(ACE Paper 33/2004)
For discussion

Findings of the Ecological Surveys

Purpose

ACE paper 13/2002 briefed members on a territory-wide biodiversity survey programme. The present paper reports the findings of the survey programme.

Background

2. We drew up the survey programme in 2002 with a view to establishing a more comprehensive territory-wide ecological database for Hong Kong in phases by 2005. The survey programme covers all major habitats of high conservation value in Hong Kong, including the location, status and composition of *fung shui* woods, and the distribution and abundance of selected animal groups.

3. The items that we have covered in the survey programme and the findings are described in the following paragraphs.

Findings of the survey

Habitat survey

4. In September 2002, the Sustainable Development Unit (SDU) commissioned a consultant to undertake a study entitled *Terrestrial Habitat Mapping and Ranking Based on Conservation Value*. The objective was to update the findings of the *Environmental Baseline Survey on Terrestrial Habitat Mapping and Ranking Based on Conservation Value* commissioned by the Planning Department through 200 days of field surveys. To avoid duplication of efforts, we provided professional advice to SDU throughout the updating study instead of carrying out a separate terrestrial habitat survey by ourselves.

5. The study was completed in June 2003 and an updated terrestrial habitat map at the scale of 1:20 000 with 24 habitat types was produced. The updated map has been distributed to all government bureaux/departments as part of the Computer Aided Sustainability Evaluation Tool for conducting sustainability assessment for territory-wide strategic development and land use planning.

6. SDU plans to commission another study to further update the terrestrial habitat map by using a combination of up-to-date satellite images, orthophotos and field truthing surveys. The tendering process for the study has just started, and we will again provide professional advice to SDU where necessary throughout the study and update our ecological database as appropriate.

Plant survey

Plant Communities

7. *Fung shui* woods were selected as the focus of the plant community survey because *Fung shui* woods have been preserved by villagers for *fung shui* reasons. They are considered as remnants of the original lowland forests in Hong Kong and are important both floristically and culturally.

8. We surveyed 111 *fung shui* woods and recorded more than 500 plant species in the woods. We ranked the relative conservation value of the sites based on four criteria, namely area, species richness, *fung shui* wood indicator species and species of conservation concern.

9. We had also surveyed 23 freshwater wetlands. They were mostly lowland freshwater marshes, formerly used by villagers for agriculture but then lay fallowed. Although more than 300 plant species were recorded, these wetlands were found to be dominated by a number of common species (mostly of the grass (Poaceae 禾本科) and sedge (Cyperace 莎草科) families), making them relatively homogenous in terms of plant diversity. We are now analysing the data collected with the objective of generating a list of indicator species for freshwater wetlands. This plant list is potentially useful for freshwater wetland assessment, evaluation, enhancement and/or creation in the future.

Rare Plants

10. Field studies to identify rare plant populations were carried out in conjunction with the plant community survey, and supplemented by various targeted surveys conducted in remote and hard-to-reach locations which have never been surveyed before. We have surveyed and identified 174 major plant populations belonging to 127 species of rare plants.

11. Based on rarity as well as protection status in local, regional and international context, we have drawn up a preliminary list of plant species of conservation concern. The list contains some 700 native species, including those recorded in the "Rare and precious plants of Hong Kong" published by the Agriculture, Fisheries and Conservation Department (AFCD) in 2003 and species reported as rare by other parties, including the University of Hong Kong and the Kadoorie Farm and Botanic Garden. The list is being finalised, taking into account comments from relevant experts outside AFCD. We have been carrying out transplantation and propagation programmes for rare plants such as *Aristolochia thwaitesii* (Seaside Dutchman's Pipe 海邊馬兜鈴), the endemic *Croton hancei* (Hong Kong Croton, 香港巴豆), the rare *Ligustrum punctifolium* (斑葉女貞) and the *Illigera celebica* (Illigera 寬藥青藤).

Animal distribution survey

12. We are surveying and monitoring the distribution and abundance of specific animal groups. The species groups selected are those which are widely used as indicator species of the ecological value, level of disturbance and/or status of different habitats/sites.

Mammals

13. We have surveyed over 400 sites throughout the territory by camera trapping for large mammals and recorded 17 species. Among these, Malayan Porcupine (豪豬), Small Indian Civet (小靈貓), Indian Muntjac (赤麂), Wild Boar (野豬) and feral dog (野狗) are the most widely distributed species in Hong Kong. On the other hand, Chinese Otter (水獺), Bandicoot Rat (板齒鼠), Chinese Pangolin (穿山甲), Yellow-bellied Weasel (黃腹鼬) and Crab-eating Mongoose (食蟹獴) have restricted distribution only. Further trapping and radio-tracking studies will be carried out for species of conservation concern in the future.

14. Supplementary cage trapping for small mammals using Sherman traps has been carried out at over 50 sites, and five species have been recorded. House Shrew (臭鼩), Chestnut Spiny Rat (針毛鼠), Sikkim Rat (黑緣齒鼠) and Buff-bellied Rat (黃胸鼠) are widely distributed, and Ryukyu Mouse (卡氏小鼠) has relatively restricted distribution.

15. We began a bat survey in 2003. As different species are susceptible to different survey methodologies, a combination of methods is being used, including direct counting, harp trapping and mist netting. Data on the abundance, sex, age and body measurement of bats has been compiled. All major bat roosting sites have been surveyed at least twice per year. Our surveys have so far recorded 19 out of the total of 22 bat species that have even been recorded in Hong Kong. Among the recorded species, 14 are common and widespread. The five rare/uncommon species are : Horsfield's Bat (霍氏鼠耳蝠), Daubenton's Bat (水鼠耳蝠), Brown Noctule (褐山蝠), Chinese Pipistrelle (灰伏翼) and Lesser Yellow Bat (中黃蝠).

Birds

16. We are coordinating with the Hong Kong Bird Watching Society (HKBWS) to carry out a territory-wide winter bird survey in Hong Kong. Over 80% of the one-kilometre grids were surveyed in the last three winters (2001/2002 – 2003/2004) and the whole survey covering the whole territory of Hong Kong is expected to be completed in the winter of 2004/2005. All data collected will be analysed to produce a winter bird atlas showing the abundance and distribution of birds in Hong Kong during winter months.

17. A long-term waterbird monitoring programme to monitor the status of the Deep Bay ecosystem has been conducted since December 1997 as a part of the management

strategy of the Mai Po Inner Deep Bay Ramsar site. Monthly counts of waterbirds were conducted by HKBWS under direct subvention from AFCD from 1997/1998 to 2003/2004. The trend of the bird numbers is closely monitored as an indicator of changes in environmental conditions of the Ramsar site. In the winter of 2002/2003, 53 700 waterbirds including migratory ducks, gulls, shorebirds, cormorants, egrets, rails and coots were recorded in the Deep Bay area.

18. We have also been carrying out species-specific studies on selected birds of conservation concern to enhance our understanding of them. These studies, such as the egretry survey, population survey of breeding terns, breeding survey of White-bellied Sea Eagles (白腹海鵰) and woodland bird survey, will provide us with up-to-date information on the distribution and abundance of these species in Hong Kong and allow us to have a more comprehensive evaluation of their status in a territory-wide scale.

Amphibians and reptiles

19. We have surveyed over 140 sites throughout Hong Kong for amphibians and reptiles. Both day and night surveys were conducted in order to collect information on diurnal as well as nocturnal species. Surveys were mainly conducted by active searching in their potential hiding places and breeding grounds such as rock crevices, bushes, water pools and tunnels. Pit-fall traps, auditory detection of mating calls and dip-netting of tadpoles in potential habitats were also carried out to supplement findings obtained from active searching.

20. Including the exotics, 23 amphibian and 65 reptile species have been recorded in our surveys, including the latest record of the endemic Bogadek's Burrowing Lizard (鮑氏雙足蜥) *Dibamus bogadeki* on Shek Kwu Chau in 2002. Through communications with mainland experts, we recognise that the Hong Kong Newt (香港瘰螈) *Paramesotriton hongkongensis* and Hong Kong Cascade Frog (香港湍蛙) *Amolops hongkongensis*, once thought to be endemic to Hong Kong, can now be found also in Guangdong Province. Hence, only three recorded species of this group are endemic to Hong Kong. They are Bogadek's Burrowing Lizard *Dibamus bogadeki*, Short-legged Toad (短腳角蟾) *Megophrys brachykolos* and Romer's Tree Frog (盧氏小樹蛙) *Philautus romeri*.

21. We are reviewing the local rarity and restrictedness of amphibians and reptiles to facilitate the drawing up of appropriate conservation plans. For example, trial tagging of Big-headed Terrapin (平胸龜) *Platysternon megacephalum* has started in summer 2004 with a view to assessing and monitoring their population in Tai Mo Shan.

Freshwater fish

22. We have adopted a combination of sampling methods include bankside counting, hand netting, pot trapping, seine netting, gill netting, angling and cast netting to survey the distribution, composition and diversity of freshwater fish. Over 220 localities have been covered and 347 specimens belonging to 113 species have been collected and kept

for reference purposes. Our survey has raised the number of freshwater fish species recorded in Hong Kong from 140 in 2002 to 167 in 2004.

23. Various conservation action plans have been implemented for selected species of conservation concern. For example, we have started breeding programmes for Hong Kong Paradise Fish (香港鬥魚) *Macropodus hongkongensis*, Rice Fish (弓背青鱂) *Oryzias curvinotus* and Rose Bitterling *Rhodeus ocellatus* (高體鱒鮀). Captive-bred individuals have been transferred to suitable and secure sites inside country parks. We have been monitoring the recipient sites regularly. While the monitoring work confirms the establishment of sustainable populations of Hong Kong Paradise Fish and Rice Fish at the sites, there is no evidence that the released fish would have any adverse impacts on the ecology of the recipient sites. We will continue the monitoring work and review the action plans as appropriate.

24. We have also conducted trials on wetland creation for the sake of freshwater fish conservation. A fish pond was created in Tai Lam Country Park in late 2003 and stocked with the rare Chinese Rasbora (斯氏波魚) *Rasbora steineri*. A population of a few hundreds individuals was established in summer 2004. We plan to conduct more trials, creating ponds and wetlands for the conservation of other species of conservation concern.

Butterflies and moths

25. Butterfly surveys were conducted through sighting and capture using hand nets to record the distribution of butterflies. We have surveyed 195 sites and recorded 197 species. More than 700 specimens of 193 species comprising different sexes and stages have also been collected.

26. In the winter of 2002/2003, we conducted a capture-mark-recapture study on the butterflies at a number of overwintering sites. The results indicate that several locations within country parks are used by overwintering butterflies as transitional stops and Siu Lang Shui is the largest aggregation site in Hong Kong for overwintering butterflies, with an estimated peak of over 40 000 individuals.

27. A butterfly garden, planted with different nectar plants and larval food plants and installed with interpretation signboards, was set up in Shing Mun Country Park in 2003. The butterfly garden is designed to attract both target species for conservation purpose and other common species for the public to enjoy butterflies watching.

28. Since March 2004, we have also started preliminary surveys on moths. We have conducted 50 light trappings and recorded 893 species. The rediscovery of (米埔樟青尺蛾) *Thalassodes maipoensis* in the Mai Po Nature Reserve since its last record in 1994 is a good example. Over 1 000 specimens belonging to 375 species have been collected and are now kept in our reference collection. Results from the survey will facilitate our understanding of the present situation of moths in Hong Kong.

Dragonflies

29. We have been surveying dragonflies and damselflies since 2002 by direct sighting and active searching. We use hand net and kick net to sample larvae while tailor-made dragonfly net and binocular are used to record the distribution, diversity and abundance of adults. 175 sites have been surveyed and 427 specimens comprising 62 dragonfly and 30 damselfly species have been collected.

30. In the summer of 2004, we started a trial capture-mark-recapture study on damselfly Four-spot Midget (廣瀨妹蟌) *Mortonagrion hirosei*. This species is listed as endangered by the World Conservation Union (IUCN) and the trial aims at collecting information on the local biology of this species for their conservation.

Information compilation and management

31. So far, over 35 000 records of about 1 500 species of plants and animals have been collected, verified, and stored preliminarily on spreadsheets for internal reference. Each record contains general information such as location, collection time and abundance, and some also contain specific information such as sex and stage of life-cycle where applicable. These data enable preliminary assessment of the ecological importance of different sites/species in the territory-wide scale and facilitate the formulation of more detailed ecological studies for specific sites/species.

32. In the longer term, we plan to develop a systematic database containing the baseline information on the natural environment and biodiversity of Hong Kong, incorporating data collected in our surveys and ecological information available from other sources. The database will be developed on a geographic information system (GIS) platform to store the spatial data. Development of the GIS-based database, which will be integrated into the departmental GIS system of AFCD, will begin later this year and is planned to be completed around late 2005.

33. To arouse public interest in local biodiversity and to win public support for nature conservation, we are compiling an internet-based database on representative species and habitats for public access. The pilot phase of this internet website, called the Hong Kong Biodiversity Online, is under preparation and will be available for public browsing later this year. We plan to link the final version of this internet database to AFCD's departmental GIS system once the latter is operational so that the public can also have access to the GIS functions (e.g. to generate distribution maps of animals and plants interactively) while browsing the database.

34. Since 2002, we have published a newsletter – *Hong Kong Biodiversity* to update AFCD staff involved in the ecological survey programme on the survey findings. To further disseminate the results of our surveys, we have taken steps to send copies of the newsletter to the public upon request.

35. We have also published a number of reference books on the natural environment and biodiversity of Hong Kong. For example, making reference to the findings of the

surveys, we have published field guides to the freshwater fish, butterflies and dragonflies of Hong Kong. We plan to publish more field guides on the biodiversity of Hong Kong in the near future as part of the promotional efforts in conservation education.

Major findings

Species records

36. Our findings confirm that Hong Kong has a rich biodiversity and there are many species awaiting our discovery/rediscovery. For example, we have confirmed that Chinese Pangolin and Chinese Otter, though rare and restrictedly distributed, can still be regularly found in Hong Kong. The extensive camera trapping concludes that Indian Muntjac *Muntiacus muntjak* is the only deer species of Hong Kong, and Reeves's Muntjac (黃猄) *Muntiacus reevesi*, which was believed to be a deer species of Hong Kong, is absent from Hong Kong.

37. We have also found a number of species which are new to Hong Kong or even new to science. These include -

- Mammals: Yellow-bellied Weasel *Mustela kathiah* found in Plover Cove, Pat Sin Leng and Sha Tau Kok and Lin Ma Hang.
- Birds: Red-throated Diver (紅喉潛鳥) *Gavia stellata* found in Luk Keng mudflat in 2002 and Short-tailed Shearwater (短尾鼱) *Puffinus tenuirostris* in Mirs Bay in 2004.
- Freshwater fish: *Mangarinus waterousi* (芒鰕虎魚) found in Sham Chung in 2002.
- Butterflies: Tawny Mine (褐斑鳳蝶) *Chilasa agestor* found in Tai Po Kau in 2002, Yellow Coster (苧麻珍蝶) *Acraea issoria* in Plover Cove in 2002, Monastyrskyi's Ace (黑斑陀弄蝶) *Thoressa monastyrskyi* in Yung Shue O in 2002 and Small Yellow Sailer (彌環蛺蝶) *Neptis miah* in Tai Mo Shan in 2004. There are two other new records – Orange Emigrant (鎘黃遷粉蝶) *Catopsilia scylla* and Common Grass Dart (黃弄蝶屬) *Taractrocera maevius* made by other parties.
- Moth: Chinese Oak Silkmoth (柞蠶) *Antheraea pernyi* found in Tai Po Kau Nature Reserve in 2004.
- Dragonflies: *Fukienogomphus* sp. nov. (閩春蜓屬新種) found in Wu Kau Tang in 2004, Blue-spoted Emperor (黑紋偉蜓) *Anax nigrofasciatus nigrofasciatus* in Ma On Shan in 2003, Yellow-spotted Dusk-hawker (克氏頭蜓) *Cephalaeschna klotsi* in Tai Mo Shan Country Park in 2003 and Ferruginous-faced Sprite (赤斑蟌) *Pseudagrion pruinosum fraser* in Lau Shui Heung Reservoir in 2003. The Dancing Dropwing (灰脈褐蜻)

Trithemis pallidinervis, also a new record for Hong Kong, was discovered by another party.

Distribution records

38. In addition to new species records, our surveys also enrich our knowledge on the distribution of our animals and plants. For example,

- most Hong Kong bat species, such as Leschenault's Rousette (棕果蝠) *Rousettus leschenaultia* and Himalayan Roundleaf Bat (大蹄蝠) *Hipposideros armiger*, have been considered as vulnerable due to the limited number of natural roosting sites before. However, they were found to colonise many caves and water tunnels throughout Hong Kong in our surveys.

- the density of White-bellied Sea Eagle in Hong Kong, in terms of nest per kilometre coastline, is comparable to that in Australia where the species is regarded as common.

- the Greater Painted-snipes (彩鷸) *Rostratula benghalensis* were found to breed at the Mai Po Nature Reserve (the first breeding record there) and in a constructed wetland in Sheung Shui. In addition, there were sighting records of the species at the Hong Kong Wetland Park in Tin Shui Wai and the Lok Ma Chau Bend.

- the number of sites at which the endemic Hong Kong Paradise Fish were found have been doubled and half of the localities are within country parks.

- the rare freshwater fish *Pseudobagrus trilineatus* (三線擬鱨), which was known to be found in one small freshwater marsh in Hong Kong only, were found in water tunnels, rivers and marshes in the region.

- two rare butterflies *Zographetus satwa* (黃裳腫脈弄蝶) and *Arthopala pseudocentaurus* (銀鏈嬈灰蝶), which were previously known to be found at one site only, were found at more than six localities.

- the known localities for the endemic dragonfly Spangled Shadow-emerald (伊中僞蜻) *Macromidia ellenae* has been raised from three to seven and at least half of the populations are within country parks.

39. To assess how effective our protected areas system[Note] is for the protection of our animals, we have charted the distribution of individual species. Findings suggest that our protected areas are protecting a very significant portion of our biodiversity. For the species groups surveyed and analysed, over 95% of the terrestrial and freshwater representatives which are regularly seen in Hong Kong have representative population(s) inside our protected areas.

[Note] This includes the Ramsar site, country parks, special areas and Sites of Special Scientific Interest.

Way forward

40. We have convened a number of specialist group meetings on individual species groups. These groups comprise experts from local specialist organisations and tertiary institutions, and have met a number of times to exchange information and views on their respective species groups. Topics discussed include our assessment on the ecological importance of different habitats/sites, criteria for assessing rarity of species, target species for enhanced conservation and measures for their conservation. We will continue to convene these specialist group meetings as and when necessary to seek experts' advice on issues related to biodiversity conservation in Hong Kong.

41. Since ecology is dynamic, we intend to follow up the surveys with long term continuous monitoring and repeated surveys to update the database. Based on the experience gained in the surveys, we will develop a strategy for continuously updating the database from 2005 onward.

Advice sought

42. Members are invited to note and comment on the findings of the survey programme as outlined in this paper.

Agriculture, Fisheries and Conservation Department
October 2004