴大。「蟬鳴」實際上就是不同震幅產生的一連串快速聲響。

兩蟻相遇

隱藏在植物中螳螂

蟬

蛸象

觀察昆蟲的地點

以品種論，昆蟲是地球上數目最多的生物，遍佈每一個角落。細心觀察有助了解牠們的分佈與不同生境之間的關係。

自然環境

找尋陸上昆蟲

胡蜂和甲蟲喜歡躲藏於岩石、石縫和枯木等黑暗潮濕的環境。這些昆蟲在枯木中築巢度過冬季。

你也可以撥開泥土上的腐殖土和枯葉，會發現螞蟻、蟋蟀和甲蟲棲身其中並尋找食物。小心翻開表土，可輕易找到蟬和蛾等昆蟲的幼蟲，藏身於表土以植物的根部為食糧。

動物的糞便對某些昆蟲如大牛糞金龜和蒼蠅而言既是溫暖的環境，也是含有豐富養分的理想育幼地方。因此，動物糞便往往吸引有這「癖好」的昆蟲，其他腐壞的有機物質如動物的屍體等也是昆蟲的食物來源。

觀察樹木生境

草地和樹木的葉是找尋蝴蝶幼蟲、草蜢、螳螂、瓢蟲和甲蟲的理想地點。草和葉的枯黃部份可能是昆蟲進食後遺下的痕跡，留意這些細微的痕跡便有機會找到牠們。此外，也需留意葉的底部，通常是昆蟲產卵的主要地點。

白蠟蟲和蛾擁有保護色，外貌與樹皮相似，喜歡在樹幹上棲息。部份在樹幹築巢的昆蟲如木蜂和齒小蠹會在樹上留下隧道狀的坑紋。有些昆蟲把巢築在樹根或懸吊於樹枝上，黑樹蟻便是典型的例子。另有一些昆蟲如甲蟲和蝴蝶則在遮蔽的樹枝上結蛹冬眠。

有強烈氣味的花朵、果實和硬殼果往往被昆蟲視為佳餚。蝴蝶、胡蜂和蜂等採食花蜜的昆蟲經敘在花叢留連。蚜蟲和沫蟬以果實為食物，因此敘見成熟的果實有被蟲咬留下的斑點。搜集某類昆蟲的食物資料有助找尋個別的昆蟲。

知多一點點

蝴蝶挑選植物產卵的要求十分嚴格，其幼蟲一般只以一至兩種植物為食糧。成蟲若找不到合適的植物作為幼蟲的食糧便不會產卵，假若幼蟲被移離這株植物便會餓死。

觀察水生境

沼澤、河流、池塘和湖泊等不同的水生境各有不同的動植物物種，這些物種吸引不同的昆蟲在水面和水中生長。開闊而清澈的水生境是觀察水生昆蟲的理想環境。

集中觀察淡水池塘的水面一般可帶來豐富的收獲，可找到水黽在水面滑行覓食，亦可找到划蝽蟲和龍蝨不時浮出水面呼吸。蜻蜓會停歇在水面的植物上，雌性的蜻蜓會把腹部輕點水面產卵。

部份水生昆蟲會在池塘邊、岩石或池塘底部停駐，並以水生蕈草為棲息地和食物。小心觀察這些地點，可發現甲蟲和蜻蜓、蜉蝣和豆娘的幼蟲或若蟲。

米埔自然保護區內的淡水生境

觀察飛行昆蟲

蜻蜓、蛾和白蛾等飛行昆蟲在下雨前後較為活躍。選擇在「適當」的時間和「適當」的地點觀察飛行昆蟲定可滿載而歸。例如，蝴蝶在日間最為活躍，蛾多在晚間活動，在淡水生境則較容易找到蜻蜓。

人造環境

找尋家中昆蟲

廚房是昆蟲最常出沒的地點。象甲喜歡穀物，因此常見於米箱；令人厭惡的螞蟻、蟑螂和蒼蠅以廚房內餘下的食物或糕點為目標，也常出沒於廢物箱、污水管或未有妥善貯存的食物中。

衣魚和嚙蟲喜歡躲藏在地櫃、衣櫃或書架等黑暗的角落。衣蛾在衣服上產卵，其幼蟲以棉和毛皮作食物。

在人體或寵物的身體上也可找到昆蟲。蚊、虱和蚤便以哺乳動物的血液為食糧。

在公園找尋昆蟲

市區的綠化地如各大小休憩公園，各種植物和水生境設施經常吸引不同的昆蟲。

觀察昆蟲的最佳時節

季節的分際

昆蟲雖見於一年四季，但香港以春夏兩季為觀察昆蟲的黃金季節，大部份昆蟲此時由幼蟲蛻變為成蟲，為交配和繁殖作好準備。昆蟲在冬季減少活動，部份躲於遮蔽處越冬，較難找到牠們。

搜集昆蟲生命週期的資料有助認識某種昆蟲。牠們因應食物的供應和氣候的變化，於特定季節經歷不同的成長階段。

按日的變化

大部份昆蟲活躍於日間，忙於覓食或交配，每遇下雨或刮風等惡劣天氣，便躲於安全的遮蔽處，部份則於夜間蠢動覓食；部份昆蟲喜「撲火」，於夏夜經敘可以看見牠們於街燈下飛動。大部份昆蟲選擇於晚間蛻變，藉此減低受襲的機會。

活躍於日間的昆蟲

蝴蝶、蜉蝣、蜻蜓、胡蜂、蜂、瓢蟲、蟬、蒼蠅、螞蟻

活躍於夜間的昆蟲

蛾、蟋蟀、蟑螂、蚊、螢火蟲

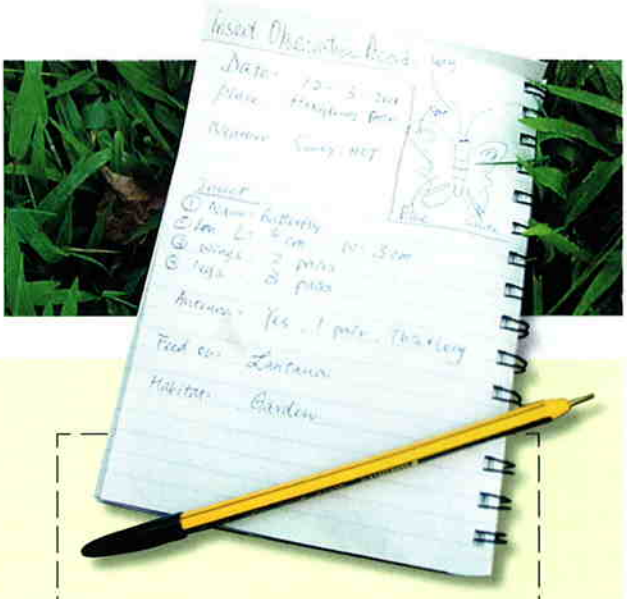
觀察昆蟲的秘訣

野外記錄

把昆蟲的特徵記錄下來，令觀察記錄更豐富有趣。扼要的筆記不但有助加紳觀察者的記憶；更方便於不同的時間、地點、天氣進行比較和分析，同時亦可隨時加入參考讀物的額外資料。筆記隨時日不斷累積，有助增進觀察者對昆蟲世界的認識。有條不紊的筆記不但成為寶貴的個人參考資料，也是監察生境地生態狀況的珍貴資源。

編製筆記注意事項：

- 觀察昆蟲時把袋裝筆記本和防水原子筆放在外褸袋等觸手可及的地方。
- 有趣的昆蟲隨時隨地出現，請沿途帶備筆記本。
- 一張有系統的分類記錄表有助初學者寫下詳細記錄。
- 把所見所聞即時記下，重點有可能於考察完畢後遺忘。
- 昆蟲出現時，把日期、時間和發現地點記下，這些資料對研究昆蟲生態十分重要。
- 未能即時識別昆蟲的名稱並不重要，留意昆蟲的特徵與四周環境的關係有助辨認其身分和研究其生態。
- 昆蟲速寫是準確快速的記錄方法。
- 趁記憶猶新，儘快翻查辨認昆蟲的參考資料。
- 比較於同一地點但在年中不同時間記下的資料，或可發掘出更新奇的資料。



昆蟲觀察記錄範例

日期：_____

時間：_____

天氣狀況：_____

地點：_____

昆蟲速寫

昆蟲的資料

有見過這種昆蟲嗎？☐有 ☐沒有

名稱：_____(如知道)

體長／翅膀展開長度：_____毫米／_____毫米

顏色／圖案：身體：_____ 翅膀：_____

腳：_____ 觸角：_____

翅膀數量：☐沒有 ☐一對 ☐兩對

性別：☐雄 ☐雌 ☐不肯定

行為：☐交配 ☐產卵 ☐歇息

☐打鬥 ☐運送物料：_____

食物類別：生果／花／葉／木／動物糞便／腐殖土／其他：_____

曾留連的植物的名稱：_____

☐其他：_____

數量：☐單獨 ☐成群

四周環境

發現地點：☐空中 ☐植物表面 ☐石塊表面

☐水面 ☐水底 ☐其他：_____

生境種類：☐自然環境：林地／河流／河塘／淡水池塘／草原／海岸

☐人造環境：市區公園／家中／學校／食肆

☐其他：_____

備 註 ：

_____

_____

後記：

_____

_____

觀察活動

根據前文提供的資料，你應對怎樣觀察、何時和何處觀察昆蟲有概括的認識。累積所得的經驗和資料有助你了解觀察特定昆蟲的最佳地點和時間，藉此豐富你對環境的認識。

昆蟲放大鏡

在觀察過程中運用你的視覺、聽覺和嗅覺增添觀察的樂趣。放大鏡或收集昆蟲的膠瓶等簡便的工具有助你仔細觀察，緊記攜同筆記本並把資料記下。

環保小建議

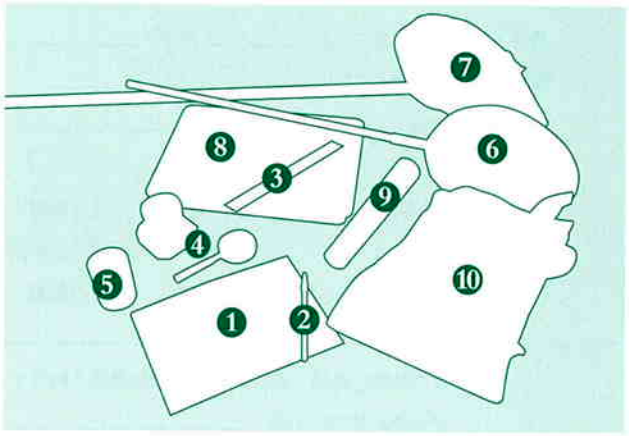
在野外觀察昆蟲，不一定要帶備所有工具，徒手觀察也能體會箇中樂趣。然而，對於部份極其活躍的昆蟲卻需運用一些技巧和工具協助進行仔細研究，不過，有關的活動必須按照環保守則進行，請參閱第二章。

昆蟲研究的基本用具

觀察昆蟲的輔助工具有多種，簡便的工具如收集昆蟲的膠瓶、筆記本、網等皆是初學者的必備用具。每次到野外觀察昆蟲，應按季節和地點從清單中挑選合適的工具。

昆蟲觀察用具清單

1. 筆記本
2. 原子筆
3. 間尺：量度昆蟲的大小。
4. 放大鏡：尋找細小的昆蟲和仔細觀察其身體部份。
5. 收集昆蟲的膠瓶：盛載捕捉回來的昆蟲作觀察。
6. 捕蟲網：大而深的網方便捕捉陸上昆蟲，網袋的堅韌度需足以承受樹木或草的割損。
7. 撈網：網較堅韌，呈三角形或「D」形，方便舀取河塘底部的昆蟲和防止昆蟲從網底漏出。
8. 白色盤子：方便觀察捕獲的昆蟲
9. 手電筒：於晚上吸引蛾和螢火蟲。
10. 百寶袋：存放所有用具。



我可以自製用具嗎？

雖然上述用具並不難找，自己動手製作或以其他物料代替也是很好的主意。自製觀察昆蟲工具是一項趣味盎然的觀察前活動，請依照第24頁的指示，善用家中的物料製作，並發掘當中的樂趣！

捕蟲工具

捕捉昆蟲的方法

雙手

捕捉陸上昆蟲的最容易方法是直接用手捕捉。然而，部份昆蟲為了自衛會刺螫人類，引起皮膚敏感。因此，除非確定安全，勿徒手拾起昆蟲。一隻邊緣順滑（如塑膠製）的鉗子也能發揮作用，但注意捕捉昆蟲時力度應適中，避免造成傷害。

網

網最宜用來捕捉飛行的昆蟲，但緊記牠們的雙翼十分脆弱，應選用以棉線等又輕又軟的材料製成的網。

工具：

■ 捕蟲網

怎樣捕捉昆蟲？

1. 悄悄靠近目標昆蟲。
2. 把捕蟲網迎向目標昆蟲，快速把牠困在網內。
3. 把網翻轉並把尖的一端垂直拉起，讓昆蟲爬進網內的尖端。
4. 把網口扭緊，令昆蟲困在內。
5. 待網中物靜止下來，然後細心觀察牠。
6. 把收集昆蟲的膠瓶小心放進網內並移向昆蟲，讓牠慢慢爬進瓶內，注意不要弄傷昆蟲。
7. 從網內把瓶子取出，並蓋上盒蓋。
8. 把資料記錄在筆記本，然後把昆蟲釋放。

小建議：

■ 你可以使用捕蟲網捕捉草地或雜草中的昆蟲，踏足草地時，把網在身前作「8」字形橫向擺動。

請君入甕

設置陷阱是捕捉爬行昆蟲的良方。

物料：

■ 鐵罐

■ 泥鏟

■ 扁平的石塊一塊用以遮蓋瓶口

■ 小卵石四塊

■ 不同種類的食餌

怎樣做？

1. 在罐底戳穿數個小洞疏導雨水，避免雨水淹死昆蟲。把枯葉、食物渣滓或水果等食餌放進罐內。
2. 把罐子放進去，罐口須與地面高度一樣。在罐口附近放數塊卵石，並蓋上扁平石塊，令其看來較自然。
3. 在日間和晚上定時檢查罐子，把昆蟲落入陷阱的時間、數量、物種、特徵等資料記錄下來。
4. 完成記錄後把昆蟲釋放回原處。
5. 實驗完成後把罐子移走。

小建議：

利用不同的食餌重覆實驗，你會驚訝落入陷阱的昆蟲種類迥異，從而了解不同種類的昆蟲的覓食習慣和類別。

自投羅網

此技倆方便捕捉叢林昆蟲。

物料：

■ 淺色的雨傘或白色的膠片

■ 樹枝一根

怎樣做？

1. 把傘子翻開倒轉放在樹下或灌木叢下，也可把白色的膠片放於地上代替雨傘。
2. 以樹枝拍打草叢或樹幹，或輕搖樹幹，令昆蟲跌下。
3. 有需要時利用放大鏡、網或鉗子把昆蟲拈到昆蟲收集箱內觀察。
4. 完成後把昆蟲釋放回原處。

糖衣陷阱

設置糖衣陷阱吸引蝴蝶或蛾等採花蜜的昆蟲。

物料：

■ 糖、糖漿、冧酒、啤酒或果汁等帶甜味和味道濃烈的液體。

■ 刷子

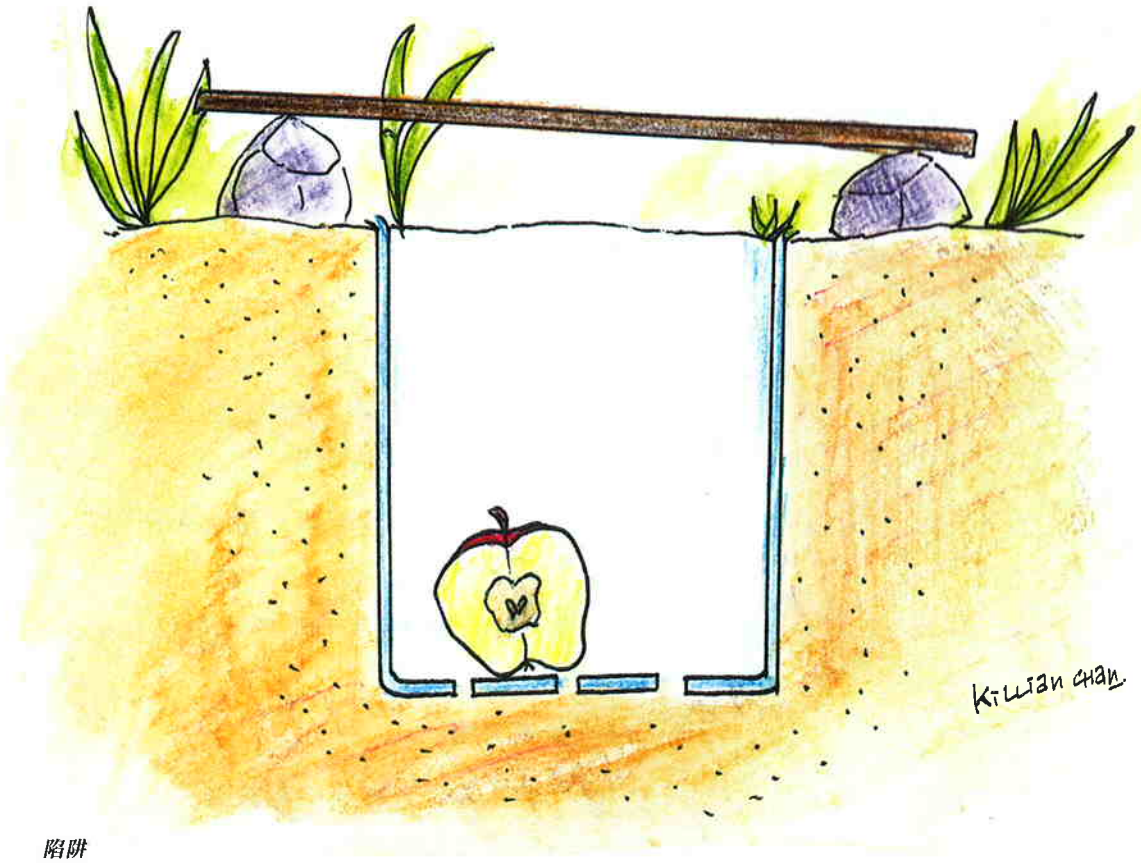
■ 電筒（用以在夜間觀察蛾）

怎樣做？

1. 用刷子在樹幹塗上香甜的液體。
2. 比較日間和夜間糖衣陷阱吸引的昆蟲類別。

小建議：

塗上不同的液體重覆實驗，藉此吸引不同種類的昆蟲。例如，以果汁作餌吸引進食水果的昆蟲。



陷阱

捕蟲網

池塘探索

要捕捉蜻蜓幼蟲、龍蝨和水黽等水生昆蟲，可一試池塘探索活動。

物料：

- 白色的盤或淺身的碟子
- 撈網
- 膠篩
- 泥鏟
- 放大鏡

怎樣做？

1. 選擇合適的淡水生境如河流、湖泊或池塘等進行池塘探索活動。
2. 站在池塘的淺水處或岸邊，把網探到塘底，或用網捕捉水面的昆蟲。
3. 使用膠篩或泥鏟掘開塘邊的泥，發掘躲藏於泥中的昆蟲。
4. 把昆蟲倒進盤裏。
5. 用放大鏡仔細觀察盤裏的昆蟲並辨認其身分。
6. 思考部份昆蟲如何終生或大部份時間生活於淡水生境。

注意安全：

- 參加者必須站立於安全的地點並有成人陪同下方可進行此活動。
- 此活動不適宜在暴雨後一星期內進行，避免山洪暴發。
- 切勿在逾0.7米的水紳處進行。

參考讀物

單靠閱讀資料並不如親身仔細觀察般學得多和印象深刻。如對觀察存疑，不妨參考其他讀物並把額外的資料記錄在筆記本。隨著時間和經驗的累積，你的昆蟲筆記本會成為你的重要參考資料。

池塘探索活動

小朋友正在觀察水生昆蟲

透過活動認識昆蟲

在進行戶外昆蟲觀察活動前後舉行以環境為題的活動，可增進活動的成效，豐富參加者對環境概念的認識。以下列舉一些活動意念作參考：

戶外觀察前活動建議

活動一

自製昆蟲觀察工具

捕蟲網

目的：

- 加強參加者認識捕捉昆蟲的環保守則和技巧；
- 提高小朋友對昆蟲觀察的興趣。

地點：課室或活動室
需時：四十五分鐘
程度：適合八至十二歲的小朋友

物料：

- 鐵線衣架一個
- 竹竿一枝
- 約六十平方厘米的紗布一塊
- 針一根和一些堅韌的棉線

步驟：

1 把鐵線衣架的接口解開，並把鐵線拗成環狀。
2 把紗布對摺後用線把摺口縫合，保留兩端開口。
3 把其中一個開口用線縫合，另一端縫在鐵線環上成為捕蟲網。
4 把鐵線環的末端纏在竹竿上，或用膠紙貼緊。

知多一點點

你可以同樣的方法製作撈網，但撈網的鐵線應拗成三角形或「D」字形，並應使用尼龍或更堅韌的物料作為網的材料。

活動二

自製昆蟲觀察工具

安全捕蟲器

目的：

- 介紹捕捉昆蟲需要運用技巧；
- 引發參加者對昆蟲觀察的興趣。

地點：課室或活動室
需時：三十分鐘
程度：適合八至十二歲的小朋友

物料：

- 連蓋的透明膠杯一隻
- 膠飲管兩枝
- 膠紙
- 小塊紗布

步驟：

1 用紗布把飲管的一端封口，並以膠紙貼緊，避免活動進行時吸入昆蟲。
2 在杯蓋和杯底各開一個洞，注意洞的直徑需與飲管的直徑相同。
3 把兩枝飲管從杯蓋和杯底的洞插進杯內，有紗布的一端應在杯內。
4 發現小昆蟲時，把捕蟲器放近，然後在有紗布的飲管吸氣，昆蟲便會從另一枝飲管隨空氣吸進膠杯內。
5 觀察完畢後，打開杯蓋並把昆蟲釋放回原處。

「D」字形撈網

安全捕蟲器

活動三

是蟲？非蟲？

使用「3+3方程式」分辨出哪些是昆蟲，並把正確答案圈出來。

天牛

蟹

蜘蛛

千足蟲

蛾

胡蜂

知多一點點

昆蟲有三對腳和三個身體部份，這條「3 + 3方程式」有助分辨昆蟲與其他貌似昆蟲的生物。

活動四

自製蜻蜓模型

目的：

- 認識昆蟲的基本結構；
- 說明淡水生境對蜻蜓等水生昆蟲十分重要。

地點：課室或活動室
需時：四十五分鐘
程度：適合八至十二歲的小朋友

物料：

- 長形汽球一個
- 乒乓球一個
- 顏色筆
- 膠水
- 鐵線
- 保鮮紙
- 管刷

步驟：

1 把汽球充氣。

2 把汽球扭成三節，前兩節較第三節短，作為蜻蜓的頭、胸、腹。

3 在保鮮紙上畫出蜻蜓的翅膀，然後剪出貼在鐵線上。緊記蜻蜓共有兩對翅膀。

4 把翅膀黏在汽球第二節的上方。

5 把管刷黏在汽球第二節的下方作為蜻蜓的三對腳。

6 把乒乓球切成兩半，染成黑色並黏在頭部。

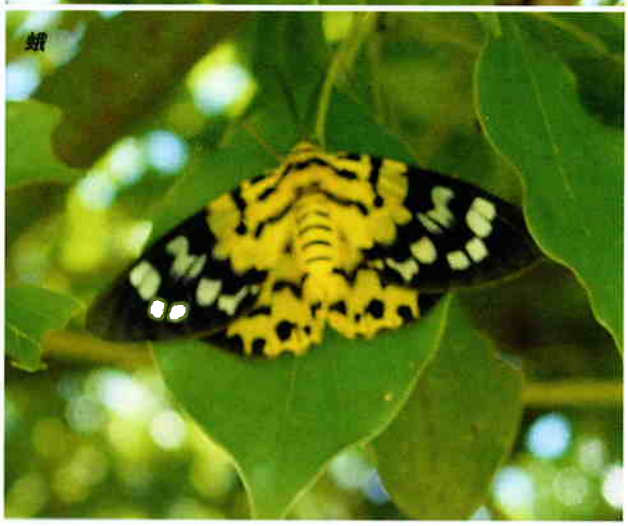
7 詢問參加者蜻蜓身體的節數，答案可在製成品中尋找。借助蜻蜓模型講解昆蟲的基本結構，並分辨昆蟲和蜘蛛的不同。

知多一點點

蜻蜓是飛行速度最快的昆蟲，時速可達九十公里。淡水生境是蜻蜓的重要繁殖地，若蟲在水中生活兩年才長至成蟲。成蟲大約只有一個月的壽命。

蜻蜓

蝴蝶



蛾

活動五

考眼力

蝴蝶與蛾的外貌相似，仔細分辨下卻有多個不同的特點，試把不同的地方寫出來。

蛾		蝴蝶
	觸角	
	翅膀	
	活動時間	

知多一點點

蛾一般在晚上活動，但也有例外，如豹赤蛾便常於日間活動，在米埔自然保護區便可找到牠們。

戶外觀察後活動建議

活動六

昆蟲變變變

目的：

■ 介紹不同昆蟲的生命週期。

地點：戶外操場

需時：三十分鐘

程度：適合八至十二歲的小朋友

準備工作：準備五套昆蟲生命週期卡
（請參閱附錄一的插圖）

步驟：

1 請參加者把五種不同的昆蟲與牠們的生命週期配對，遊戲進行時需保持肅靜。

2 讓參加者圍成圓圈，面向圓心，每位參加者掛上一張昆蟲生命週期卡，但不要讓他們知道卡上的昆蟲是甚麼。

3 提醒參加者不可作聲，用動作告訴其他參加者背上的是甚麼昆蟲，直至認為找到與自己扮演相同昆蟲的同學後便可手牽手，以示完成遊戲。遊戲進行期間可隨意走動。

4 約五分鐘後，指示認為已找到扮演相同昆蟲的參加者坐下。

5 讓參加者取下掛在頸上的紙卡，保持兩人一組，排列昆蟲生命週期的正確次序。

6 把答案貼在黑板或壁報板上。

7 由老師或導師核對答案。

8 詢問參加者昆蟲與動物的生命週期的分別，和昆蟲處於不同的生命週期的外貌特徵。

9 向參加者講解昆蟲變態的概念，並舉出一些經歷完全變態和不完全變態的昆蟲的例子。

知多一點點

■ 一些昆蟲的生命週期分成四個不同的階段，若蟲或幼蟲期與成蟲期的分別很大，蝴蝶、蚊和蜂是完全變態昆蟲。完全變態的好處在於成蟲與幼蟲不會互相爭奪食物和地域棲息。

■ 一些昆蟲的幼蟲與成蟲十分相似，需經過多次蛻皮才進入成蟲階段。蜻蜓、草蜢和蟬是不完全變態昆蟲。

活動七

昆蟲化妝大會

目的：

■ 講解昆蟲的保護色在大自然發揮的作用；

■ 說明保護色是昆蟲適應環境的特性。

地點：草地

需時：三十分鐘

程度：適合八至十二歲的小朋友

物料：繩圈、雀鳥卡、顏色筆、昆蟲剪紙

準備工作：

■ 準備十五套、每套兩張共三十張雀鳥卡，並在每張卡繫上繩圈，方便掛在參加者的頸上。

■ 依照附錄二的昆蟲繪圖形狀，在紅、褐、綠、黃色的舊膠袋裁剪出不同顏色的昆蟲剪紙。看意每種顏色的昆蟲數目需相同，每種顏色最少有五隻昆蟲。

步驟：

1 遊戲進行前把預先準備好的顏色昆蟲散佈在草地上。

2 把雀鳥卡分發給參加者並囑咐他們掛在頸上。

3 先講解一遍雀鳥的名稱，然後讓他們尋找持有與自己相同的雀鳥卡的參加者。

4 兩人一組，依照二人三足的形式把各人的一隻腳綁在一起。

草蜢

5 告訴參加者他們扮演的雀鳥都進食昆蟲，他們的任務是在三分鐘內兩人一組在草地上尋找顏色昆蟲。老師可展示昆蟲樣板讓他們參考。

6 三分鐘後召集所有參加者，根據不同顏色把尋獲的昆蟲分類。

7 與參加者一起計算每種顏色的昆蟲數目，若所得的數目不相同，找出哪一種顏色的昆蟲數目最多，哪一種最少。

8 總結遊戲，說明很多昆蟲擁有與四周環境接近的保護色，以免被捕食者侵襲。

9 與參加者一起收集在草地上未被發現的顏色昆蟲。

知多一點點

■ *除保護色外，一些昆蟲具有鮮豔的顏色和圖案，藉此嚇退捕食者；也有一些具有螫針，部份更帶有毒性。一些則模仿這兩類昆蟲的防禦技倆以保護自己。*

活動八

昆蟲水族箱

目的：

- 透過觀察，了解水生昆蟲如何適應環境；
- 說明淡水生境對昆蟲的重要價值。

地點：課室或活動室

需時：兩至四星期

程度：適合八至十二歲的小朋友

準備工作：進行池塘探索活動收集水生昆蟲。

物料：尼龍或網、夾子、魚糧或藻粒魚糧、水、玻璃魚缸、砂、石、幼竹竿和淡水植物

步驟：

1 把幼竹竿和砂石放進缸底，加入淡水植物並把魚缸注滿一半淡水。讓缸水沉澱一至兩日。

2 把從池塘收集回來的水生昆蟲放進缸內。

3 用尼龍或網覆蓋魚缸，用夾子固定網的位置。

4 把魚缸放在幽暗清涼的角落，避免放在陽光照射處，以免水溫上升。

5 每天更換四杯新鮮的淡水，以保持缸水清晰。

6 如附近有池塘，可用塘水代替淡水，為昆蟲提供食糧。否則，用魚糧或藻粒魚糧餵飼缸中的昆蟲，但切勿餵飼過量魚糧。

7 讓參加者觀察缸中的昆蟲，並把觀察所得記錄下來。詢問他們哪些昆蟲棲於水面，哪些棲於水底，而棲於水底的昆蟲又怎樣維持生命。

8 說明不同的水生昆蟲各有在水中呼吸的獨特方法，並指出淡水或濕地生境是昆蟲的重要繁殖和覓食地點。

9 實驗完畢後把所有昆蟲釋放回原處。

活動九

生境真細小

目的：

- 講解生境喪失對野生生物造成的直接影響；
- 說明人類對野生生物和自然環境造成的破壞。

地點：戶外操場

需時：三十分鐘

程度：適合八至十二歲小朋友

物料：報紙十張

步驟：

1 把十張報紙鋪在地上。

2 讓參加者繞著報紙圍成圓圈。

3 指示參加者繞圈行走，至喊停時儘快站在有報紙位置。

4 找不到有報紙位置站立的參加者須退出遊戲，站在一旁觀看遊戲進行。拿走一張報紙以縮小圓圈的範圍並繼續遊戲。

5 重覆步驟3和4直至餘下少於五位參加者。

6 詢問所有參加者對遊戲的感覺。

7 說明報紙就如野生生物賴以生存的生境，而參加者則扮演各種爭奪生境棲息的野生生物。健全的生境可讓野生生物和人類共同棲息，和諧共存；生境一旦遭破壞，棲於其中的生物便需爭奪生存空間，部份物種更可能因而減少甚至絕種。

生境真細小遊戲

活動十

滑水能手水黽

目的：

- 講解水黽這種水生昆蟲如何適應水上環境；
- 說明水質污染如何影響野生生物和破壞自然環境。

地點：課室或活動室

需時：三十分鐘

程度：適合八至十二歲小朋友

物料：水、盤、針和洗潔精

步驟：

1 把盤注滿水。

2 示範如何把一根針放在水面而不會下沉，向參加者解釋空氣與水接觸時，水面形成一層富有彈性的表面，稱為水的張力。

3 詢問參加者曾否見過在水面滑行的昆蟲，試形容牠們的滑行動作。

4 以水黽為例說明在水上滑行的動作。水黽修長的腳和輕巧的身軀長有細小的纖毛，有助在水面浮游，加上水的張力，使牠能在靜止的水面上滑行而不會掉進水中。水黽雖長有翅膀，但並非飛行能手。

5 請一位參加者把一滴洗潔精滴進水中，浮在水面的針便會沉到水中。

6 藉此說明洗潔精如何對水造成污染，破壞水的張力，直接危害野生生物的生存，對生態環境造成破壞。

知多一點點

- 水黽的每對腳各有不同的功用。後腳作用如方向舵，位於中間的腳用以推動身體滑行，前腳則用來探測在水中掙扎的獵物造成的漣漪。

第 四 章

大埔海濱公園昆蟲屋

訪蟲何處去？

觀察昆蟲是任何時候也可進行的活動，只要多往戶外考察，便能掌握箇中的技巧和累積經驗。香港有多個交通便利的觀蟲好去處，讓初學者實習觀察昆蟲的技巧。多個教育中心和以昆蟲為主題的展覽館都有介紹昆蟲的生態資料。獅子會自然教育中心、嘉道理農場暨植物園、以至香港公園和動植物公園等市區公園也是理想的觀蟲地點。

郊野公園適合較有經驗的觀蟲愛好者或籌辦昆蟲觀察活動的人士。在郊野公園可深入研究昆蟲與其所處的自然環境，部份郊野公園附設訪客中心和教育設施，可令觀察昆蟲的活動內容更富豐富。

獅子會自然教育中心

米埔沼澤野生生物教育中心

（一）市區公園

	名稱	開放時間
A	香港公園	06:30-23:00
B	香港動植物公園	06:00-22:00
C	維多利亞公園	廿四小時開放
D	九龍公園	06:00-00:00
E	屯門公園	廿四小時開放
F	元朗公園	廿四小時開放
G	天水圍公園	廿四小時開放

（二）郊野公園

所有訪客中心開放時間為 09:30-16:30
逢星期二休息

H	香港仔郊野公園
I	城門郊野公園
J	大帽山和林村郊野公園
K	西貢郊野公園
L	清水灣郊野公園
M	八仙嶺郊野公園

（三）教育中心

	名稱	開放時間
N	獅子會自然教育中心 逢星期二休息	09:00-17:00
O	嘉道理農場暨植物園	09:00-17:00
P	米埔沼澤野生生物教育中心	09:00-17:00
Q	大埔海濱公園昆蟲屋	08:00-19:00

第五章

加者進行池塘探索活動

實地考察：米埔點蟲蟲

米埔濕地的昆蟲

濕地跟雨林和海洋都是孕育生命的重要生態系統。濕地生境扶育林林總總的動植物，包括昆蟲。米埔濕地由淡水魚塘、傳統淺蝦塘(基圍)、紅樹林和潮間帶泥灘組成，並於一九九五年成為拉姆薩爾國際重要濕地。

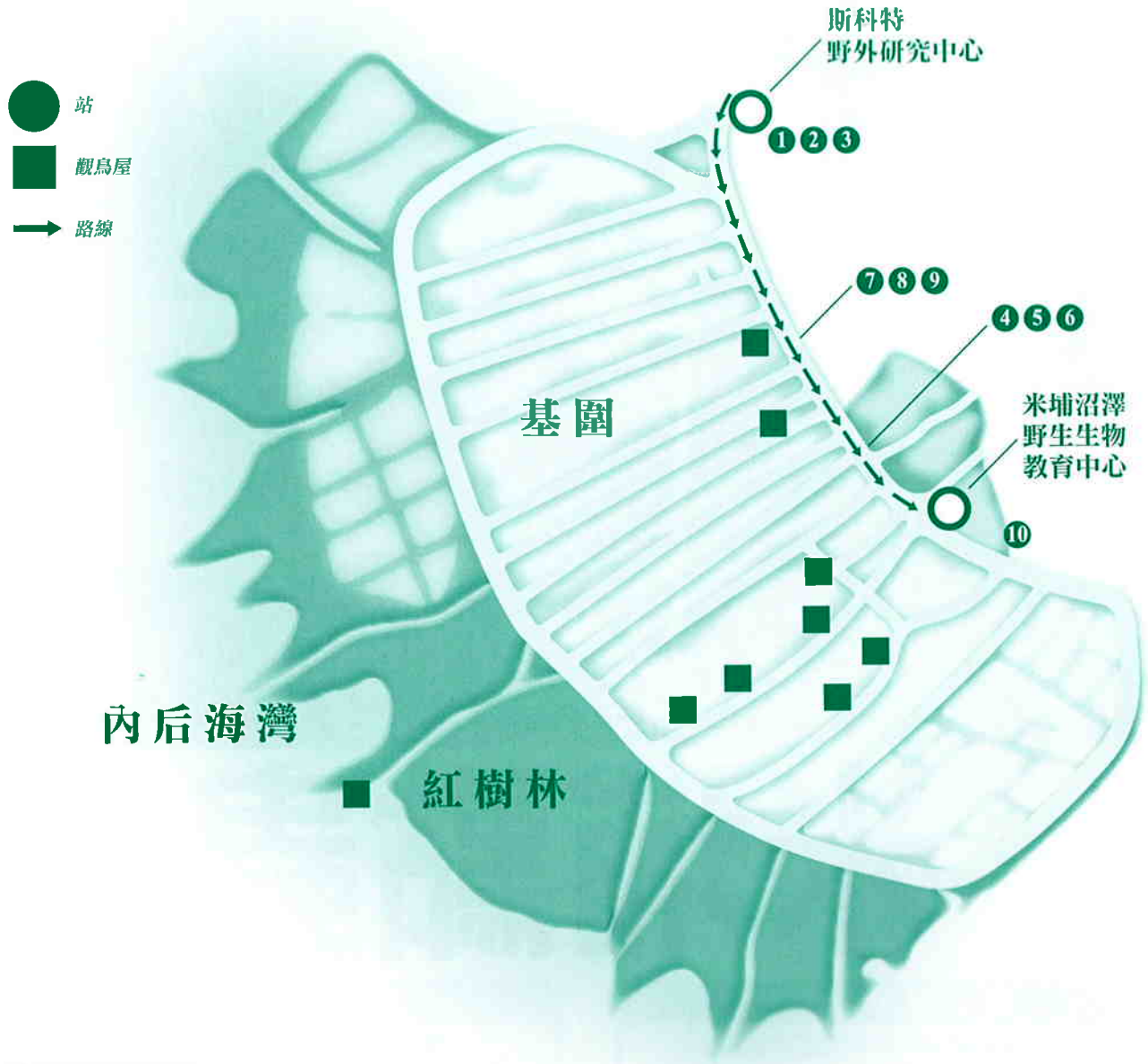
濕地生境是昆蟲繁殖和覓食的地方，一些昆蟲終生棲居水裏，另一些經歷不同階段才長至成蟲。米埔自然保護區曾錄得逾四百種昆蟲，包括香港約百分之十二的蝴蝶品種和一百二十多種蜻蜓中的四十五種。

米埔點蟲蟲

米埔不單是觀鳥勝地，其濕地更孕育不計其數的野生生物。每年逾四萬名公眾人士和學生到訪米埔自然保護區參加本會精心安排的各項參觀和教育活動。「米埔點蟲蟲」教育活動於一九九九年夏季展開，每年招募約一千名八至十二歲的青少年參加。

活動目標

- 透過觀賞昆蟲，培養青少年欣賞和愛護大自然的意識。
- 介紹昆蟲的身體結構並講解牠們怎樣適應米埔的濕地生境。



米埔點蟲蟲的講解路線

- 介紹和示範正確的觀察昆蟲技巧。
- 提高公眾的環保意識，並闡釋環境保育對保護香港自然環境的重要價值。

如何在米埔自然保護區內推行「點蟲蟲」活動

走進大自然，親近昆蟲的生境和了解牠們的生態，往往能發掘有關牠們的有趣資料。自然基金的「米埔點蟲蟲」以米埔自然保護區為觀察昆蟲地點，讓參加者透過親身觀察，了解昆蟲的生態。

第一站

示範捕捉昆蟲的技巧

- 在活動開始前必需向參加者示範捕捉昆蟲的正確技巧，避免傷害昆蟲。

第二站

細看昆蟲的身體特徵

- 請參加者仔細觀察捕獲的昆蟲的身體結構，計算昆蟲有多少對腳，並觀察牠們有沒有觸角和翅膀。透過仔細的觀察，可判斷捕獲的生物是否昆蟲。

第三站

認識昆蟲適應環境的能力—陸地生境

■ 陸地昆蟲的背部或翅膀長有不同顏色的花紋，可與周遭的環境完全融合，這技倆稱為保護色，用以避過捕獵者的耳目。

參加者正在捕捉昆蟲作仔細觀察

第四站

尋訪昆蟲的「家」

■ 尋找黑樹蟻的巢穴，了解黑樹蟻怎樣適應濕地生境。牠們把巢築在樹上，以避過潮濕的濕地土壤。

■ 一些昆蟲故意把黃槿的葉捲起，捲蛾的毛蟲便是當中的代表，以絲把葉縱向捲起，然後鑽進「保護罩」生活、進食和化蛹。

黑樹蟻巢

第五站

了解昆蟲是如何長大的

■ 讓參加者檢拾蟬蛹，從而闡釋昆蟲的不同生命週期。

■ 告知參加者一些昆蟲是人類的良朋，如蟬蛹便應用於傳統中醫藥。

第六站

與昆蟲為伍

■ 植物與昆蟲的密切關係對人類舉足輕重，因為昆蟲是傳播花粉的重要媒介。

■ 馬纓丹是闡釋昆蟲與植物之間的關係的最佳例子。

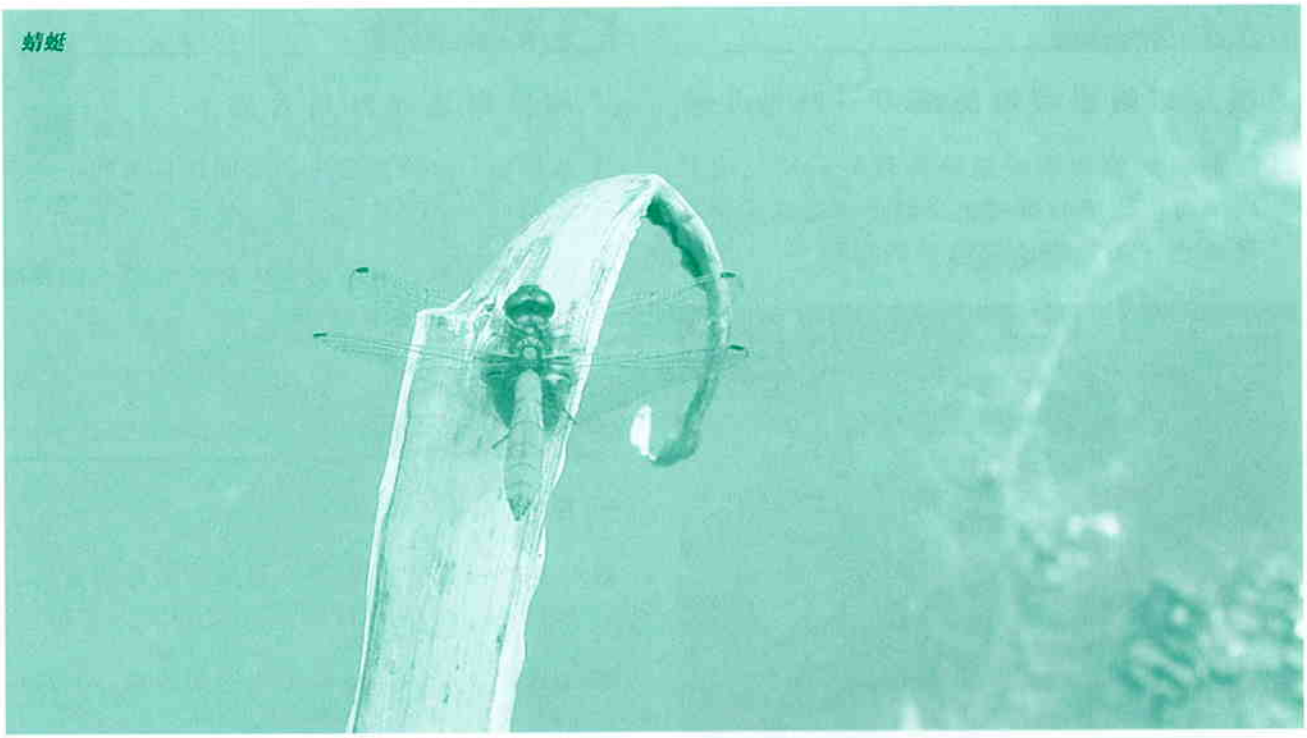
■ 在亞洲地區，人們以種植桑樹，養蠶取絲來生產珍貴的絲質製品。

馬纓丹

第七站

與昆蟲為敵

■ 白蟻等昆蟲進食木材，並利用特別的酵素消化木纖維。木蜂則在樹幹上鑽洞築巢，樹木因此而被這些昆蟲侵蝕。


蜻蜓

第八站

傾聽昆蟲的鳴聲

■ 昆蟲各自有其發聲方法。以蟬為例，向參加者說明牠們怎樣鳴叫。郊外常傳出的蟋蟀叫聲代表牠們正在求偶。

第九站

昆蟲與其他生物的關係

■ 有些雀鳥只進食昆蟲，家燕在飛行途中捕食昆蟲，鶺鴒捕食蒼蠅，蜂虎則以蜜蜂為食糧。

第十站

認識昆蟲適應環境的能力—水生境

■ 參加者在池塘探索活動過程認識水生昆蟲適應環境的特性。

■ 觀察水生昆蟲的不同呼吸系統，了解各種水生昆蟲在水裏呼吸的方法。

■ 以水黽為例，向參加者解釋水黽怎樣在水上滑行。

如何參加「米埔點蟲蟲」活動

自然基金誠邀你於今夏參加「米埔點蟲蟲」教育項目。齊來認識有趣的濕地生物，找尋棲身水裏、泥濘、樹叢、石堆和林木的昆蟲！

有興趣參加或欲索取更多自然基金教育項目資料的人士，請致電 2526 4473 與本會聯絡，或瀏覽本會網頁：http://www.wwf.org.hk 。

Contents

Page number

Preface

Moses supposedly inflicted a plague of locusts upon the Pharaohs and, today, at the start of the third millenium it is remarkable testimony to this insect's success that Australia is preparing for a plague of the same animal. Vast areas of crops will be lost, despite the farmer's best efforts. At the very personal level too, insects impose themselves upon us, from the mosquito buzzing around our head at night, to the scuttling cockroach in the kitchen. Yes, some insects are pests. On the other hand, other insects are a source of beauty and inspiration: the beautiful butterfly, industrious ants and busy bees.

In terms of the biomass, ants alone weigh more together than all the humans on Earth and are certainly more important than us in processing soils. Of all creatures on Earth, insects are by far the most numerous, most diverse (what was it Charles Darwin said? "God must have an inordinate liking for beetles!") and most important in binding together the fabric of our Earth's ecology. And yet, we actually know very little about them - probably fewer than 10% of them have even been described. Only a few insects have been studies in any detail, and these are usually commercially important ones.

The aim of this pack, which has been sponsored by Environmental Campaign Committee and Environment and Conservation Fund, is to introduce children, for the first time, to the world of insects: what they are, what they do and why they are important. For our part, it is important that we understand them because only then will we be able to appreciate the crucial role they play in the ecology of the Earth and, thus, how they help us to sustain it and the other life upon it, for our ultimate benefit.

Brian Morton

Professor Brian Morton
Chairman
WWF HK Education Committee

Introduction

Insects are the most abundant animals on Earth and are very important to human beings. They appear almost everywhere in all terrestrial and aquatic habitats, and they can even fly. They are a good subject for environmental education to let our children learn about the inter-relationships between human beings and wildlife through an enjoyable field trip.

Objectives Of The *Let's Go Insect Watching Education Pack*

In promoting insect watching, the objectives of this education pack are:

- To promote understanding of the inter-relationship between human beings and the environment;
- To arouse people's, particularly children, interest in studying the environment;
- To encourage education IN the environment for an enriching learning experience;
- To promote the wider use of the urban and country parks for environmental education.

Let's Go Insect Watching Education Pack Target Audiences

The Let's Go Insect Watching Pack is an educational resource for teachers, parents and social workers to share nature with primary-school-aged children. The activities proposed in this education pack can be organised either as a school or youth centre programme. Through the process of insect watching and environmental games, we will learn with our children about the amazing and wonderful world of insects. The strong bond between human beings and nature will be made clearer through insect watching and teach us how to live in harmony with all life on Earth.

How To Use This Education Kit?

The Let's Go Insect Watching Education Pack is composed of five main chapters and an appendix. The five main chapters provide background information on insects, environmental friendly principles and techniques for carrying out insect-watching activities. The appendix provides a reference list and materials for organising post-visit activities.

Step 1 Read through the information provided in this kit to acquire basic knowledge about insects and insect watching.

Step 2 With reference to the suggestions proposed in Chapter 4, identify a suitable site for insect watching activities.

Step 3 Based on the advantages and constraints of the site identified, select the most suitable activities to carry out on site.

Step 4 Select and organise pre-visit activities and briefings to prepare children for a deeper understanding of insects and environmentally-friendly principles for insect watching.

Step 5 Conduct insect watching activities at your selected site, and organise post-visit activities to consolidate children's environmental conservation concepts.

For Enquiries

Please do not hesitate to contact WWF HK Education Officers by telephone on 2652 0285 or by e-mail to <ihesc@wwf.org.hk> should you have any questions about the *Let's Go Insect Watching Education Pack* or about insect watching.

Please HELP WWF HK to continue to improve our environmental education programmes

Your valuable comments are an indispensable reference for us to further improve our education work! Please fill in the questionnaire listed on page 82 and send it back to us either by fax to 2651 0276 or by post to the following address:

WWF HK Island House Conservation Studies Centre,
Island House Lane,
Tai Po, N.T.,
Hong Kong

CHAPTER 1

The Wonder of Insects

Insects And People

Insects are animals which we commonly encouter in our own daily life, such as our food supply(honey), materials for clothing(silk worms) and medicines. They are also closely linked with human culture and beliefs.

Myths About Insects

Owing to the close relationship between people and insects, facts about their life cycles have been integrated into many cultural, festivals, ceremonies and beliefs.

In China,

- The "Insect Awakens", is one of the traditional festivals which marks the 'waking up' of insectsin spring. This is probably due to the fact that insects are more active when spring comes and the weather gets warmer.
- The most famous story about insects in Chinese Literature is the "Butterfly Lovers". It is a well-known story about a pair of lovers, Mr. Liang Shan-po and Miss Zhu Ying-tai, who turn into butterflies after their deaths, thereby flying out of control of the families who opposed their relationship.
- In ancient times, the Chinese regarded cicadas as the symbol of rebirth or immortality. That's why cicada shaped jade has been found placed in the mouths of the dead in ancient tombs to wish them rebirth and a new life.

In the West,

- Ancient Egyptians put sacred beetles in tombs with a similar belief as the ancient Chinese about cicadas. Beetles were regarded as one of the most important religious symbols in ancient Egypt.

- In the past, ladies believed that a ladybird could tell their marital fortune. The ladies put a ladybird in their hands and the direction that the ladybird flew to marked where their future husband would be coming from.

Friend Or Foe?

Insects live closely with people and they can be either a friend or a foe.

Insects can Sometimes be Our Friends

- Insects are the most important plant pollinator in the natural world. Butterflies, bees, wasps, ants and other insects visit flowers to eat the nectar or pollen and indirectly help plants with pollination. Some plants, such as wild orchids, are specially built to facilitate the visit of their particular insect partners.
- Insects are the scavengers of the wild world. For example, ants, termites and some beetles feed on dead organic matter ranging from fallen leaves or rotten tree branches to animal dung and bring these materials to the food chain.
- Some insects, like silk worms, produce silk from their cocoons, which is a valuable material used in human clothing.
- Insects also produce a nutrient-rich food supply which humans enjoy, such as honey extracted from a bee comb. Insects are also prey for insectivorous animals, including people. Locusts, ants, termites, beetles and grasshoppers are widely eaten in African and Arabia, as well as in many Asian cuisines.
- Some insects are effective in biological pest-control. For example, ladybugs are loved by farmers and gardeners as they eat plant-eating insects such as aphids.

Insects can Sometimes be Our Foes

- Insects can be vectors for human disease such as Malaria, Yellow fever and Bubonic Palgue, which are transmitted either by female mosquitoes or fleas. Insect stings, for example, by wasps and bees, sometimes stimulate severe allergic responses in humans which can be fatal.
- Insects are common parasites of domestic livestock and the irritability created affects the health and appetite of these animals.
- Some insects which feed on plant tissues, like migratory locusts, may cause severe crop damage to farmers and they are seen as pests.

Did You Know?

Most of the insect related diseases, such as Malaria, Yellow fever and Bubonic palgue, can be controlled by improved hygiene!

CHAPTER 2

Environmental Friendly Principles *for Insect Watching*

Insect Watching But Not Insect Collection!

Collecting insects to make specimen may pop up in one's mind when mentioning insect watching but it is a totally WRONG concept. Insect watching, just like bird watching, can be done in an environmentally friendly way without harming wildlife.

Insect specimens should be only perpared for scientific research or for display in museums for educational and research purposes. The commercial trading of insects is becoming more popular especially with the development of tourism which sees insect specimens sold as souvenirs or as collectable. These commercial activities involve the collection of insects from the wild and leads to the decline of their populations, which eventually upsets the ecosystem which relies on insects to play many roles (pollinators, scavengers, pest control and food supply) in the complicated yet delicate food web.

Moth specimens

Making insect specimens is UNNECESSARY for insect watching. Through observing the natural habitats of living insects, we learn not only about their biology but also how they associate with other living organisms and the environment. We may need to capture them for closer observation but we can do this in an environmentally friendly way to minimize disturbance to wildlife. We will introduce these techniques in Chapter 3.

Important Notes For Insect Watching

DOs for insect watching:

- Capture insects ONLY if necessary and release them to their original place of capture after observation.
- Use live traps rather than killing ones to in capture insects for observation.
- Select appropriate techniques for capturing insects and use bug boxes or containers of a suitable size.
- Handle every insect with great care when trapping and releasing to minimize damage.
- Use bug boxes to hold the insect captured for observation. Use a hand lens for detailed observations.
- Use an individual bug box for holding each insect.
- Avoid any disturbance to the environment when doing insect watching.
- Make sure all insects captured are released before leaving the field trip site.
- Remember to wash your hands with clean water and soap after conducting pond-dipping activities.

DON'Ts in insect watching:

- Don't use your hands to capture or to hold insects for observation.
- Don't collect insects make specimens.
- Don't touch any insect directly with your body.
- Don't shake the bug box when there is an insect inside it.
- Don't hold an insect inside a bug box for more than 15 minutes.
- Don't place a bug box which has an insect inside under strong sun or in water.
- Don't put more than one insect in one bug box.
- Don't disturb the natural habitat while capturing insects.
- Don't dip from steep pond banks or trample them when looking for aquatic insects.

Procedures For Organising an Insect-watching Activity

PRE-VISIT:

- Clarify the objectives of the activity (science concepts, environmental education principles, recreation).
- Conduct pre-visits to potential field trip sites and select the most appropriate one (group size, transportation, safety).
- Reseach the physical environment and common insects in your selected field trip site.
- Prepare tools for potential insect trapping activities and conduct a briefing session for participants.
- Prepare for the outings according to the guidelines issued by the Education Department or other organisations.
- Check the weather condition/forecast with the Hong Kong Observatory.

DURING ACTIVITY:

- Remind participants about safety and environmental guidelines.
- Conduct activities under close supervision.
- Gather participants together regularly to share what they find.
- Ensure all insects captured are properly released.

POST-VISIT:

- Post-visit activities are recommended to help participants recall the concepts they have learnt.
- Conduct de-briefings to strengthen students' environmental conservation concepts.
- Encourage participants to sustain their interest by establishing an insect corner in school or youth centre for posting insect-related news clippings and posters, as well as keeping reference books and other informative materials.

CHAPTER 3

Explore the Insect World

WHAT TO WATCH?

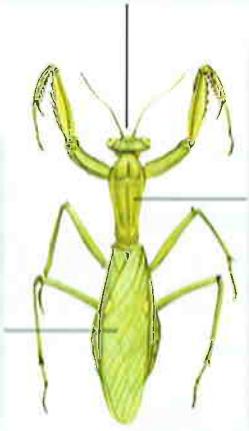
Insects are a rich topic with plenty of interesting things to explore. Each insect is unique and equipped with special features which adapts them to their specific environment. Studying insect behaviour and looking into their inter-relationships with other living organisms and their habitat leads us to discover how an ecosystem works and an understanding of the importance of biodiversity.

INSECTS' 3 + 3 FORMULA

Insects belongs to the Animal Kingdom, Class Insecta. The '3+3 Formula' is one of the features for identifying insects from other insect-like creatures. This

HEAD

- *Two compound eyes (in most insects)*
- *A pair of antennae. They are sensory detectors located between the eyes and above the mouthparts.*
- *Mouthparts (various forms of mouthparts, for examples, tongue like for external digestion, straw-like for sucking and mandibles for chewing)*



ABDOMEN

- *This is the posterior region which contains important organs for digestion and reproduction.*

THORAX

- *Three pairs of legs*
- *An adult insect has either one or two pairs of wings attached to the thorax. Some, however, are even wingless.*

A QUICK TEST

Using the '3+3 Formula', can you identify which of the following creatures are insects?

Millipede

Spider

Grasshopper

Stinkbug

Snail

(Answer: Stink bug and grasshopper are insects)

simple rule reflects the external features of an adult insect which has 3 body parts plus 3 pairs of legs. The three body parts are: head, thorax and abdomen. Insects are invertebrates which means they do not have a backbone. The body is supported by an external skeleton called an exoskeleton and this armour protects the insect and provides a foundation upon which the legs and wings are attached.

Are they insects?

The physical structures of several groups of animals belonging to the Class Arachnida are similar to insects. Examples of Arachnida include spiders, scorpions and ticks. You can tell the difference from insects by using the 3+3 formula.

Centipedes and millipedes resemble insect larvae but you can tell they are different by using the 3 + 3 formula again. As the common names of "hundred feet" or "thousand feet" imply, the numbers of legs far exceeds that of insects. Their bodies are also multi-segmented instead of having only three distinctive body parts.

TOOLS FOR FEEDING

Insects may feed on leaves, nectar, pollen, wood, or even decaying organic matter. Different mouthparts cope with different types of food. By studying the mouthparts of an insect, you should be able to learn about its feeding habits and habitat. Here are the major types of mouthparts:

Chewing mouthparts

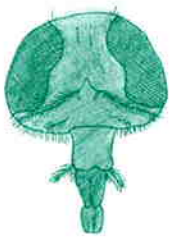
This is the most commonly found mouthpart among insects. The diet of insects which have chewing mouthparts is mainly solid food. Their mouths have jaw-like structures called 'mandibles', adapted for cutting, crushing and grinding food. Dragonflies, grasshoppers, locusts and crickets are some examples which have this type of mouthpart. Bees also have chewing mouthparts but they also have an elongated structure for lapping up nectar.

Chewing mouthparts

Sucking mouthparts

Sucking insects consume liquid food such as blood, nectar or plant sap. Their mouthparts are modified into a 'proboscis' or an elongated tube to suck up liquid food. Insects such as true bugs, llice and mosquitoes have sucking mouthparts. Butterflies and moths extend their proboscis deep into flowers to sip nectar.

Sucking mouthparts



Sponging mouthparts

Sponge mouthparts

This is not a common type of mouthpart, but it is found in most flies. The proboscis soaks up liquids and food particles like a sponge.

ANTENNAE FOR DETECTION

The pair of antennae, or feelers, attached to an insect's head is an important feature or identification. Most insects use their antennae as sensory organs for smelling, touching, hearing and even for communication. For example, male moths can use their antennae to detect the chemical scent released by a female moth many kilometres away.

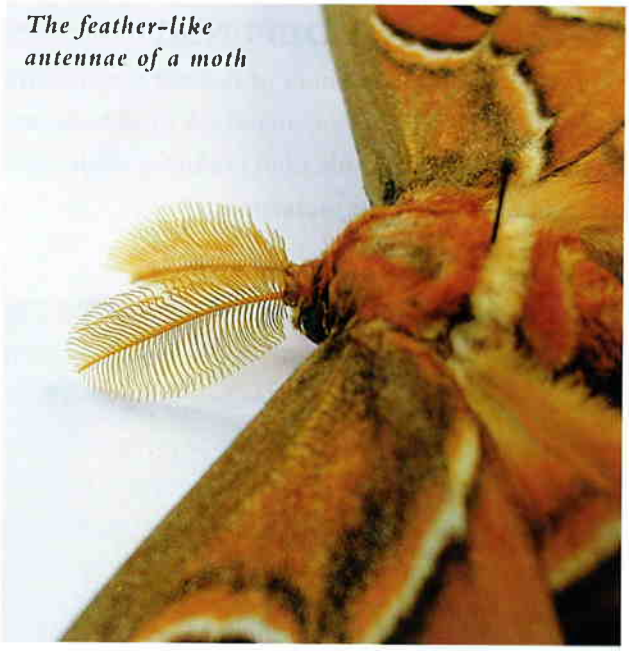
The stalk-like antennae of a butterfly and the feathery antennae of a moth is a key feature distinguishing between them.

WINGS OR NO-WINGS?

Some insects have wings while others are wingless. Wings vary greatly in size, shape and colour. The wing pattern is important for insect identification. Wing paterns help in survival.

Take butterflies, for example, the wing colour of the Chocolate Pansy is deep brown with a dark brown pattern which helps camouflage it from predators. Some butterflies like the Peacock Pansy bear conspicuous eye-like spots on their wings to frighten predators away. Other butterflies, like the Chocolate Royal have antennae-like features at the tip of its hind wings to confuse a predator.

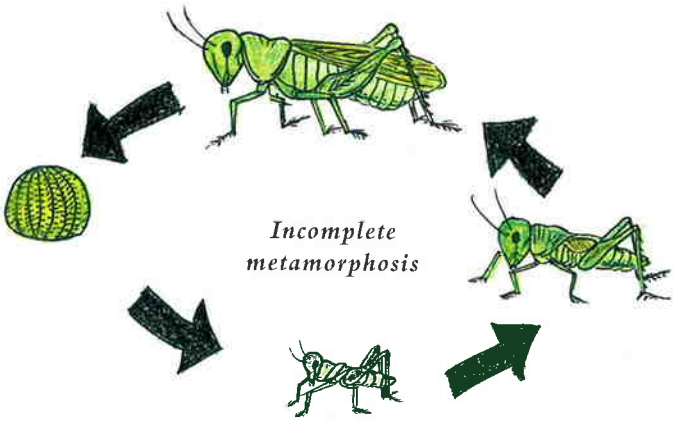
A butterfly with big spots on its wings to scare away an enemy



The feather-like antennae of a moth

INSECT LIFE CYCLE

Most insect species undergo noticeable changes in form as they are grow to a mature state. This process is known as metamorphosis. All insects display either Incomplete or Complete Metamorphosis.

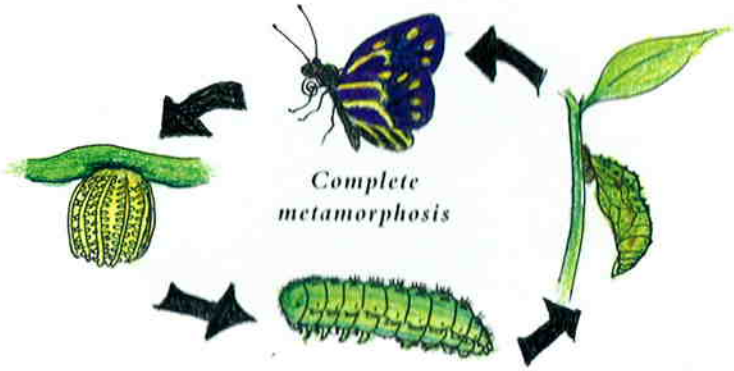


Incomplete Metamorphosis

Insects which undergo incomplete metamorphosis look as adults similar to their immature stages, during which they are called nymphs, except there is a difference in size and an absence of wings. Nymphs undergo several molt during which a new cuticle grows and the old one is shed. Dragonflies, damselflies, grasshoppers and cockroaches are examples of insects which undergo incomplete metamorphosis in their life cycles.

Complete Metamorphosis

There are four distinct stages in the life cycle of an insect which undergoes complete metamorphosis. These are the egg, larva, pupa and adult. The larva hatches from an egg. When it molts into the pupal stage, it does not feed nor move. Eventually, the adult insect emerges from the pupa by pushing and crawling out of the pupal case. The larvae and pupae of insects which undergo complete metamorphosis do not resemble the adult in appearance nor food type. Butterflies, moths and bees are examples of insects which undergo complete metamorphosis in their life cycles.



OFFENSE AND DEFENSE

Insects develop a number of defense mechanisms to protect themselves from enemies. A small body size enables them to hide easily from predators, while there are many other ways of protection:

Defense by camouflage

The colours and patterns of the exoskeleton or wings of some insects look very similar to their environment to make them less obvious to predators. Some insects have body shapes and appendages modified to mimic natural objects. The Stick Insect is a good example of this - it resembles a green stick which matches surrounding plants. The caterpillar of the Great Orange Tip butterfly protects itself by mimicing an aggressive snake to put off attackers. Some other insects have contrasting patterns to distract a predators' attention.

Defense by offense

Some insects have poisonous stings, spines, repellent glands or irritating bristles to protect themselves from predators. Bees and wasps are well-known social insects which work in colonies of thousands of individuals to deter invaders.

LOCOMOTION

Insects rely on either their legs or wings to travel from one place to another. The joints and design of legs have evolved into different types of movement and uses such as walking, jumping, swimming and even for transporting food. For example, the Giant Dung Beetle uses its hind legs to roll a ball of dung into a specially dug out underground breeding tunnel while the honey bee uses their modified hind-legs to carry pollen. Sometimes insects move their body parts for communication instead of travelling. Social insects, like honeybees communicate with each other by performing a dance to show other worker bees how to find nectar. Antennae are commonly used by ants for communication and they touch each other to pass on messages. European mound-building ants exchange chemical messages through their mouthparts, which appears like they are kissing each other.

LISTENING TO INSECTS

Many insects make audible sounds, and therefore listening to insects is a way to search for them. The main reason insects make sound is for communication, including attracting mates. Different insects have unique sound-making organs, for example, crickets produce sound by rubbing their wings against each other sideways; locusts 'sing' by rapidly raising and lowering their hind legs alternately to allow the spur on the inner surface of each hind leg to brush against the tough veins on the wings.

SMELLING INSECTS

Many insects have distinct odours. They release odours, or chemicals, to either communicate with each other or to deter predators. Stinkbugs have well-developed glands from which they secrete an obnoxious, foul smelling fluid for protection. The chemical released by female Emperor Moths, for example, which cannot be detected by humans, can be detected by males up to 5 km away with his large feathery antennae!

Did You Know?

For Cicadas, the stridulatory organs are only found in males; the females are quiet. The organ consists of a taut rigid membrane which is distorted by a special muscle and this distortion produces a 'click' sound rather like a tin can lid being pushed in. The click-noise is amplified by a special resonating chamber next to the membrane. The cicada song is actually a rapid series of clicks produced at different amplitudes.

Two ants meet each other

A praying mantis is well camouflage on the leaf

A cicada

A stinkbug

WHERE TO WATCH?

In terms of species, insects are the most numerous group of creatures on Earth. They can be found almost everywhere. By careful observation, you can understand the distribution of insects and their relationship with the habitats they live in.

NATURAL ENVIRONMENT

Looking for terrestrial insects

Wasps and beetles love to stay in dark, damp places such as behind rocks, stones and decaying wood branches. Some insects build their nests in rotten wood logs and hibernate there during winter.

You may also find ants, crickets and beetles by removing the humus and leaf litter on the soil surface which these animals feed on. By carefully digging up the topsoil, you should find insect larvae such as cicada nymphs and moth larvae in the topsoil where they hide and feed on roots.

The warm environment and rich organic matter of animal manure makes it an important nursery for insects such as dung beetles and flies. That is why the scent of animal manure always quickly attracts insects. Other decaying organic matter, like carcasses, also attracts insects to feed.

Investigating arboreal habitats

Grass and the leaves of trees or shrubs are ideal places for looking for butterfly larvae, grasshoppers, the praying mantis, ladybirds and beetles. Look for leaves or grass with brown patches, which were possibly damaged by insects. Also pay special attention to the underside of leaves and grass as insects usually lay their eggs there.

Insects such as lantern flies and moths which are camouflaged to look like tree bark, often rest on tree trunks. Some insects, such as carpenter bees and bark beetles, nest on tree trunks and may leave tunnel-like damage trails. Insects can also construct nests near roots or hanging off tree branches like the Black-tree Ant. Some insects such as beetles and butterfly pupae even hibernate under tree bark during winter.

Flowers, fruits and nuts with strong scents always attract insects. Butterflies, wasps and bees which feed on nectar are frequent flower visitors. Aphids and spittlebugs which feed on fruit can be found in ripening fruits bearing spot damage. Acquire information about the plants which insects like to feed on and it helps you search for particular ones.

DID YOU KNOW?

Butterflies are highly selective in choosing plants where they lay their eggs and butterfly larvae normally feed on only one or two types of plants. Adult butterflies will not lay eggs if they cannot find the right food plant that its larvae can feed upon, and the larvae will starve to death if it is removed from its specific food plant.

INVESTIGATING AQUATIC HABITATS

Different aquatic habitats, such as marshes, rivers, ponds and lakes, have their own special fauna and flora, which attracts insects to live on the surface or even underwater. Open and clear water is best for observing aquatic insects.

Focusing on the surface of a freshwater pond will often be a fruitful experience. You may find water skaters or water crickets skating over the pond surface in search of food. You also might come across water boatman and diving beetles surfacing regularly to breathe. Dragonflies may rest on floating plants and female dragonflies will 'dip' the water-surface to lay their eggs.

Some aquatic insects support themselves by anchoring to the edge of a pond, or on rocks and debris at the bottom of the pond, or they may also live in and

Fresh water habitat in Mai Po Nature Reserve

feed on aquatic weeds. By carefully inspecting these sites, you may discover beetles, bugs, as well as larvae or nymphs of dragonflies, mayflies and damselflies.

Looking for Flying Insects

Flying insects such as dragonflies, moths and termites are usually more active before and after rain. Looking for flying insects at the 'right' time and 'right' place will bring a rewarding experience. For example, butterflies are usually active during the day while moths are more active at night. Dragonflies are easier to find near freshwater habitats.

MAN-MADE ENVIRONMENT

Looking for Insects at Home

The kitchen is a place where insects can be easily found. Weevils like to feed on crops and thus maybe found in rice containers. Ants, cockroaches and houseflies feed on the food available in the kitchen, like left-over food and delicious cakes. They may be found in rubbish bins or refuse piles, as well as on the food that you forgot to cover.

Silverfish and booklice love to hide in dark places like basements, wardrobes and bookshelves. Cloth moths lay eggs on clothing as their larvae feed on wool and fur.

You may also find insects on your body or your pets – mosquitoes, lice and fleas all feed on mammals' blood.

Looking for Insects in Parks

Urban parks always attract insects because of the plants and aquatic habitats found there.

When To Watch?

SEASONAL VARIATIONS

Insects can be found year round but spring and summer are the best seasons for insect watching in Hong Kong. Most insects emerge from a pupa to become an adult during these seasons and begin actively mating to produce the next generation. During the cold season, insects are less active and some hibernate making it difficult to find them.

Acquiring information about the life cycle of insects also helps you look for specific species. Insects may have specific seasons when they go through each of the specific stages of their life cycles. This may be related to the availability of food and weather.

DAILY VARIATION

Most insects are active during the day for either feeding or mating. They will hide in a safe and sheltered place when it is raining or there is a typhoon. Some insects are active at night which is their prime time to search for food - some of them are attracted by light. It is easy to see insects under street lamps on a summer night. Most insects exuviate or emerge at night since it can minimize the risk of being eaten by predators.

Insects active in the daytime

Butterflies, Mayflies, Dragonflies, Wasps, Bees, Ladybirds, Cicadas, Flies, Ants

Insects active at night

Moths, Crickets, Cockroaches, Mosquitoes, Fireflies

How To Watch?

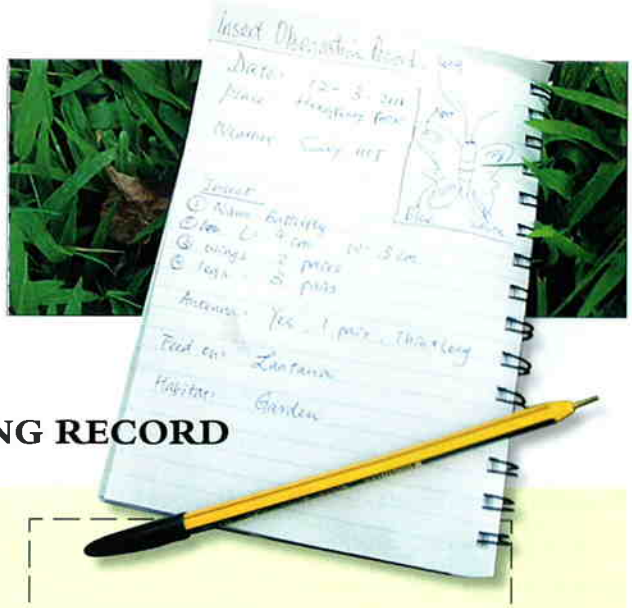
KEEPING FIELD NOTES

Your observations of insects will be more fruitful if you record what you have observed. Concise notes allow insect watchers to record their observations, to refresh their memory, for cross-referencing or analysing results recorded at different times, venue or weather, as well as for keeping additional information collected in your reading. The information recorded will be accumulated as time passes and the learning process will deepen one's understanding of the insect world. A well-kept field notebook will not only serve as a useful personal reference but will also act as a valuable resource for monitoring the ecological condition of each insect habitat.

PRINCIPLES FOR FIELD NOTE RECORDING:

- Use a pocket size notebook and a waterproof pen for recording field notes. Keep the notebook and the pen in an easily accessible place like your jacket pocket while going insect watching.
- Bring the notebook with you whenever possible as you may come across interesting insects almost anywhere at any time.
- A systematic record sheet with important observations listed will help guide beginners in making detailed records.
- Always try to record your observations on the spot, otherwise important details may be forgotten.
- Make a note of the date, time and a brief description about where the insects are found - these are important pieces of information when studying insects.
- Don't worry about the name of the insect but pay attention to its features and how it is associated with its environment. This information will be useful for identification and studying insect ecology.
- A sketch of the insect will help with accurate and fast recording.

- Check reference materials for insect identification while your memory is still fresh.
- Cross referencing records made at the same place at different times of the day, or year, as well as comparing records made over the years, will help you understand evolve new and interesting findings.



AN EXAMPLE OF INSECT WATCHING RECORD

Date: _____

Time: _____

Weather conditions: _____

Venue: _____

Sketch of the insect

About the insect

Have you ever seen it? ☐ yes ☐ no

Name of insect: _____ *(if you know it)*

Body length/Wing Span: _____ mm/_____ mm

Colour/Pattern:

body: _____ wing: _____

legs: _____ antenna: _____

Number of wings: ☐ none ☐ one pair ☐ two pairs

Sex: ☐ male ☐ female ☐ not sure

Behaviour: ☐ mating ☐ laying egg ☐ resting ☐ fighting

☐ transporting materials: _____

Feeding on: ☐ fruit ☐ flowers ☐ leaves ☐ wood ☐ animal manure

☐ humus ☐ others: _____

☐ name of plant which it visited: _____

☐ others: _____

Number: ☐ appears singly ☐ appears in a group

About the surrounding environment

It was found: ☐ in the air ☐ on plants ☐ on rocks ☐ on the water surface

☐ underwater ☐ others: _____

Habitat types: ☐ natural environment:woodland/river/stream/freshwater pond/grassland/seashore

☐ man-made environment: urban park/home/school/restaurant

☐ other: _____

Remarks:

_____

Post-trip findings:

_____

_____

_____

OBSERVATIONS

According to the information provided in earlier sections of this chapter, you should already have an idea about what to observe, and when and where to go insect watching. Experience and information gathered will help you become an expert on where and when are the best places/times for watching particular insects, as well as enriching your knowledge and understanding of the environment.

Getting a Closer Look at Insects

You can enjoy a fruitful experience simply by using your sense of sight, sound and smell. Some simple equipment such as a magnifying glass or bug box are useful equipment to help bring the insect closer for observation. Don't forget to bring your notebook with you to record your findings!

Environmental Friendly Principles

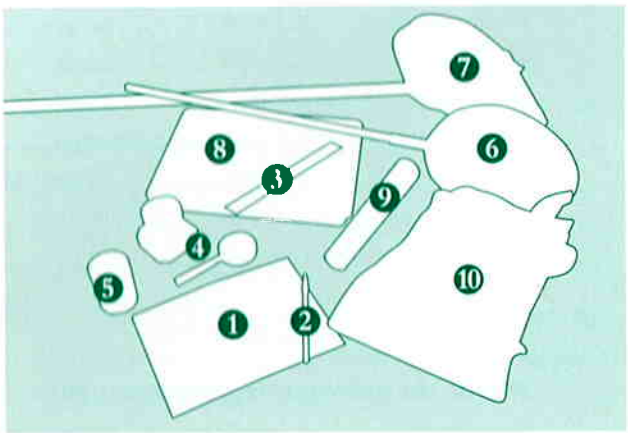
You can go searching for insects without special equipment if you just want to observe them. However, some insects are very active and rarely stand still. As a result, you may need some skills and equipment to catch these mobile animals if you want to study their features. When you are going to capture insects, please do so observing the environmentally friendly principles (Please refer to Chapter 2 for more details).

Basic insect studying equipment

There is some collecting equipment available which can assist with insect observations. Simple equipment such as a bug box, notebook and net are important tools for insect watchers to get started. Select the proper equipment from the checklist according to 'When' and 'Where' you are going to do insect watching.

Checklist for insect watching

1. Note book.
2. Pen.
3. Ruler: to measure the size of insect.
4. Magnifying glass: to search for small insects and see different parts of it.
5. Bug box: store the collected insects for observation.
6. Sweep net: a net which is large and deep enough to capture terrestrial insects. The net bag should be strong enough to withstand damage from trees or grass when collecting insects.
7. Dip net: a heavy-duty net with a triangular or 'D ' shaped rim to help scoop the bottom of a pond or river. The shape of the rim prevents loss of specimens underneath the net.
8. White coloured tray for ease of observing any collected aquatic insects.
9. Flashlight: search for and attract moths and fireflies at night.
10. A bag to keep all the equipment.



Can I make my own equipment?

SURE you can! Although all the above equipment is easy to buy, it can be equally convenient for you to make it yourself or to find a substitute. MAKING YOUR OWN INSECT-WATCHING KIT is a good pre-visit exercise for you and your young participants. Please refer to page 62 in the instructions for making insect watching equipment and don't forget your home is a treasure trove of materials from which they materials can be made - have fun!

Insect watch equipment

WAYS FOR CAPTURING INSECTS OF OBSERVATION

HAND COLLECTION

The easiest way to capture a terrestrial insect is to 'pick' it up directly. Some insects possess defense mechanisms like stings which can either hurt or cause a harmful allergic reaction. Therefore, never pick up any insect with your fingers unless you know it is safe to do so. A pair of forceps may help but make sure the edges of the forceps are smooth (example, plastic forceps). You should hold the insect gently, otherwise you will hurt.

CAPTURE INSECTS BY USING A NET

A net is the best means of capturing flying insects but always remember the wings of flying insects are very fragile. Use a net which is made of light and soft material like cotton.

What do you need?

- A hand, or sweep net

How to do?

1. Stalk the insect slowly and quietly.
2. Sweep the net towards the insect. Swoop and trap the insect inside the net.
3. Turn the net over and hold the pointed end of the net straight up. Let the insect crawl upward towards the sealed end of the net.
4. Trap the insect at the sealed end of the net by twisting the front end.
5. Observe the insect through the net.
6. Put the bug box into the net carefully, and move it towards the insect. Let the insect crawl into the bug box.
7. Take the bug box out of the net and cover it with the lid.
8. Record your observations in your field notebook and then release the insect.

Tips:

- You can use a sweep net to capture insects in grasses or weeds. Hold your net downward and swing, left and right, the net in an arc in front of you when you step into the grasses.
- Avoid water depths greater than 0.7 metres.

PITFALL TRAP

A pitfall trap is an effective means of capturing crawling insects.

What you need?

- A tin
- Trowel
- One flat stone to cover the mouth of the tin
- Four small pebbles
- Different kinds of bait

What to do?

1 Make a few holes at the bottom of the tin to avoid drowning the trapped insect by letting rain water drain out. Place bait such as rotten leaves, food debris or fruit in the tin.

2 Dig a small hole in the ground to a depth equal to the height of the tin. Insert the tin in the hole so that its opening is at the same level as the ground surface. Put the four pieces of pebbles around the tin and place the flat stone on the top to make it look natural. Remember, the mouth of the tin should be level with the ground surface.

3 Check the tin at regular intervals during the day and night. Record the time, number, species/ features of the insects that fall into the trap.

4 Release insects on the spot after a record has been taken.

5 Remove the tin from the field when the experiment is completed.

Tips:

Repeat the experiment using different types of bait. You will be amazed you by the wide range of insects trapped. This allows you to find out the food and feeding habits of different types of insects.

DROP NET

This method is good for capturing woodland insects.

What do you need?

- A light coloured umbrella or a white plastic sheet
- A stick

What to do?

1 Upturn the umbrella and place it under trees or shrubs. You could spread out a white plastic sheet on the ground instead of an umbrella.

2 Beat the shrubs or the tree branches with a stick or you may shake the tree branches slightly. Insects will fall down onto the umbrella or the white sheet.

3 Use a hand net or forceps to transfer the insects to your bug box for observation if necessary.

4 Release the insects after observation.

SUGARING

Sugaring is a simple method for attracting nectar-feeding insects such as butterflies or moths.

What do you need?

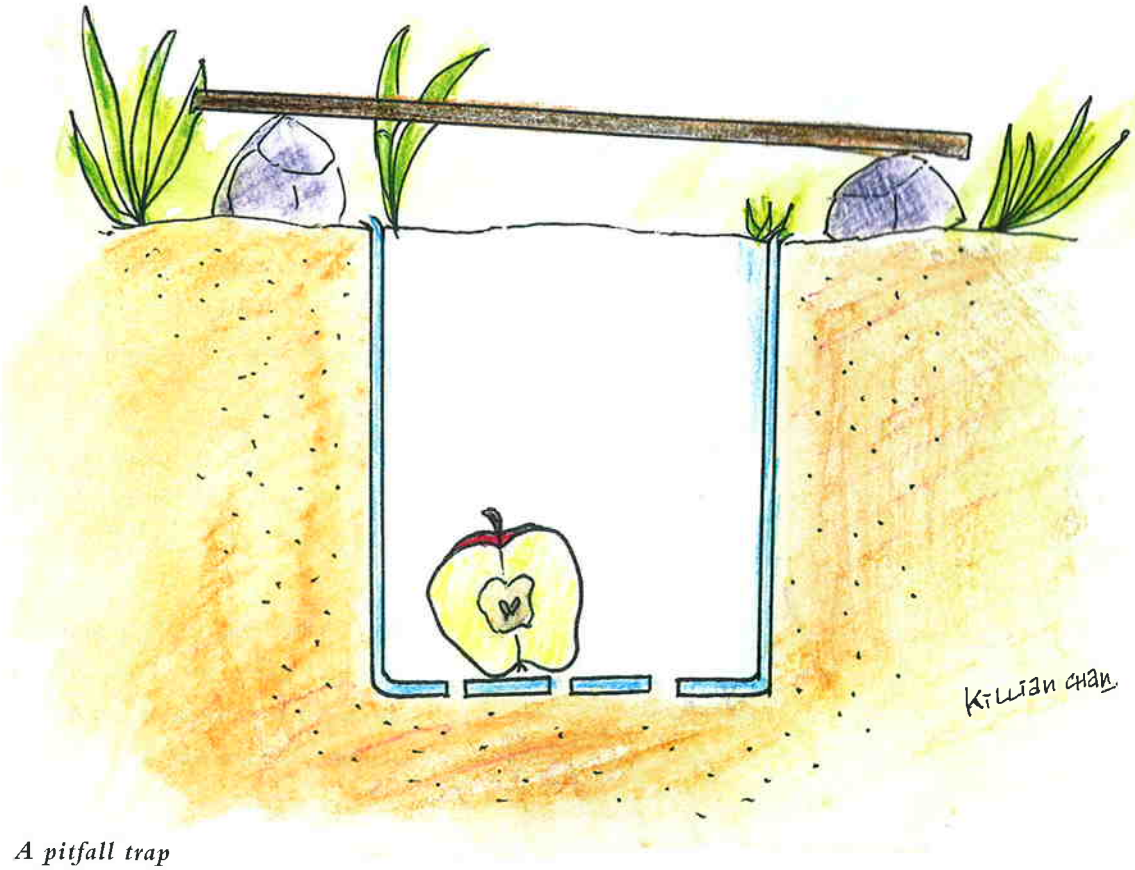
- Fluid which is sweet, such as sugar, syrup, rum, beer or fruit juice
- A brush
- A torch (for observing moths at night)

What to do?

1. Use a brush to smear the sweet fluid on tree trunks.
2. Compare the insects attracted to the sugared tree during daytime and at night.

Tips:

Repeat the experiment by smearing other types of fluid to attract different types of insects. For example, fruit juice can attract insects which feed on fruit.



A pitfall trap

A drop net

POND-DIPPING

Pond-dipping is used to capture aquatic insects such as dragonfly nymphs, diving beetles and water skaters, for observation.

What do you need?

- A white coloured tray or shallow dish
- A pond net
- A plastic sieve
- A trowel
- A magnifying glass

What to do?

1. Select a freshwater habitat such as river, lake or pond to conduct the pond-dipping activity.
2. Stand in the shallow water at or the pond's edge and use the net to dip down to the bottom. You can also use the net to collect insects on the water surface.
3. Use a plastic sieve or trowel to scoop up mud from the pond's edge, some insect may hide under the mud.
4. Tip your collected creatures into the tray.
5. Observe carefully the creatures in the tray with your magnifying glass and try to identify them.
6. Think of how some insects can spend their entire life, or part of their life, in a freshwater habitat.

Safety hints:

- ONLY carry out this activity at places where it is safe for the participants to do so.
- The activity should be conducted under close adult supervision.
- The activity should NOT be carried out within a week after heavy rain to avoid flooding or unstable soil conditions especially in stream habitats.
- Avoid habitats with a water depth of greater than 0.7 meters.

FURTHER READING

People always learn and remember more from their own detailed observations than reading information. Look for references whenever you are in doubt about your observations and record the findings in your field notebook. Given time, your field notebook will become your most valuable tool in insect watching.

Kids doing pond dipping

The youths observing aquatic insect

LEARNING ABOUT INSECTS USING ENVIRONMENTAL ACTIVITIES

Organising activities before and after an outdoor insect watching activities enhance the smooth running of the activities and enriches participants' understanding of environmental concepts. Here are some ideas for reference:

PRE-VISIT ACTIVITIES

ACTIVITY 1

DIY insect watching equipment

MAKING A SWEEP NET

Objectives:

- To enhance participants' understanding of environmental principles and skills in capturing insects.
- To stimulate participants' interest in insect watching.

Venue : Classroom or activity room
Duration : 45 minutes
Level : Children aged between 8 to 12 years

Materials:

- A wire coat hanger
- A stick
- A piece of gauze about 60 cm^2
- A needle and some strong cotton thread

Procedures:

1. Straighten out the wire coat hanger and bend it into a loop.
2. Fold the gauze around the loop and sew across the opposite edge. Leave both ends open.
3. Sew one end of the gauze and run the wire through the hemmed end of it.
4. Wind the ends of the wire round the stick or tape it to.

DID YOU KNOW?

You can use the same method to make a dipping net. When you bend the wire, make it into a triangular or 'D' shape. You should use nylon or heavy-duty netting for this net.

ACTIVITY 2

DIY insect watching equipment

MAKING A POOTER

Objectives:

- To illustrate collecting insects requires technical skills.
- To arouse children's interest in participating in insect watching programmes.

Venue : Classroom or activity room
Duration : 30 minutes
Level : Children aged 8 to 12 years

Materials:

- A transparent plastic cup with lid
- Two plastic drinking straws
- Cellotape
- A small piece of gauze

Procedure:

1. Tape the gauze over the end of one straw to prevent the inhalation of insects.
2. Make two holes in the lid and the bottom of the cup. The size of the holes are the same width as the straw.
3. Insert the straws into the cup. The end of the straw with the gauze should be inside the cup.
4. When there is a tiny insect, hold the pooter near it. Inhale on the muslin-covered straw. Air and tiny insects should be sucked into the plastic cup.
5. After you complete recording your observations open the lid and release the insect back where it was found.

The D-shape net

A pooter

ACTIVITY 3

INSECT? OR NOT?

Using the '3+3 Formula' identify which of the following animals are insects.

(Please circle the insects)

Longhorn Beetle

Crab

Spider

Millipede

Moth

Wasp

DID YOU KNOW?

Insects have 3 pairs of legs and 3 body-parts. This is the 3 + 3 formula for identifying insects from other insect-like animals.

ACTIVITY 4

BUILD A DRAGONFLY

Objectives:

- To explain the basic structures of an insect.
- To illustrate why freshwater habitats are important for aquatic insects such as dragonflies.

Venue : Classroom or activity room
Duration : 45 minutes
Level : Children aged 8 to 12 years

Materials:

- Long balloon
- coloured pen
- Wire
- Pipe cleaners
- Ping-Pong ball
- Glue
- Cling film

Procedure:

1. Blow up a long balloon.
2. Twist and tie the balloon twice to make the three body sections: head, thorax and abdomen. The first two sections are smaller than the last section.
3. Draw a wing shape on the clear cling film. Cut it out and glue it on the wire. Remember, a dragonfly has two pairs of wings on its back.
4. Glue the wings onto the second section of the balloon.
5. Glue 3 pairs of pipe cleaner onto the second section as legs.
6. Cut the Ping-Pong ball into half. Paint it black and glue it to the head as eyes.
7. Ask children how many sections does a dragonfly have. Use the dragonfly they made to illustrate insect structures. Identify the difference between insects and spiders.

DID YOU KNOW?

Dragonflies are the fastest flying insects. They can fly at 90 kilometres per hour. The freshwater habitat is an important breeding ground for dragonflies. The nymph stays in water for about 2 years before emerging into an adult. The life of an adult dragonfly is only about one month.

Butterfly Dragonfly

Butterfly

Tiger Moth

ACTIVITY 5

IDENTIFYING THE DIFFERENCE

Butterflies and moths look similar but they have features which are different from each other. Write down differences between a butterfly and a moth.

Moth		*Butterfly*
_____	Antennae	_____
_____	Wings	_____
_____	Active time	_____

DID YOU KNOW?

There are exceptions, so that some moths are active in the daytime, like the Tiger Moth which can be easily seen at Mai Po Nature Reserve during summer days.

POST-VISIT ACTIVITIES

ACTIVITY 6

METAMORPHOSIS GAME

Objectives:

- To illustrate the life cycle of different insects.

Venue : Outdoor playground
Duration : 30 minutes
Level : Children aged 8 to 12 years
Preparation : Prepare five sets of insect life cycle cards
(illustration provided in Appendix 1)

Procedure:

1 Tell the children that they are going to do a matching exercise on the life cycle of five different insects, and the exercise has to be conducted in 'silence'.
2 Ask the children to sit in a big circle with their faces towards the centre. Hang an insect life cycle card to the back of each child so that he/she will not know what it is.
3 Remind the children that the game has to be conducted in absolute silence, and they have to help each other to find others who role-play the same insect. Children have to hold hands and work together once they find their partner(s). Start the game and let the children walk around to do the activity.
4 In about five minutes time, ask the children to sit down in groups with the children whom they think are role playing the same insects.
5 Ask the children to take the cards off their back, and work out the sequence of the insect life cycle in each group.
6 Ask the group to paste the insect-cycle they worked out on the blackboard/notice-board.
7 Check with the children to see if there are any odd ones in the cycle and put them back in the right place(s).
8 Ask the children if there are differences in the appearance of insects at different stages in their life cycle.
9 Explain to children about the concept of complete metamorphosis and incomplete metamorphosis by giving examples.

DID YOU KNOW?

- *Some insects have four distinct stages in their life cycle and the nymph or larval stages are dramatically different from the adult. Butterflies, mosquitoes and bees go through complete metamorphosis. Complete metamorphosis avoids competition for food and territory between adults and juveniles.*
- *Some insects' juvenile stages are similar to the adult's. They molt and emerge several times before changing into an adult. Dragonflies, grasshoppers and cicada go through incomplete metamorphosis.*

ACTIVITY 7

CAMOUFLAGE GAME

Objectives:

- To demonstrate the importance of camouflage in nature.
- To illustrate that camouflage is an adaptative feature of insects.

Venue : grass
Duration : 30 minutes
Level : Children aged 8 to 12 years old
Materials : string, bird cards, colour pens, insect plates

Preparation:

- Prepare 15 pairs of bird cards. Fix a string on each card to hangit on the children's necks.
- According to the shapes of the insect cut-outs in Appendix II, prepare insect cut-outs of different colours, that is , red, brown, green and yellow plastic sheets (you may reuse plastic bags of different colours for this activity). There should be the same number of cut-outs for each colour, and prepare at least five cut-outs of each colour.

Procedures:

1 Spread the prepared insect plates on the grass in advance of the activity.
2 Distribute a bird card to each child and ask them to hang the cards on their necks.
3 Go through the names of the birds and ask the children to look for his/her partner who is holding a card with the same bird as he/she does.
4 Working in pairs, each group has to tie their legs together with a piece of cloth provided.
5 Tell the children that all birds they are role playing are insect eaters. They have to work in pairs to look for insect plates on/in the grass. Show the children a sample of the insect plates that they have to look for. Time given will be three minutes.

Grasshopper

6 Gather the children together after three minutes and separate the insect plates collected according to the different colours.
7 Together with the children, count the number of different colour plates collected. If the numbers are different, ask the children to check which colour has the largest number of cards collected and which one has the least.
8 Conclude the game by saying that many insects have their body colour which looks similar to the environment so that it serves as camouflage for their protection. The colour makes them look less conspicuous to predators.
9 With the children, collect the rest of the plates which remained undiscovered by the children during the activity.

DID YOU KNOW?

Apart from using camouflage, some insects use bright colours and patterns as warning signals to scare off predators. Some of these insects have defense weapons like stings, some are poisonous, while some mimic the above two groups.

ACTIVITY 8

MAKE AN INSECT AQUARIUM

Objectives:

- To understand the adaptation of aquatic insects through observations
- To illustrate the importance of freshwater habitats for insects

Venue : Classroom or activity room
Duration : 2 to 4 weeks
Level : Children aged 8 to 12 years
Preparation : Conduct a pond dipping activity to collect some aquatic insects
Materials : Nylon or netting, clips, flaked fish food or algae pellets, water, a glass fish tank, sand, stones, sticks and pond weeds

Procedures:

1 Put the sticks, sand, stones on the bottom of the tank. Add water plants and then freshwater until the tank is about half-full. Let it settle for one or two days.

2 Put the collected aquatic insects into the tank.

3 Cover the tank with nylon or netting secured with clips.

4 Keep the tank in a shaded place or cool corner of the room. The water temperature will increase if it is placed under sunlight.

5 Change four cups of tank water for freshwater each day to keep it fresh.

6 If a pond is nearby, you can replace it by water from here as it will provide food for the insects. Otherwise, add a few flaked fish food or algae pellets into the tank to feed the insects. Remember do not over feed them.

7 Let the children observe the tank and make an on-going record of the insects. Ask them which insects live near the surface or on the bottom as well as how they live under water.

8 Tell the children that different aquatic insects have special ways to breathe underwater. Tell them that freshwater or wetland habitats are important breeding and feeding grounds for insects.

9 When the experiment is finished, put all the insects back to the place they were caught.

ACTIVITY 9

HABITAT DESTRUCTION GAME

Objectives:

- To illustrate how habitat loss directly affects wildlife
- Explain human impacts on wildlife and the natural environment

Venue : Outdoor playground
Duration : 30 minutes
Level : Children aged 8 to 12 years
Materials : 10 pieces of newspaper

Procedures:

1 Lay 10 pieces of newspaper on the ground.
2 Ask children to stand in a big circle surrounding the newspapers.
3 Ask them to walk round along the edge of the circle, and then rush in to find a place to stand on the newspaper when you shout 'stop'.
4 Children who cannot find a place to stand have to stand aside to watch the rest of the game. Reduce the area by removing one piece of newspaper.
5 Repeat procedures 3 and 4 until there are less than five people left.
6 Ask all children what they felt while playing the game.
7 Explain that the newspaper resembles habitats that wildlife relies on and all of them are different animals that compete for survival. In a healthy habitat, wildlife and people can live together in harmony and comfortably. As habitats are destroyed, living things have to fight for survival. Some species will be reduced in number and may eventually go extinct.

Youths playing the habitat destruction game

ACTIVITY 10

FLOATING WATER SKATERS

Objectives:

- To illustrate the adaptations of aquatic insects - Water skaters
- To promote understanding of how humans affect wildlife and natural environments through water pollution

Venue : Classroom or activity room
Duration : 30 minutes
Level : Children aged 8 to 12 years
Materials : water, bowl, needle and detergent

Procedures:

1 Fill the bowl with water.
2 Demonstrate how to float a needle on the surface of the water without sinking. Explain to the children that when air and water meet, a stretchy surface forms at the water surface, which is due to water tension.
3 Ask the children if they have ever seen an insect which skates over water and ask them to describe the motion.
4 Use water skaters to illustrate the skating motion: Water skater's slender legs and light body are both covered with tiny hairs to buoy it on the water surface. It depends on the tensile strength of water to enable it to skate swiftly about on the still surface without falling through. It has wings but is a feeble flier.
5 Invite one child to add a drop of detergent to the water and see the needle sink.
6 Explain how detergents pollute the aquatic environment and destroys the surface tension of water. This directly affects the survival of wildlife and upset the natural ecology.

DID YOU KNOW?

- *Each pair of water skater's leg has different functions. Rear legs are rudders for steering, middle legs enable the skater to move and its front legs act as a detector to sense ripples from struggling prey.*

CHAPTER 4

Tai Po Insect House

Where to Go

Insect Watching *in Hong Kong*

Insect watching is a hobby that you can do whenever you like. Insect watching skills and experience will develop with practice. There are many easily accessible places in Hong Kong which beginners can go to learn more about insects. There are several education centres and thematic insect exhibition halls in Hong Kong which describe the biology and ecology of insects with exhibitions and displays. The Lion Club Education Centre, Kadoorie Farm and Botanic Garden, and even urban parks like Hong Kong Park and the Zoological and Botanical Gardens are good places to visit.

Country parks are ideal places for more experienced insect watchers or for more experienced leaders. The country parks allow more in-depth study of insects and their natural environment. The visitor centres and education facilities in some country parks are additional facilities that allow for a wider variety of programmes in an insect watching tour.

Lions Nature Education Centre

Mai Po Marshes Wildlife Education Centre

I. Urban Parks

	Name of park	Opening Hours
A	Hong Kong Park	06:30 - 23:00 hrs
B	Hong Kong Zoologicaland Botanical Gardens	06:00 - 22:00 hrs
C	Victoria Park	Open 24 hours
D	Kowloon Park	06:00 - 00:00 hrs
E	Tuen Mun Park	Open 24 hours
F	Yuen Long Park	Open 24 hours
G	Tin Shui Wai Park	Open 24 hours

II. Country Parks

All Visitor Centres Closed on Tuesdays. Open from 09:30 - 16:30 hrs

H	Aberdeen Country Park
I	Shing Mun Country Park
J	Tai Mo Shan & Lam Tsuen Country Park
K	Sai Kung Country Park
L	Clear Water Bay Country Park
M	Pak Sin Leng Country Park

III. Education Centres

	Name of Education Centre	Opening Hours
N	The Lions Nature Education Education Centre	09:30 - 17:00 hrs Closed on Tuesdays
O	The Kadoorie Farm and Botanic Garden	09:30 - 17:00 hrs
P	The Mai Po Marshes Wildlife Education Centre	09:30 - 17:00 hrs
Q	The Tai Po Water Front Park — Insect House	08:00 - 19:00 hrs

Pond Dipping Activity

Case Study:

Mai Po Wetland

Insect Watch Activity

Insects In The Mai Po Wetland

In addition to rainforests and the ocean, wetlands are important life-support systems. Wetland habitats support a wide variety of flora and fauna including insects. Mai Po contains freshwater fishponds, traditional shallow shrimp ponds (Gei wai), mangrove forests and intertidal mudflats. It was designated as a Ramsar Site in 1995 and is now China's seventh Wetland of International Importance.

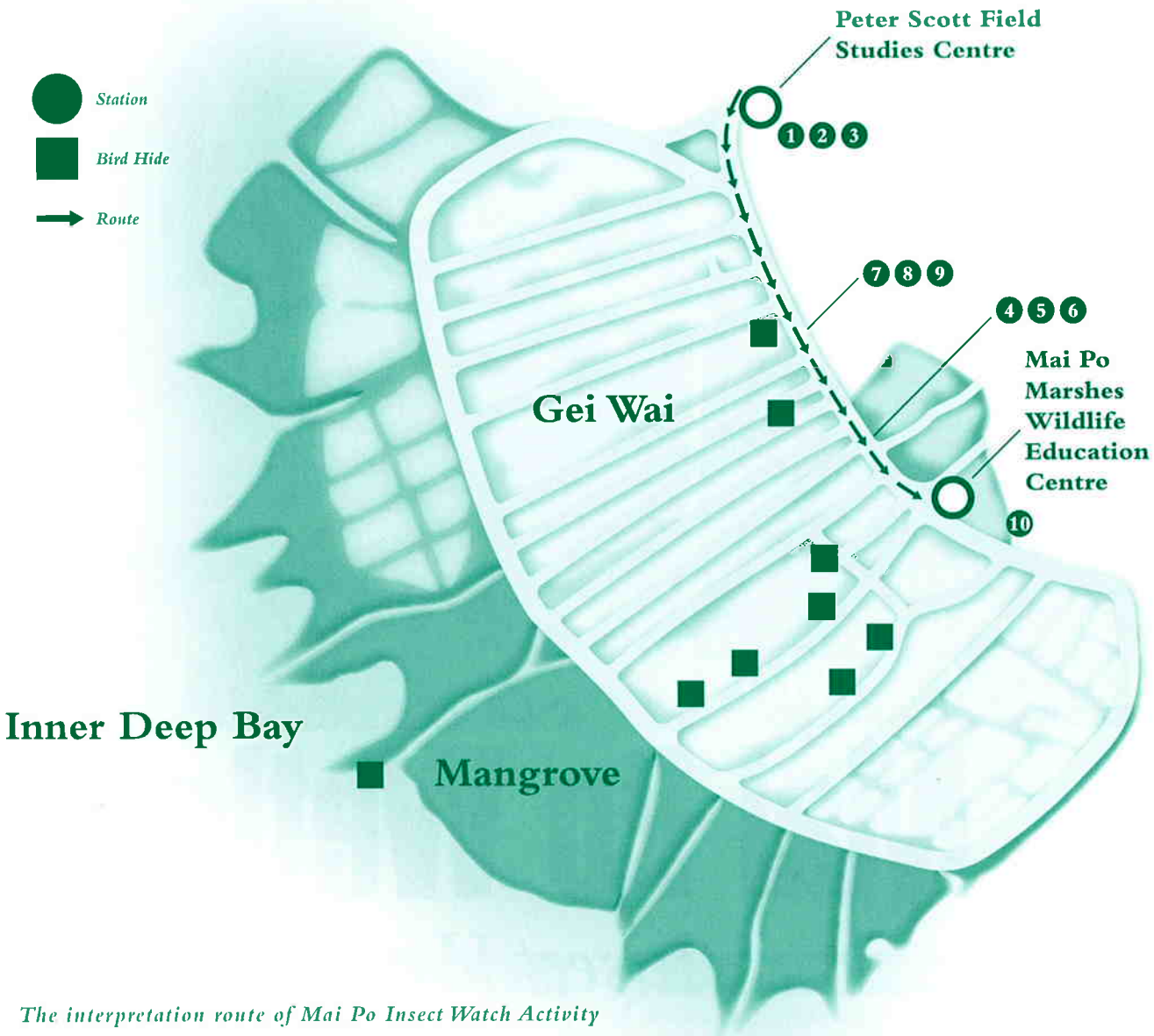
A wetland habitat is important for insects. Some insects spend their entire life underwater and some go through different stages before they emerge as adults. At the Mai Po Nature Reserve more than 400 species of insects have been recorded. Approximately 12% of Hong Kong's butterfly species and over 45 out of about 120 species of dragonfly can be found within Mai Po.

Mai Po Wetland Insect Watch

Mai Po is not only a place for bird watching, it is the wetland that harbours an amazingly rich diversity of wildlife. Up to 40,000 visitors come to Mai Po Nature Reserve annually through a variety of guided study visit programmes provided for students and the general public. The Mai Po Wetland Insect Watch began in the summer of 1999. About 1,000 children aged between 8 to 12 years are invited each year from various Child and Youth Centres in Hong Kong.

Objectives of the programme

- To arose children's appreciation of nature through the insect watch programme.
- Explain the general structures of insects and how they have adapted to the Mai Po wetlands.



The interpretation route of Mai Po Insect Watch Activity

- Demonstrate correct insect catching techniques for participants.
- Promote public awareness and understanding of the importance of environmentsl conservation in our local community.

How Do We Implement The Insect Watch Activity In The Mai Po Nature Reserve

By studying the biology of living habitats and insects as well as their ecology, we can discover some interesting facts about them. Throughout this Insect Watch activity, we make use of different areas of the Mai Po Nature Reserve to help visitors learn about the ecology of insects through observation.

Station 1

Demonstrate insect catching skills

- It is necessary to demonstrate the correct way of in catching insects, without hurting them, to participants BEFORE they start to collect insects.

Station 2

Observe the physical features of an insect

- After collecting insects in the field, we ask participants to observe the structure of an insect by investigating the number of legs, and to look for their antennae and wings, to check if the creatures we collect are definitely insects.

STATION 3

Explain the adaptations of insects to Terrestrial habitat

- Terrestrial insects have different coloured patterns on their backs or wings which may match the surrounding background colour. This is known as "camouflage" which protects the insects from being seen by predators.

Youths doing Insect Watching

STATION 4

Observing the insect nests

- Explain the adaptations of the Black Tree Ant in the wetland habitat by studying an ant's nest. The Black Tree Ant constructs its nest in trees to avoid the wet soils found in wetlands.
- Some leaves of the tree, Cuban bast are deliberately rolled up by insects. This is because caterpillars known as Leaf-rollers, have rolled the leaf longitudinally with silken strands to live, feed and pupate within the protective roll.

Black Tree Ant Nest

STATION 5

Understanding an insect's life cycle

- The cicada sloughs are a good example of different stages in the life cycle of an insect.
- Participants are told that some insects are beneficial to people since cicada sloughs are useful in Traditional Chinese medicine.

STATION 6

Insects as Friends

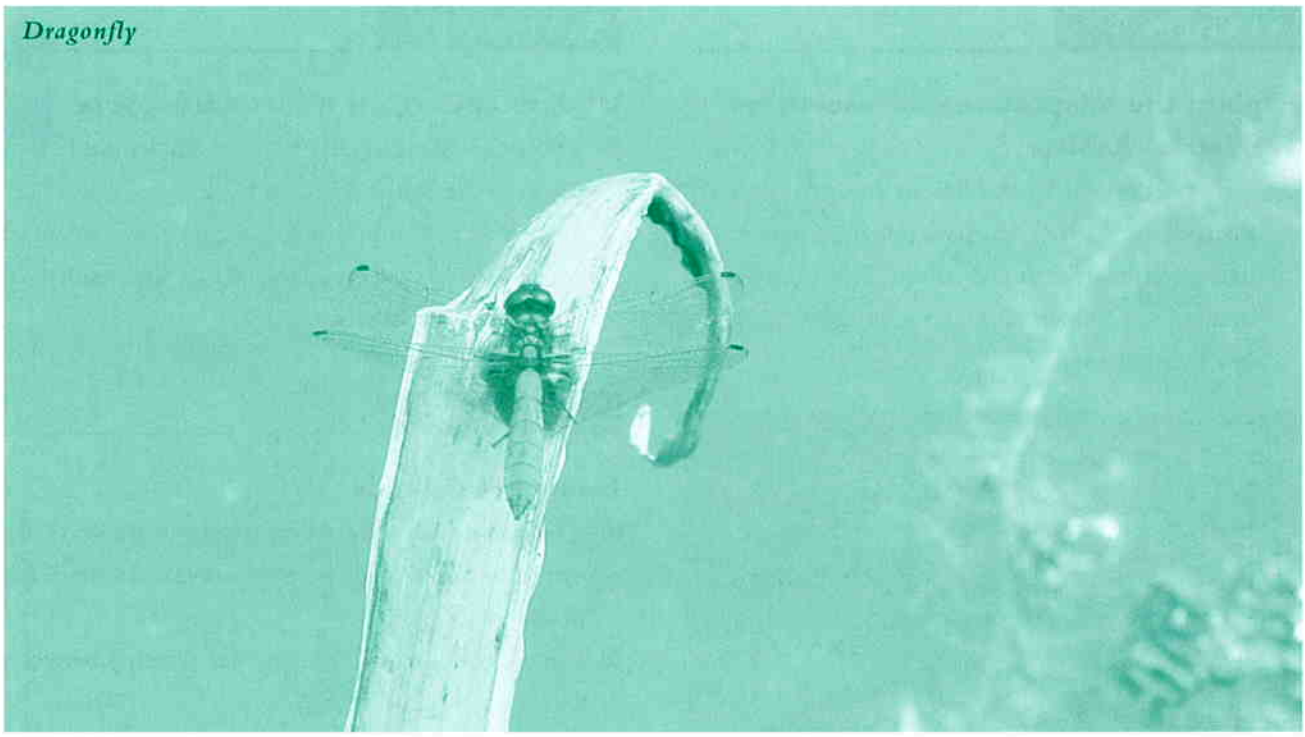
- The relationship between plants and insects are important to us because they are the essential for plant pollination.
- Lantana can explain the inter-relationship between insects and plants.
- Insects are vital in the manufacture of silk, a valuable commercial product in Asia. We use the White Mulberry Tree as an example. The silkworm larvae feed on the leaves and then make silk when it forms a cocoon.

Lantana

STATION 7

Insects as Foes

- Termites consume wood as food by using special enzymes to digest wood tissues. Carpenter Bees drill holes in wood to make a nest.



Dragonfly

STATION 8

Listen to insects

- Different insects have their own ways of making sound by quoting cicada as an example and explain how they do it.
- Listening to the calls made by crickets which are common in the countryside for the purpose of attracting mates.

STATION 9

The relationship between insects and other creatures

- Many species of birds feed solely on insects. The Barn Swallow eats insects while they are flying. Other birds such as the Flycatcher eats flies and the Bee-eater eats bees.

STATION 10

Aquatic habitat

- A pond dipping activity provides opportunities for participants to observe the special adaptive features of aquatic insects.
- By observing the different respiratory organs of aquatic insects, participants will discover how various species have different ways of breathing under water.
- Using the water skater as an example to explain how it moves over water without difficulty.

HOW TO JOIN THE MAI PO WETLAND INSECT WATCH

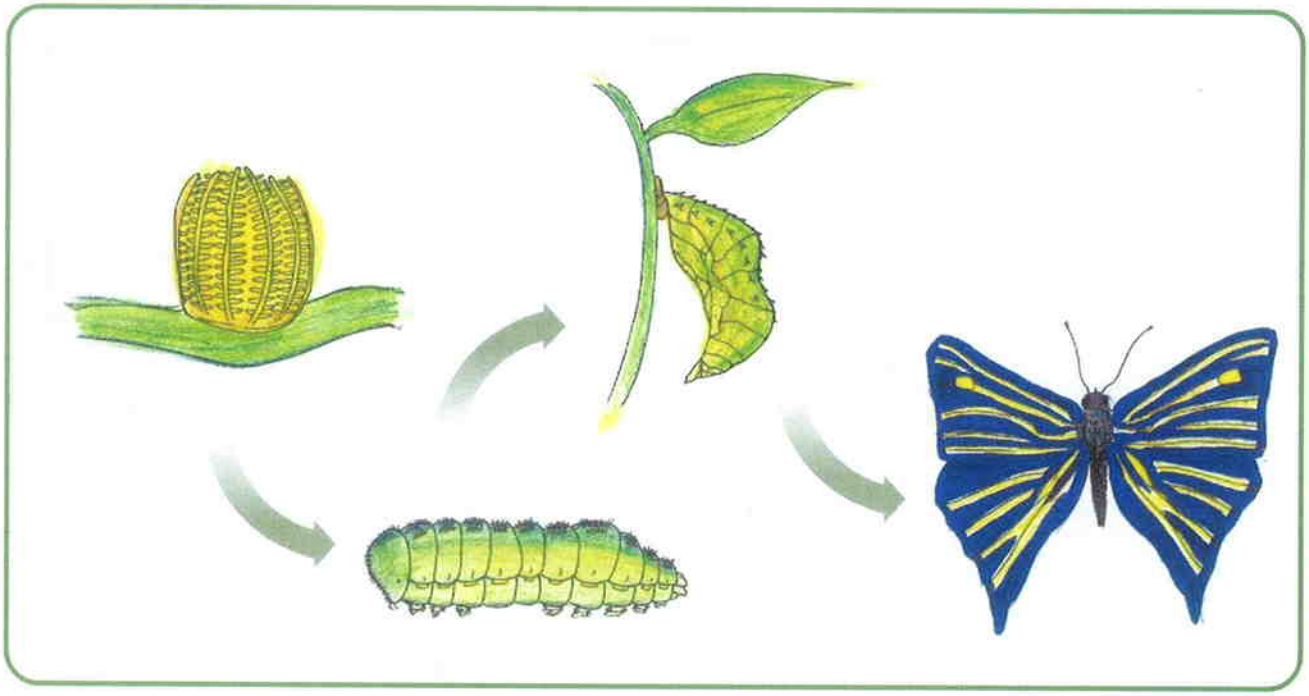
We are pleased to invite you to join our Mai Po Wetland Insect Watch programme each summer. Let us go together to search for many amazing insects under rocks and logs, as well as bushes, in the mud and water!

For those who are interested in joining or obtaining more information about WWF HK and its environmental education materials and programmes, please contact us at 2526 4473 or visit our Website at ***http://www.wwf.org.hk***.

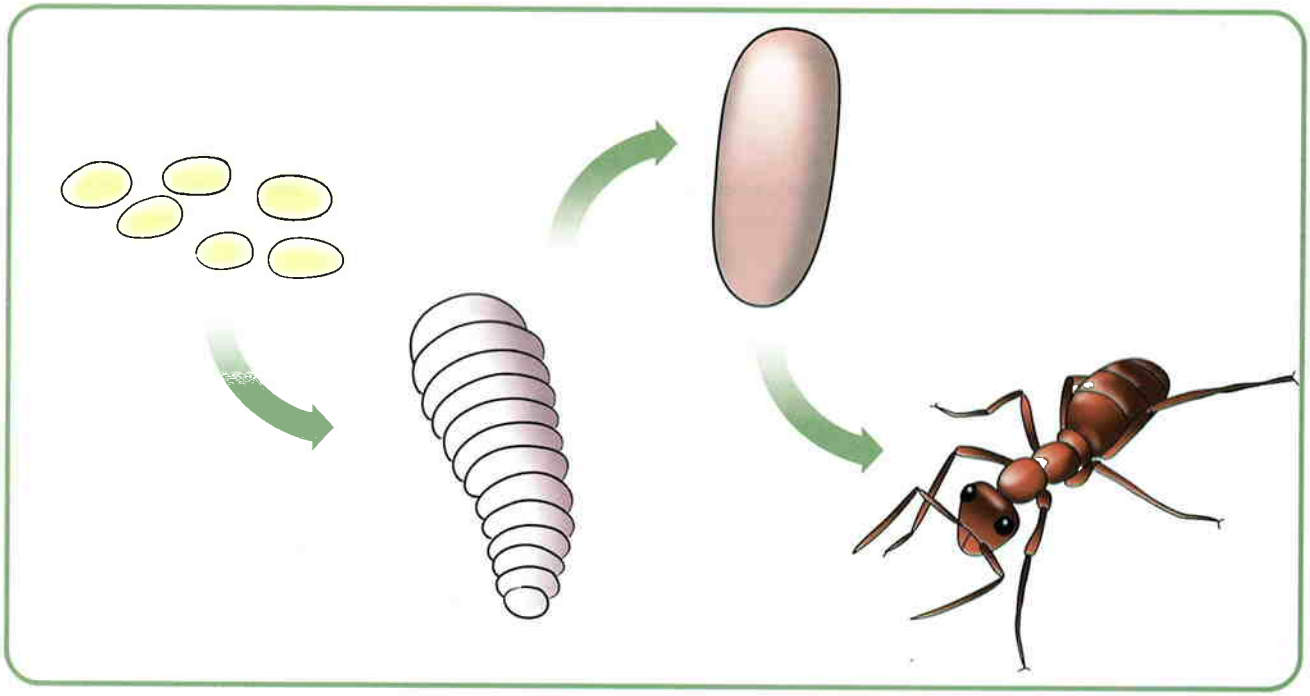
附錄一 APPENDIX I

適用於活動(六)的昆蟲生命週期卡
THE INSECT LIFE CYCLE CARDS FOR ACTIVITY 6

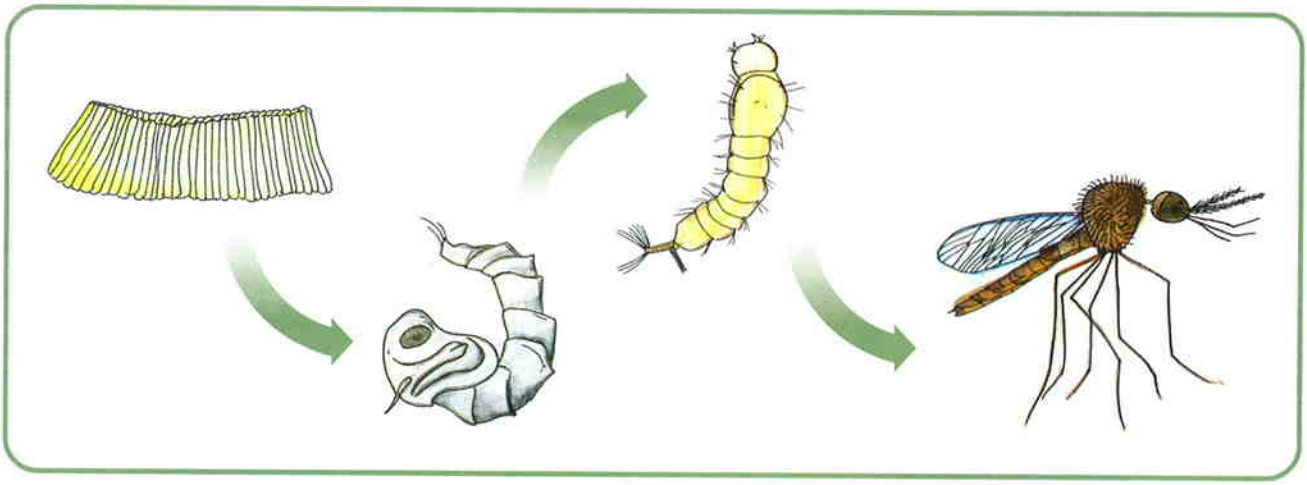
1. 蝴蝶的生命週期經歷完全變態過程。
   The life cycle of a BUTTERFLY undergoes complete metamorphosis.



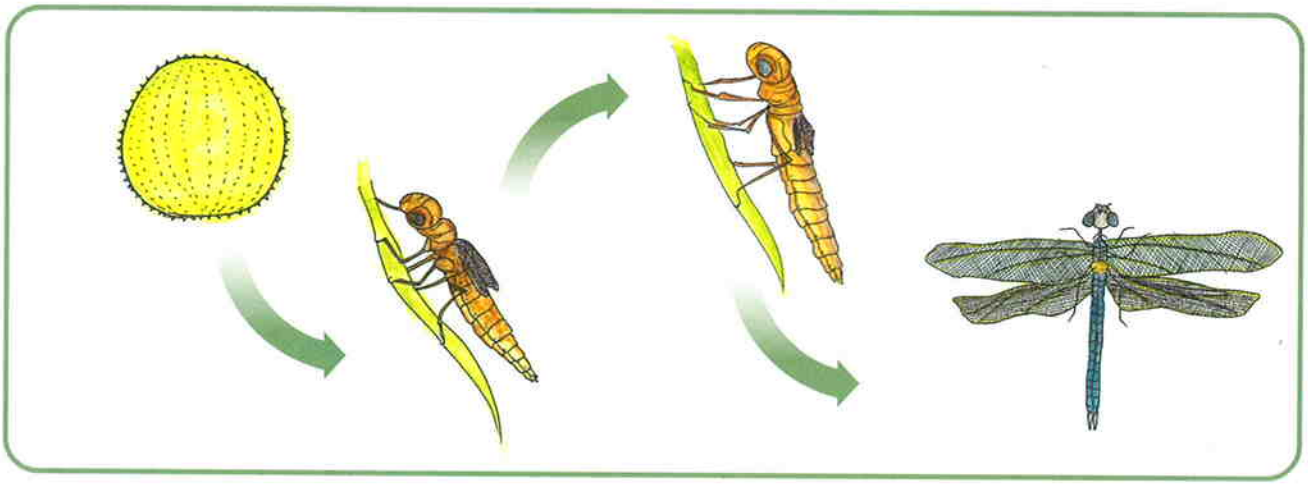
2. 螞蟻的生命週期經歷完全變態過程。
   The life cycle of an ANT undergoes complete metamorphosis.



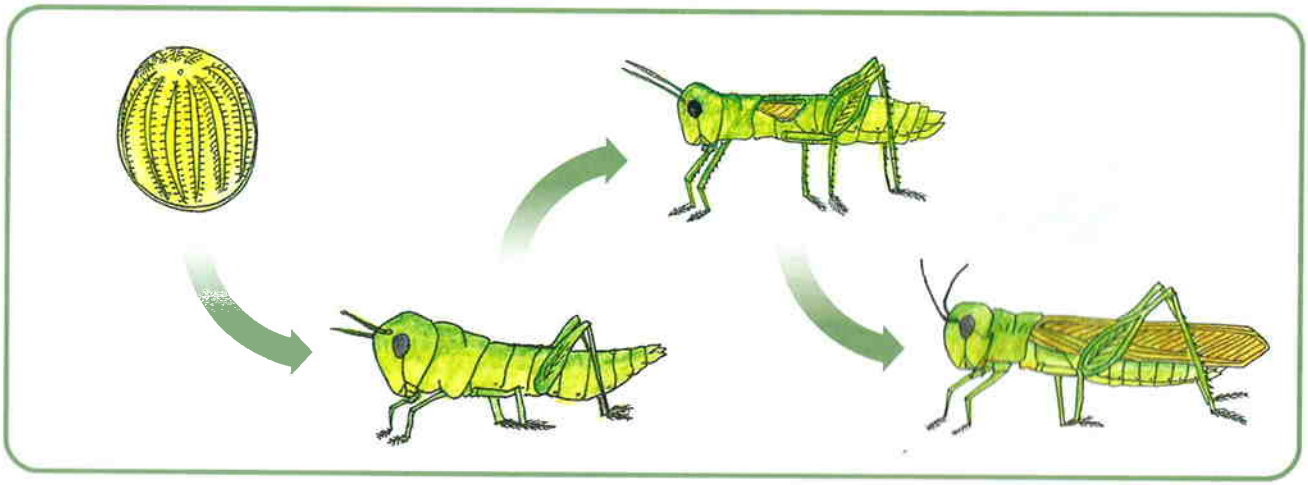
3. 蚊的生命週期經歷完全變態過程。
The life cycle of a MOSQUITO undergoes complete metamorphosis.



4. 蜻蜓的生命週期經歷不完全變態過程。
The life cycle of a DRAGONFLY undergoes incomplete metamorphosis.

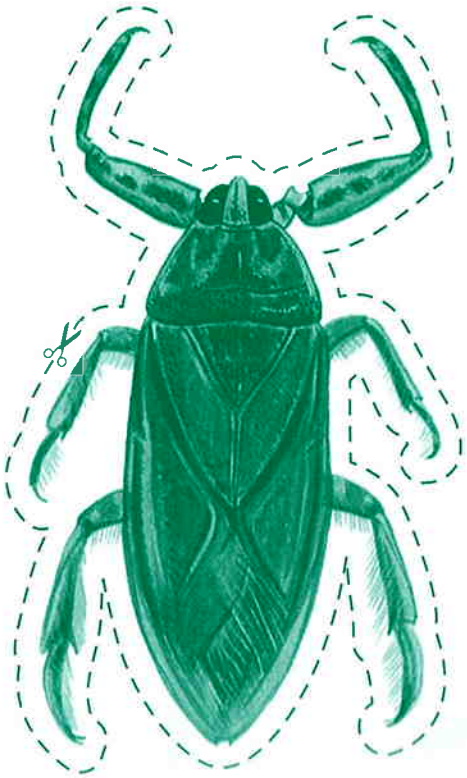


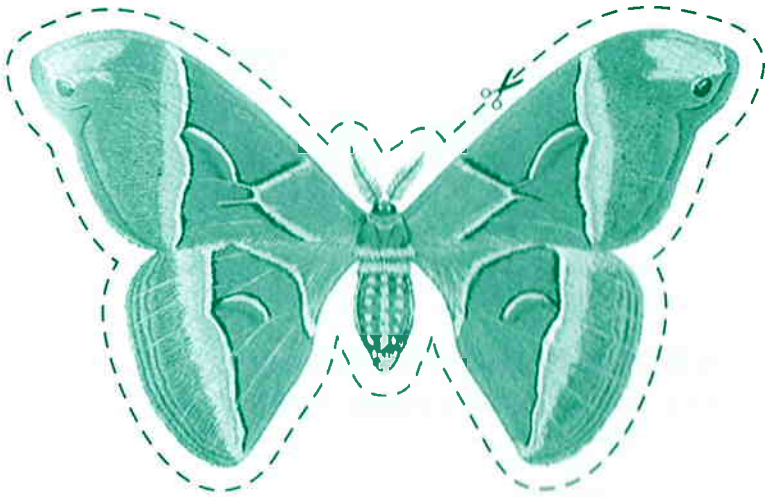
5. 草蜢的生命週期經歷不完全變態過程。
The life cycle of a GRASSHOPPER undergoes incomplete metamorphosis.

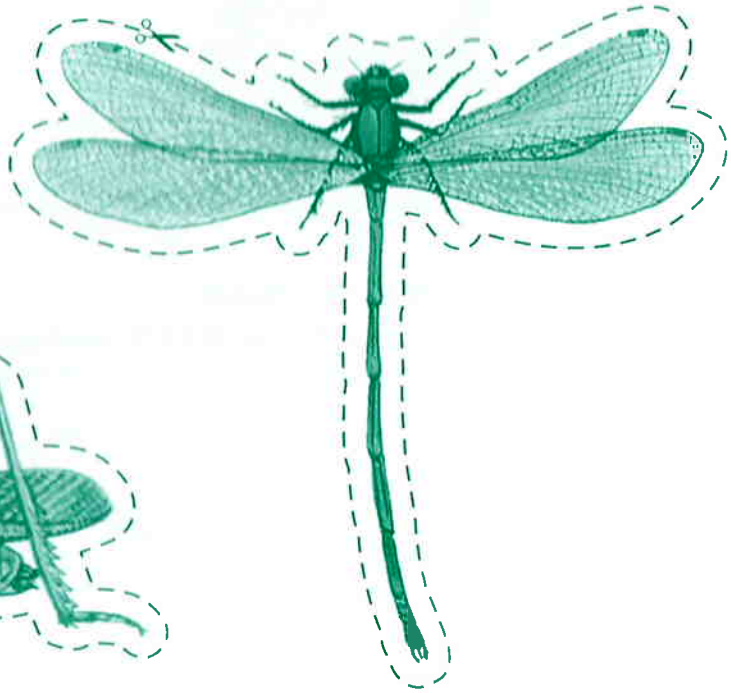


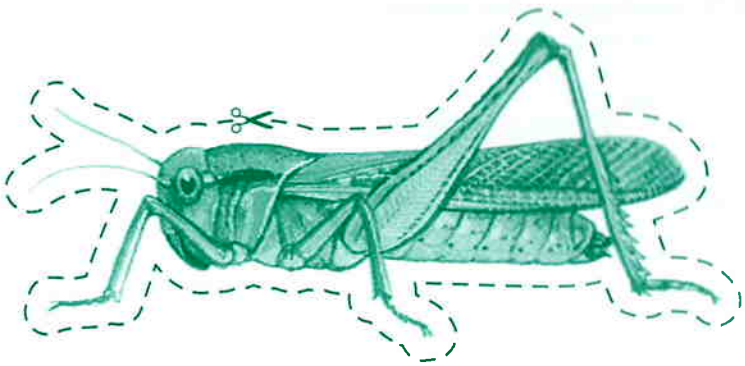
附錄二 APPENDIX II

適用於活動(七)的昆蟲剪紙
INSECT CUT-OUTS FOR ACTIVITY 7









「齊來點蟲蟲」教材套問卷調查

一般資料*(可選擇性填上)*

教師 / 導師姓名: _____

學校 / 機構名稱: _____

學校 / 機構地址: _____

聯絡電話及傳真號碼: (電話) _____ (傳真) _____

電郵地址: _____

請在適當的方格上加上「✔」號。

第一部份：關於教材套的綜合意見

		完全同意			*不同意*
		1	**2**	**3**	**4**
1	教材套內容的表達方式簡潔清楚。	☐	☐	☐	☐
2	教材套的資料能啟發本人舉辦「點蟲蟲」活動的興趣。	☐	☐	☐	☐
3	教材套的資料增進本人對昆蟲及自然環境的認識。	☐	☐	☐	☐
4	教材套的資料令本人對昆蟲抱有正面的態度。	☐	☐	☐	☐
5	教材套為老師 / 導師提供足夠的資料舉辦「點蟲蟲」活動。	☐	☐	☐	☐
6	本教材套可作為推行環境教育活動的參考資料。	☐	☐	☐	☐

第二部份：關於教材套內活動的意見

		完全同意			*不同意*
		1	**2**	**3**	**4**
1	活動內容的指示清楚及足夠。	☐	☐	☐	☐
2.	容易搜集各項活動所需之材料。	☐	☐	☐	☐
3	活動適合小四至小六學生 / 8至12歲小朋友。	☐	☐	☐	☐
4	活動能引發小朋友對昆蟲的興趣。	☐	☐	☐	☐
5	活動能令小朋友明白昆蟲在大自然的重要價值。	☐	☐	☐	☐
6	活動能增進小朋友對大自然的認識。	☐	☐	☐	☐
7	活動能提高小朋友保護環境的意識。	☐	☐	☐	☐

8 你最喜歡那一項活動? 請解釋原因。*(可列舉多於一項)*

_____

_____

9 你認為那一項活動需要作出改善? 請提供意見。

_____

_____

_____

10	你有沒有曾經進行教材套內的活動?	☐ 有 ☐ 沒有
11	你會不會進行教材套內的活動?	☐ 會 ☐ 不會
12	你會不會向他人推介「齊來點蟲蟲」教材套?	☐ 會 ☐ 不會

13 這份教材套是否需要補充? 請提供意見。

_____

_____

_____

_____

謝謝閣下的寶貴意見!

APPENDIX III

LET'S GO INSECT WATCHING EDUCATION PACK EVALUATION QUESTIONNAIRE

General Information *(Optional)*

Name of teacher /instructor: _____

Name of school / organization: _____

Address of school / organization: _____

Telephone and fax number: *(Telephone)* _____ *(Fax)* _____

E-mail: _____

Please tick the appropriate box.

Part One — General comment of the education pack

Rank		*Totally agree* 1	2	3	*Disagree* 4
1	The presentation content is clear and concise.	☐	☐	☐	☐
2	The information stimulates my interest in organising insect watching activities	☐	☐	☐	☐
3	The information enriches my knowledge about insect and environment	☐	☐	☐	☐
4	The information promotes my positive attitude towards insects	☐	☐	☐	☐
5	The information is adequate in supporting educators for organizing insect watching activities.	☐	☐	☐	☐
6	It is an useful resource for environmental education	☐	☐	☐	☐

Part Two — General Comment of the suggested activities

Rank		*Totally agree* 1	2	3	*Disagree* 4
1	The instructions of each activity are adequate and clear.	☐	☐	☐	☐
2	It is easy to gather all the materials to perform the activities.	☐	☐	☐	☐
3	The activities are suitable for primary 4 to 6 students / aged 8 to 12 years old children	☐	☐	☐	☐
4	The activities can arouse children's interest on insect.	☐	☐	☐	☐
5	The activities can promote children's understanding of the importance of insect.	☐	☐	☐	☐
6	The activities can enrich children's knowledge about environment	☐	☐	☐	☐
7	The activities can arouse children's concern about the environment.	☐	☐	☐	☐

8 Please state the names of the activity(ies) that you like the most and briefly explain why?

_____

_____

9 Please state the names of the activity(ies) that improvement is/are needed.
Please state suggestion for improvement.

_____

_____

10	Did you try out any of the activities suggested in the pack?	☐ Yes	☐ No
11	Do you plan to carry out any of the suggested activities?	☐ Yes	☐ No
12	Will you recommend the education pack to others?	☐ Yes	☐ No

13 What would you suggest to add into this package?

_____

_____

_____

_____

THANK YOU VERY MUCH FOR YOUR KIND COOPERATION!

附錄四 APPENDIX IV

有關昆蟲的參考讀物及網址

FURTHER READING ON REFERENCE BOOKS AND WEBSITES ABOUT INSECTS

昆蟲入門　張永仁先生撰寫　遠流出版社　1988

昆蟲圖鑑　張永仁先生撰寫　遠流出版社　1988

An introduction to insects. Bird Bettina, Multimedia International. 1988.

An introduction to the study of insects.. Borror, D. Joyce, Saunders College Publication. 1970.

Hong Kong Animals. Hill, Dennis and Philipps Karen, Urban Council Hong Kong. 1981.

Hong Kong Insects Volume 2. Hill, Dennis and Philipps Karen, Urban Council Hong Kong. 1983.

Hong Kong Insects. Second Edition Hill, Dennis and Philipps Karen, Urban Council Hong Kong. 1988.

This is Hong Kong: Butterflies. Johnston, B. and Gweneth. Urban Council Hong Kong. 1980.

Butterflies of Hong Kong. Lau, Paul, Paul Lau Photography. 1997.

Ecological entomology. Wiley, New York. 1984.

Hong Kong Dragonfly. Wilson, Keith, Urban Council Hong Kong. 1995 .

Elements of insect ecology. Yazdani, S. S., New Delhi Narosa Publishing House. 1997.

機構名稱 Name of organisation	網址 Website
1. 漁農及自然護理署 Agriculture, Fisheries and Conservation Department	http://www.info.gov.hk/afcd
2. 康樂及文化事務署 Leisure and Cultural Services Department	http://www.lcsd.gov.hk
3. 嘉道理農場暨植物園 The Kadoorie Farm and Botanic Garden	http://www.kfbg.org.hk
4. 獅子會自然教育中心 The Lions Nature Education Centre	http://www.hkstar.com/~lnec
5. 世界自然香港基金會 World Wide Fund For Nature Hong Kong	http://www.wwf.org.hk

鳴 謝 ACKNOWLEDGEMENTS

世界自然(香港)基金會謹向所有參與構思及製作此《齊來點蟲蟲》教材套之人士致以衷心謝意。並特此鳴謝:

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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

香港動物原色圖鑑插圖畫家費家倫小姐
Ms. Karen Phillipps, Illustrator of Colour to Hong Kong Animals

本教材套由環境保護運動委員會及環境及自然保育基金贊助製作。
Sponsorship by Environmental Campaign Committee and Environment Conservation Fund.

封面相片由韋敬輝博士提供。
Front cover photo provided by Dr. Keith Wilson.

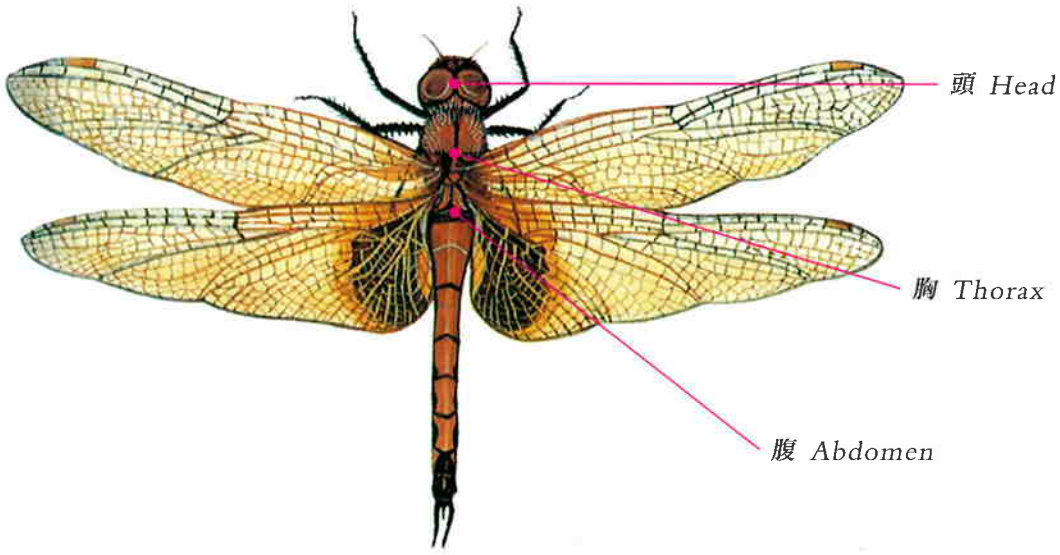
陳敏英小姐繪圖。
Artwork by Ms. Chan Man Ying, Killian.

相片由歐俊茵小姐、黃碧茵小姐及陳耀文先生提供。
All photographs provided by Ms. Joanne Au, Ms. Nicole Wong and Mr. Chan Yiu Man.

本教材套由世界自然(香港)基金會於二零零一年四月製作。
Produced by World Wide Fund For Nature Hong Kong in April 2001.

香港常見昆蟲
COMMON INSECTS IN HONG KONG

昆蟲 INSECTS



蜻蜓 *Dragonfly*

豆娘 *Damselfly*

蝴蝶 *Butterfly*

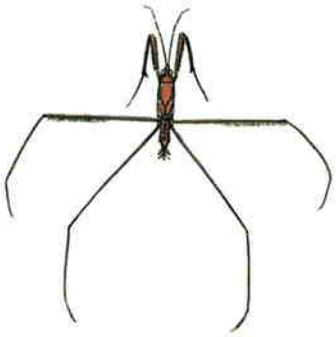
蟬 *Cicada*

草蜢 *Grasshopper*

荔枝蝽象 *Lantern Bug*

蝽象 *Stinkbug*

水生昆蟲 AQUATIC INSECTS



水黽 Water skater

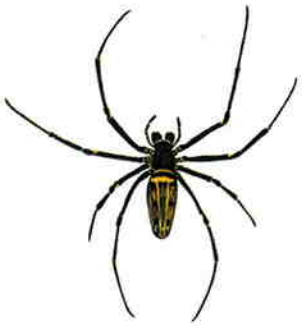
龍蝨 Diving Beetle

背泳蝽 Back swimmer

蜻蜓幼蟲 Dragonfly Nymph

非昆蟲類 NON-INSECTS

千足蟲 Millipede



蜘蛛 Spider

百足 Centipede

蠍子 Scorpion

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Illustrated by Karen Phillipps