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Porcupine!

Newsletter of the Hong Kong University Ecology Research Group

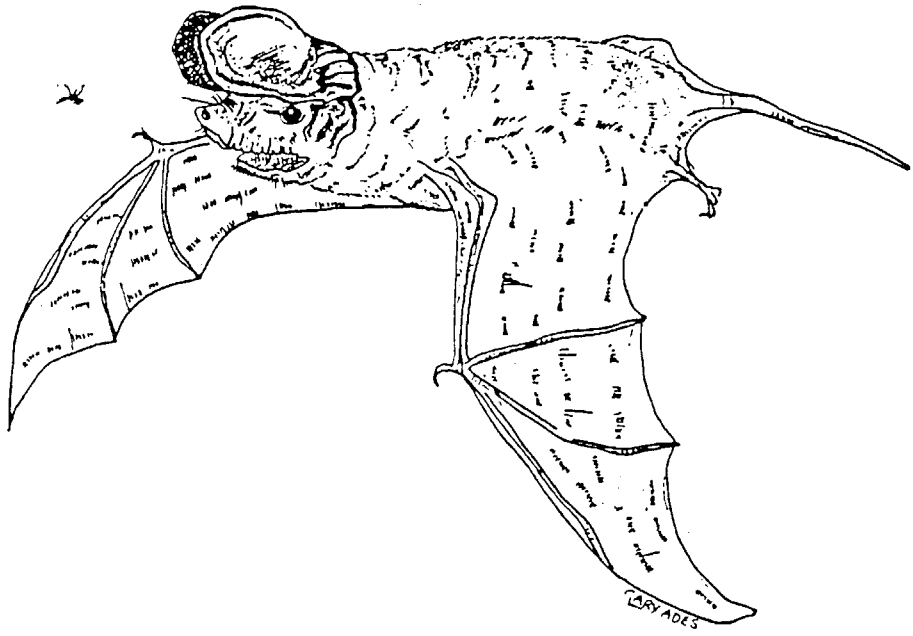
ISSUE Number 3 of **Porcupine!** comes to you rather later than usual as a result of festive excesses indulged in by both editors - a hiccup which we feel sure our readers will overlook, especially since you buggers don't even have to pay for it. In addition to regular features, this issue contains a report on a recent visit to Guangzhou's Qingping Market by ecology postgraduates and staff of WWF(HK), articles by local moth enthusiast Kent Li and Harvard zoologist James Lazell, and a mammoth essay on the joys of Principal Components Analysis by Richard Corlett. Also included in this issue is the second (and concluding) part of our list of Hong Kong mammals.

Interest in **Porcupine!** continues to grow beyond the largely academic circles for which it was originally intended. The editors were recently interviewed on RTHK Radio 3 and, amazingly enough, invited back for regular bi-monthly chats. This newsletter certainly seems to fill a niche.

Free-tailed Bat Discovery

A **Wrinkle-lipped Bat** (*Tadarida plicata*) was collected from Mei Foo Sun Chuen by an Inspector from the RSPCA on 8th December 1992. This species is the only representative of the family Molossidae found locally. It is quite unusual in that its long tail is free and not enclosed in a membrane as is the case in all other insectivorous bats in Hong Kong. It has a characteristic dog-like face with wrinkled lips and large ears which point forward over the eyes. The wings are very long and narrow as it is a fast high-flying aerial insectivore, feeding in a similar fashion to a day-flying Swift. Free-tailed bats normally roost in large colonies often consisting of many thousands of bats, but so far no roost sites have been located in Hong Kong.

The Wrinkle-lipped Bat was first discovered in Hong Kong in 1957, and one other record exists from 1967 when Marshall recorded its occurrence in Pok Fu Lam.



During the Second World War there was a secret plan by the Americans to drop thousands of Free-tailed bats over Japan. Each would carry a small incendiary device which would ignite when the bat alighted. Although the idea had partial success in practice, because this bat is very gregarious most individuals landed in the same buildings so overall damage was minimal! The scheme was eventually abandoned in favour of the atomic bomb. And the rest is history.....

I would be grateful for any information on bat roost sites located in Hong Kong.

Gary Ades

Studying the Wildlife of Hong Kong's Islands

by Professor James Lazell

I am an Associate of the Harvard Museum of Comparative Zoology, and an Officer of Harvard University. My interest lies in the study of island biogeography.

I first came to Hong Kong in 1979. I returned in 1982, but only checked Hong Kong habitats briefly before and after visiting China. In 1986 I learned of Father Bogadek*, looked him up, and went collecting with him and his students on Lantau. We got the first *Philautus romeri* (Romer's Tree Frog) ever found off Lamma on that trip. Fr. Bogadek told me of Stephen Karsen** and I arranged to pay his way out in 1987. I began serious work then, with Karsen and Michael Lau.

Hong Kong provides by far the best opportunity for study of any of the myriad islands in tropical China between Taiwan and Hainan. The habitats are (still) the best remaining. The access is vastly easier. This biogeographical region is perhaps both the most important and least known in the world. ("Most important" because it is right in those vectoring corridors of forest and mesic coast - the only such between equatorial forests and temperate-boreal forests on earth.)

In 1992 we got a new record of *Dibamus bogadeki* from Shek Kwu Chau (**Porcupine!** No. 1) and about a dozen other new island records - from as dull as *Bufo* (Common Toad) on Shek Kwu Chau to as great as *Philautus* on Po Toi (**Porcupine!** No. 1). We plan to return each year until either the Hong Kong government or the People's Republic of China allows the whole place to be destroyed. We are finishing up Lantau and its satellite islands and beginning to plan shifting over to the Port Shelter islands.

*;** author, "Hong Kong Amphibians and Reptiles" Urban Council Publication

New SSSI Proposals

Proposals for three new Sites of Special Scientific Interest are currently being formulated by WWF HK. The three sites are the Sha Lo Tung basin near Tai Po and Three Fathoms Cove on Sai Kung peninsula (Billy Hau), and Tai Tong, south of Yuen Long (Dr David Dudgeon).

Sha Lo Tung, an area of great wildlife value in general, is one of the two most important dragonfly sites in Hong Kong (see "New Dragonflies in Sha Lo Tung", Keith Wilson, **Porcupine!** No. 2). The natural integrity of the site is currently threatened by a proposed 9-hole golf course.

The Three Fathoms Cove proposal includes valuable stream and mangrove habitats that are studied by about 200 HKU undergraduates every year as part of the Ecology Field Course. A development proposal for a new town in the area poses a hazard to these habitats (Billy Hau, WWF HK).

Tai Tong is the other major dragonfly site of Hong Kong, comprising a 1km stretch of river that supports at least 36 species, including extremely high larval densities of a new species of *Paragomphus* discovered by Keith Wilson for which Tai Tong is the type locality and which he has so far found nowhere else. Pesticide run-off from an adjacent orchard threatens the site (Keith Wilson).

FREE Column

The effect of Fermentation Distillates on the foraging behaviour of Homo sapiens evoecologica : a short report.

On December 10th 1992 a preliminary trial was carried out to assess the affects of fermentation distillates on the foraging behaviour of 50 individuals of the species *H.s. evoecologica*. The experimental arena was the Spice Island Club, a familiar locality to most participants, and the trial took place between 7 and 11 pm to approximate to normal temporal conditions for alcohol consumption. Five individuals of *H.s. justalongfortheparty*, were present as controls. Alcohol (brewed and distilled forms) and an array of appetizing food was supplied. All individuals were allowed to drink and forage ad libitum. Alcohol consumption was estimated by effect (a five-point eye-bloodshotedness scale) rather than volume, to allow for variation in the type of alcohol consumed, sensitivity per kg body weight etc. Behaviour was recorded in scans and time budgets (Anderson, in blur).

An interesting swarming behaviour in both control and experimental groups was exhibited in the early parts of the trial. Alcohol consumption did not affect foraging rate or foraging efficiency in either group, however there was high variance within the groups. Mean per capita alcohol consumption was significantly higher in the control group, caused primarily by S. Reels, a member of the control group with a particularly large capacity. In conclusion, high variation is exhibited in *H.s. evoecologica* but nonetheless a cohesive social group is formed. Multiple replication of this trial is recommended, preferably as often as possible!!

- Carmen Anderson

The Qingping Report

Qingping, Guangzhou's notorious food market, has been visited by postgraduates from HKU and members of the WWF (HK) several times over the the last 3 years. The reason behind these visits is to monitor the numbers of different animal species being sold for food. An attempt is also made to obtain details on the animals' place of capture and its price, but vendors are not always forthcoming with this information. Many of the animals, which include Barking Deer, Wild Boar, Leopard Cats, Racoon Dogs and Civets, have horrific injuries sustained on capture in leg traps, and others like domestic cats are crammed into cages and often tormented by their captors. Animals are not given water during the day and only appear to be fed when they are very weak or dying, which is often too late. These visits give us some indication of the fluctuation in numbers and species which pass through this market. Although there are now inspectors based at the market to check that no endangered species (on Chinese Category I and II lists) appear for sale, we saw several such animals being sold after 5pm when the inspectors had finished work! Apart from the animals listed below, two Collared Scops Owls were seen being sold on the street and a complete, dried Otter skin was seen for sale in the market. Other, rarer animals are available if you are willing to follow shady looking characters down back streets and show that you are ready to part with some money. Presumably these animals, which include Slow Lorises, Eagles, Owls and Water Monitors, are held in warehouses away from the main market where they cannot be seen by local inspectors. One stallholder told us that he could obtain bear and tiger paws on demand. The list below represents animals that members of the visiting team were able to identify and count on visits during the last 3 years. Qingping is the biggest animal market in Guangdong, but it is probable that there are smaller markets in every large town in the Province, and elsewhere in southern China. We would be grateful to hear from anyone else who has visited such markets and can give us information on the types of animals on sale and perhaps estimates of numbers. *(Gary Ades)*

Species	***Category II Protected Species**	**Numbers counted**		
		Nov 90	**Dec 91**	**Dec 92**
Hedgehog (*Erinaceus europaeus*)	-	-	~140	-
Giant Red Flying Squirrel (*Petaurista petaurista*)	-	50	46	40
Bamboo Rat (*Rhizomys pruinosus*)	-	120	~230	50
Porcupine (*Hystrix brachyura*)	-	1	-	1
Small Indian Civet (*Viverricula indica*)	*	-	9	1
Masked Palm Civet (*Paguma larvata*)	-	78	161	90
Spotted Linsang (*Prionodon pardicolor*)	*	1	-	-
Crab-eating Mongoose (*Herpestes urva*)	-	-	4	4
Javan Mongoose (*H. javanicus*)	-	-	-	8
Ferret Badger (*Melogale moschata*)	-	6	49	100
Eurasian Badger (*Meles meles*)	-	-	1	-
Hog Badger (*Arctonyx collaris*)	-	-	17	6
Racoon Dog (*Nyctereutes procyonoides*)	-	-	35	50
Reeves' Muntjak (*Muntiacus reevesi*)	-	17	6	-
Indian Muntjak (*M. muntjak*)	-	-	12	3
Water Deer (*Hydropotes inermia*)	*	-	2	-
Musk Deer (*Moschus berezovskii*)	*	-	-	3
Wild Boar (*Sus scrofa*)	-	7	13	20
Leopard Cat (*Felis bengalensis*)	-	-	4	-
Temminck's Cat (*F. temmincki*)	*	-	1	-
Pallas' Fishing Cat (*F. viverrina*)	-	-	2	2

Wildlife Windows One

On 2nd November, 1992, we found a dead **Ferret Badger** (*Melogale moschata*) on the water catchment inside Tai Tam Country Park. The animal must have already been dead for a few days, as only the skin and fur remained.

Chong Dee Hwa &
Ho Ching Yee

Grey-sided Thrush

On 29 November I saw a **Grey-sided Thrush** (*Turdus feae*) at Kop Tong near Wu Kau Tang in the northeastern New Territories. This is the first record of this thrush for Hong Kong. It is a migratory species which travels between northeast China (near Beijing) and northern Thailand.

- Keith Wilson

Andy Nisbet found a dead **Porcupine** (*Hystrix brachyura*) at a car parking area near High Island Reservoir on 5 December. It measured about 1m long and its head had been severed. Mr Nisbet has also seen a dead porcupine on Stanley catchment, and found porcupine quills on Beacon Hill on previous occasions.

A female **Kestrel** (*Falco tinnunculus*) was regularly seen and heard at KARC throughout December.

New Plant Species

On Thursday, 12th November, Mr Chan Shu Tong of the Botany Department, HKU, discovered yet another new plant species for Hong Kong, on Mount Butler. It is a species of *Hydrocotyle*, possibly *H. tripartita*, and definitely not one of the two species of this genus previously recorded for the Territory. *H. tripartita* is a herb apparently native to Australia, and has been introduced and naturalised in New Zealand.

- Richard Corlett

A dead **Banded Krait** (*Bungaris fasciatus*) was discovered by Steve McChesney and Graham Reels on the Sek Kong catchment road near Tai Lam Reservoir on 5th October. This species is thought to be rare in Hong Kong. *- Graham Reels*

Mai Po Corner

On 16 November, a flock of 14 **Bewick's Swans** (*Cygnus bewickii*) was seen on the Mai Po mudflats, 50m in front of the floating hide, by Simba Chan and a party of school children. This is the first record of this species for Hong Kong.

* * * *

In November, a flock of at least 3,800 **Cormorants** (*Phalacrocorax carbo (sinensis)*) were regularly seen roosting on the trees around the Captive Waterfowl Collection at dusk. The captive waterfowls also attracted several hundred wild ducks to roost in the collection at nights, particularly **Wigeon, Shovelers** and **Pintails**. A flock of over 150 wild **Coots** can also be regularly seen in the collection, even during daytime.

* * * *

Over November, the gei wais at Mai Po were drained in turn so that the fish inside (principally Mullet) could be harvested and taken to the market for sale. As the ponds were drained down, the shallow water full of small fish and shrimps would attract hundreds of **herons, egrets** and **Black-headed Gulls** to feed there. During one count, over 800 such birds were seen feeding in these shallow water pools.

Lew Young

On 11 November, I saw at least 5 **Treepies** (*Crypsirina formosae (sinica)*) feeding on the fruits of *Cinnamomum camphora* on University Drive, HKU. Treepies are rare residents and occasional irruptive winter visitors. The University's camphor trees also attracted a large flock of **Blackbirds** (*Turdus merula (mandarinus)*) the week before.

Richard Corlett

In late December I saw about 20 fresh **Ferret Badger** burrows on a hillside on Tai To Yan, near Sek Kong, which had been burned in a hill fire in mid-October. *- Andrew Benton*

REQUEST FOR SQUIRREL SIGHTINGS

As far as the name of the Hong Kong squirrel given in the list of Hong Kong Mammals in the last issue of **Porcupine!** is concerned, I would like to make a correction. The squirrels that occur on Hong Kong Island belong to the species ***Callosciurus flavimanus thai***. Identification was made by the American National Museum of Natural History, Smithsonian Institution. Distinctive characters of this species include a black patch on the dorsal side of the body and orange colour on the muzzle and facial area.

In addition to the above amendment, sightings of squirrels are requested. Details of sightings (date, time, place, appearance of individual(s) seen such as any peculiar characteristics noticed, and past records of sightings in the area) would be gratefully received through the Department's address (Dept. of Zoology, Hong Kong University, Pok Fu Lam Rd., H.K.).

Ho Ching Yee

Wildlife Windows Two

A **Hawfinch** (*Coccothraustes coccothraustes*) was observed on Stonecutter's Island during the annual HK Birdwatching Society's bird count on 20 December. This is a rarely reported vagrant locally. *Jim Ades*

A pair of **White-bellied Sea Eagles** were seen near a nest somewhere in Sai Kung, some time in November.
- Michael Lau

>> A **Barred Owlet** (*Glaucidium cuculoides*) was heard and seen on several occasions in Sek Kong Village during November. At least one bird is using nest boxes erected by Jim Ades as day-time roosts.

CHEK LAP KOK

During December the following sightings were recorded by Michael Lau on the Island; One pair of **Pied Kingfishers** (*Ceryle rudis*) seen fishing along the coastline.
Two **White-Bellied Sea Eagles** (*Haliaeetus leucogaster*), one adult and one immature.
One immature **Siberian Blue Robin** (*Erithacus cyane*) which is a scarce winter visitor to Hong Kong.

A mist net containing 7 dead fruit bats was discovered at Sek Kwu Wai near Mai Po on 28 November. It was taken down and later inspection revealed that 6 of the bats were the **Short-nosed Fruit Bat** (*Cynopterus sphinx*) and the other specimen was a **Rousette Fruit Bat** (*Rousettus leschenaulti*). This find although rather sad has at least revealed that the two species of Hong Kong fruit bats obviously forage together at the same locations. *John Holmes*

More Wild Boar

Besides several more sightings of **Wild Boar** (*Sus scrofa*), at KARC during November and December, other reports have reached us from other locations in Hong Kong. Wild Boar were seen near Shatin and at Plover Cove Reservoir (*Hugh Chiverton*), in Sek Kong Village throughout December (*Jim Ades*), and Fabian Pedraezinni, the Chairman of the Green Lantau Association, described an encounter made at sea! On 12 December a very large Boar was seen swimming toward the western shore of Chek Keng Hau in Sai Kung. It was 200m away from the land. Apparently this is not such a rare occurence as other such sightings have been made locally, an indication of how adaptable these creatures are, as they will exploit food sources even if they have to swim to them!

Bat Bits!

The shredded remains of a specimen of the **Large Bent-winged Bat** (*Miniopterus magnater*) were found at Mai Po on 3 November. This is a high flying aerial insectivore which was almost certainly despatched by a **Hobby** or a **Peregrine Falcon.** *- Anjali Rao*

White-Headed Blind Snake (*Typhlops albiceps*) found on HKU campus, Pokfulam Road, in late November. This is a small worm-like snake which is very rare in Hong Kong, only two specimens having been discovered previously, the latest in 1966.
Michael Lau

Chinese White Dolphins (*Sousa chinensis*) were seen on two occasions in December (three on the10th and five on the 18th). Both sightings were made east of The Brothers' Islands to the north of Lantau, at times of very low tides. The dolphins swim down the Pearl River in the morning and return in the evenings. At low tides the dolphins follow the deep channel which runs past the Shekou peninsula and swings eastwards between Castle Peak and Lantau. *- Keith Wilson*

More Pythons

1992 really was a good year for sightings of the **Burmese Python** (*Python molorus bivittatus*). Apart from those mentioned in the last two editions of this newsletter, one specimen measuring 3m was seen struggling in the Sek Kong catchment on 5 November and was helped to saftey by several brave military personnel. It was last seen heading towards Tai Mo Shan.
> A 2.5m Python was discovered basking on a hill path behind KARC on 5 December.
- Gary Ades & Graham Reels

A Crab-Eating Mongoose (*Herpestes urva*) was seen by the border fence at Tsim Bei Tsui on 5 December by John Holmes.

A large number of **Porcupine** droppings were found along the Tai To Yan ridge north of Lam Tsuen valley on 3 January by John Fellowes and Graham Reels.

Deer Barking...

>> **Barking Deer** (*Muntiacus reevesi*) hailed the New Year in en mass with several howling reports during the first week of January:- Kadoorie Farm at 8am on 1 January, at dusk on the 4th at KARC and along the Sek Kong catchment road on the evening of 7 January.
-Sian Jones & Gary Ades

List of Hong Kong MAMMALS: Part 2

ORDER CHIROPTERA - Bats

Family Vespertilionidae - Vesper Bats

Pipistrellus abramus Japanese Pipistrelle
HB: 38-44; FA: 31-35 mm

Pipistrellus pulveratus Chinese Pipistrelle
HB: 40-49; FA: 35-36 mm

Nyctalus noctula Noctule Bat
HB: 65-68; FA: 47-55 mm

Scotophilus kuhlii Lesser Yellow Bat
HB: 63-66; FA: 47-52 mm

Miniopterus magnater macrodens Greater Bent-winged Bat
HB: 51-65; FA: 48-52 mm

M. schreibersii fuliginosis Common Bent-winged Bat
HB: 48-51; FA: 43-50 mm

M. australis Lesser Bent-winged Bat
HB: 40-41; FA: 39-42 mm

Myotis myotis chinensis Large Mouse-eared Bat
HB: 75-90; FA: 66-69 mm

M. ricketti Rickett's Big-footed Bat
HB: 70-85; FA: 55-58 mm

M. fimbriatus Long-fingered Bat
FA: 35-38 mm

M. horsfieldi Deignan's Bat
HB: 45; FA: 34-36 mm

M. daubentonii laniger Eastern Daubenton's Bat
HB: 44-45; FA: 34-35 mm

Family Rhinolophidae - Horseshoe Bats

Rhinolophus rouxi sinicus Rufous Horseshoe Bat
HB: 45-52; FA: 45-50 mm

R. affinis hainanus Intermediate Horseshoe Bat
HB: 47-58; FA: 49-53 mm

R. pusillus szechwanus Least Horseshoe Bat
HB: 39; FA: 36-38 mm

Family Hipposideridae - Round-leaf Bats

Hipposideros pomona sinensis Bi-coloured Round-leaf Bat
HB: 44-46; FA: 38-47 mm

H. armiger armiger Great Round-leaf Bat
HB: 80-97; FA: 88-95 mm

Family Molossidae - Free-tailed Bats

Tadarida plicata Wrinkle-lipped Bat
HB: 60; FA: 40-50 mm

Family Pteropodidae - Fruit Bats

Rousettus leschenaulti Leschenault's Rousette Bat
HB: 130; FA: 75-85 mm

Cynopterus sphinx sphinx Short-nosed Fruit Bat
HB: 98; FA: 66-74 mm

ORDER PRIMATES - Primates

Family Cercopithecidae - Old World Monkeys

Macaca fascicularis Long-tailed Macaque
HB: 48-55; T: 44-54 cm; Wt: 3.5-6.5 kg

Macaca mulatta Rhesus Macaque
HB: 47-64; T: 19-30 cm; Wt: 5.4-7.7 kg

Macaca thibetana Pere David's Macaque or Tibetan Stump-tailed Macaque
HB: 60; T: 6 cm; Wt: 12 kg

HB = head+body; T = tail; HF = hind foot; E = ear
FA = fore arm

Correction:
the Belly-banded Squirrel listed in List of Hong Kong MAMMALS: Part 1 (**Porcupine!** No. 2) was erroneously accorded the latin name *Callosciurus erythraeus*. It should in fact be *Callosciurus flavimanus thai*.

NEXT ISSUE:
List of Marine Mammals from Hong Kong Offshore Waters

Ho Wai Hoong & a vicious snail

Be warned -

Vegetarians: for meat-lined stomachs only.
Carnivores: what's the problem? I believe it's pre-prandial whetting.

Most species of land snails live mercifully dull and unexciting lives feeding on plant material. However Nature has unsheathed her deadly sting in the form of a carnivorous family called the Streptaxidae.
Haploptychius sinensis, a member of this family, is found in Hong Kong.

The appearance of *Haploptychius* is hardly daunting as the maximum shell height measures only 10mm. Its head-foot complex is yellow and the antennae tipped with pink. Rather attractive, but.....

Haploptychius feeds by inserting its narrow head into the aperture of the prey snail and rasping the flesh with its radula. The teeth are specialised for this purpose and are long and dagger-shaped. The radula in one animal was measured and it was nearly three-fourths its shell height! *Haploptychius* eats several kinds of snails and slugs in the lab. Handling time depends on the size of the animal, the absence or presence of a shell and the mode of feeding. For the latter, the predator usually attacks via the aperture and finishes its meal within two days. On rare occasions, the snail attaches itself to the apex of the prey shell and proceeds to feed through a hole it makes in the shell. This entire process takes roughly five days to complete.

I have not as yet seen any form of defence in the prey. For instance, subulinids release a stream of froth when attacked but this does not appear to offer any resistance. *Cyclophorus*, another prey species, has a horny operculum or lid but it was similarly attacked. Bloody hapless....

In the field prey species are not always readily available. What happens then? If you have three haemocyanin-hungry *Haploptychius* in a vial, it is not difficult to predict the outcome. Just imagine two comrades feeding on you at the same time.

Preliminary studies have provided clearer insight into possible interactions for this predaceous snail and other species. Several other questions have been raised about its preferences for species and size. Are there any defences against predation in some species? Perhaps in the near future such queries may be answered.

- HO WAI HOONG

Nick Goodyer and his droppings

It was birds that first drew me to natural history. I saw a woodpecker in the trees near my home in England, and was subsequently given the Observer's Book of Birds for my 8th birthday. (It was a Greater Spotted). This initial interest in birds broadened to cover those other organisms without feathers and more specifically to nature conservation and management. As a result, I spent much of my formative years hacking down trees and ripping saplings from the ground on various nature reserves, including a stint at the RSPB's Loch Garten Osprey reserve and six months as the sole occupant of a wooden hut in the woods at Arne nature reserve in Dorset.

Like others before me, I displayed the classic textbook symptoms of going from birdwatcher to birder to fully fledged twitcher. For those who don't know, a twitcher is one of those people who race up and down the country to see *rare* birds. This generally involves standing around in a charming place like a sewage works, peering at a grotty little brown bird that is half dead having just been blown across the Atlantic, and muttering appreciative "aw"s and "ah"s. My birdwatching career culminated with finding the sixth Desert Warbler for Britain (a BIG tick) and a trip to eastern Nepal to survey forests using birds as indicator species.

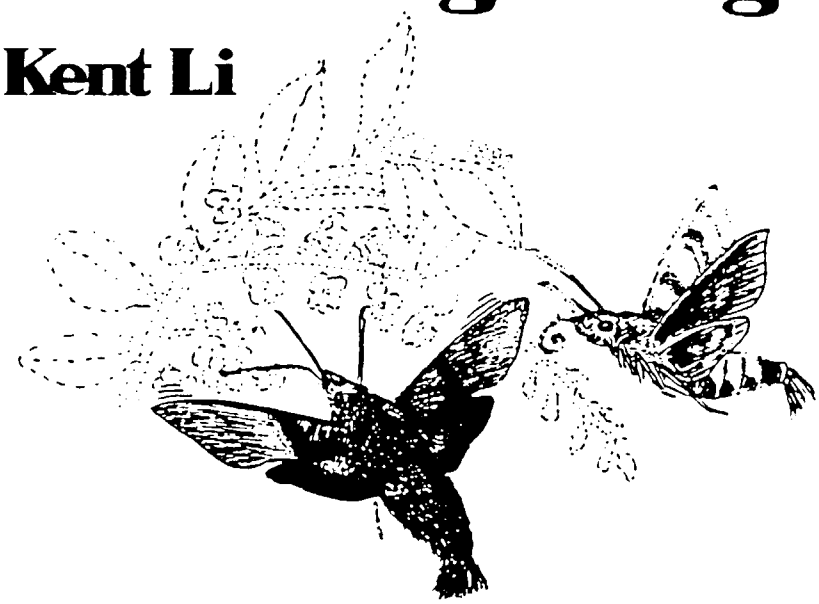
Coming to Hong Kong saw me going over to the other side: mammals. True, they aren't such good "twitch value" and they don't sing very well, but they can be a lot more interesting. My M.Phil. concerns Civets in Hong Kong and their part in seed dispersal. As I'm sure most of you know, this involves walking the countryside keeping my eyes peeled for their turds, scooping them up into little plastic vials and taking them back to the lab for analysis. I once had my bag stolen on the bus after a fruitful trip, but never got to see the culprit's face when he opened it.

So far we've established that civets disperse some thirty seed species including some that are probably solely dispersed by civets (*Gnetum montanum* for instance - a dead Masked Palm Civet brought in by Dave Willott was found to contain 25 of these large seeds). In addition to my work on civets, Dr Corlett and I have been conducting a survey of the land mammals in Hong Kong which has given us a better idea of their distribution. One surprising result is that some local mammals seem to be on the increase, probably as a result of a reduction in trapping. The porcupine *Hystrix brachyura* is one example.

- NICK GOODYER

Hawk Moths of Hong Kong

Kent Li



In 1986 I began to build up a moth collection at my home near Yuen Long, composed mainly of the larger Sphingid moths and the smaller, dull-coloured noctuid moths. In 1988, during a school picnic to Hok Tau, I observed a large number of moths settling on the walls and ceiling of the public convenience even in the day time. The next day I arrived at the site and found the moths were of different species to those collected from my garage. Ever since that time I have been making a serious study of moths, as they are so little studied, unlike the butterflies, but much varied in their patterns and forms. I made as many trips to Hok Tau as weather and time permitted. Thus moths from Hok Tau toilet occupy a very important position in my collection!

I joined the Lepidopterist's Society in 1987 and realised that I was not the only Hong Kong member when James Young wrote me a letter in January the next year. We soon went to the different sites where he used to collect butterflies. Connection with James Young led to the study of moths in Tai Po Kau in July 1988 after obtaining a permit from AFD which allowed us to use light traps and nets and to collect larvae for further study. A quarterly report on species collected and the associated foodplant has to be sent to AFD. We think we are doing a very important job: documenting the moth fauna of Hong Kong.

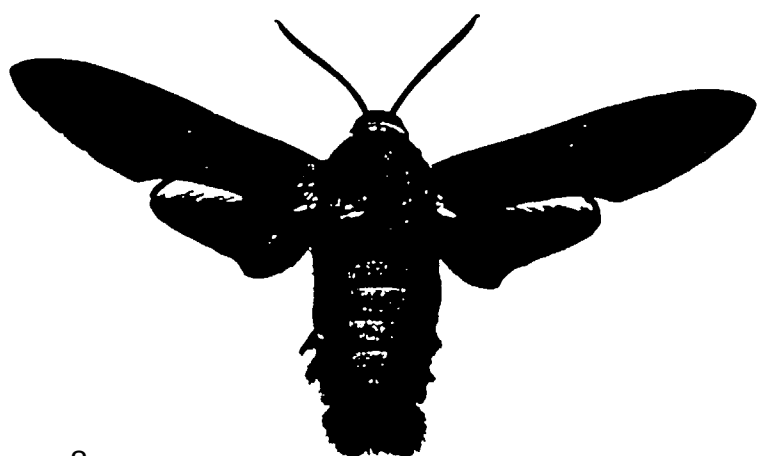
Then I joined the Natural History Society through the introduction of James Young. This resulted in a friendly visit in January 1990 from Mr John Tennent, a specialist of Sphingidae, who was then compiling a checklist of this family in Hong Kong. I was grateful to work with this very experienced collector, using two light traps at the same time and collecting in many sites including remote areas of Lantau.

John Tennent told me he had collected *Macroglossum* species on *Durenta rupens*. This moth is sometimes called the "hummingbird moth" as when it nectars it hovers without landing on the flowers.

I located a large hedge of *Durenta rupens* at Siu Hong Court and began to collect at dusk on 18th September 1990. It was amazing to record a total of 188 specimens, from nine different species collected by the end of October 1990. The dominant species that come to the flowers is *Macroglossum pyrrhosticta* (above, right), occupying about 56%, with *M. sitiene* (above, left) making up 22% of the total catch. The results of this exercise have been written up in an unpublished paper entitled "**Notes on a collection of *Macroglossum* and other sp. (Lepidoptera: Sphingidae) in Hong Kong**".

The latest project which I have launched is a study of the early life history of the rare Bee-mimic Hawk Moth, *Sataspes tagalaca* f. *tagalaca* (below) starting in June 1992. Altogether ten adults have been reared and one of these is of an all-black female form *hauxwelli*. The larvae are of at least four forms and feed on *Dalbergia* leaves. The adults are seldom seen and were thought to be rare because they are perfect mimics of the Carpenter Bees *Xylocopa* sp. Now they have been found to be widespread, preferring woodland habitat with large bodies of fresh water.

Identification has remained a problem ever since the early days of my study. Collections of several institutes and universities in Guangdong province have been visited, and I plan to visit the British Museum this year. The study of the moth fauna of Hong Kong is in its early stages and a lot of work needs to be done. Please contact me (tel. 4788942) if you have any information on moth sightings, particularly of *Sataspes tagalaca*.



PCA for fun and profit

by Richard Corlett

There comes a time in almost every ecological study when the researcher is faced with a table of multivariate data - species abundances in many samples, environmental variables at a number of sites, chemical analyses of plant material from different species, or whatever. One can, of course, analyse each variable separately but this is not only very tedious if many variables are involved but also misses the opportunity to look at the relationships between variables - often the major point of the study. One obvious way of looking at these relationships is to generate a correlation matrix showing the correlations between every pair of variables. Unfortunately, even ten variables results in 55 separate correlations, twenty in 210 and so on. For more than a small number of variables the correlation matrix is too large to grasp and interpret effectively.

While a large multivariate data set often *looks* random, we know that this is not so - there is always some non-randomness in biological data; some pattern. Plants are not randomly distributed across the earth's surface, environmental variables do not occur in random combinations, plant material is not a random mixture of chemicals, etc. The measured variables can almost always be explained in terms of a smaller number of underlying factors. Often, in ecology, there is a single major factor - a gradient - which explains much of the variation in the data set. For instance, a single factor, altitude, may explain most of the variation in the plant communities on a mountain.

With Principal Components Analysis (PCA) we can determine whether or not there are a smaller number of underlying variables (the "principal components") which explain the bulk of the variation in the data set, and we can calculate them. The output includes the percentage of the total variation accounted for by each component, the correlations between the original variables and the derived components, and the scores for the entities being studied on each component. In effect, PCA replaces the original set of variables with an entirely new set. The first principal component accounts for the most variation, the second for less and so on. With luck, a small number of components will account for most of the total variation in the original data set. If so, the analysis will have been worthwhile.

The mathematics of how PCA does this are difficult but not *too* difficult: within the capacity of anyone who has done A-level maths (and not lost too many brain cells subsequently). Indeed its "relative" mathematical simplicity is one of the attractions of PCA. A non-mathematical way of looking at the procedure - which merely requires an ability to visualise hyperspatial geometry - is given in almost any textbook of multivariate analysis for non-mathematicians. Let's take a simple case. Suppose we have only three variables. We can imagine a 3-dimensional graph in which the entities (the things the variables apply to) are plotted according to their scores on three axes representing the three variables. If the variables are at all correlated, the "cloud" of entity points will not be symmetrical but will be elongated in one direction. Now we take a chopstick and orientate it along the long axis of the cloud. This is our first principal component. We can then project the positions of the entities in 3-D space onto this component. Depending on how highly correlated the original variables are, the chopstick will retain a greater or lesser proportion of the information on the position of the points in the original 3-D variable space.

PCA constrains each successive principal component to be at right-angles to (and thus uncorrelated with) the previous one. Thus, if we want a second principal component, we must arrange another chopstick at right-angles to the first in the direction in which the points are most spread out. Projecting the positions of the points onto this second component will retain information which was missed by the first component. We could use a third chopstick at right-angles to both the other ones to capture all the remaining information, but this would be rather pointless since we would then have replaced the original three variables with three new ones. If the data is structured at all, the last component will contain little additional information and can be ignored.

If we do not think too hard about it, we can imagine this model expanded to any number of dimensions, with PCA producing the most efficient (in terms of retaining information) projection of the points in 1, 2, 3 etc.-dimensional space, depending on how many components we calculate.

What can you do with the principal components when you have got them? One common use is as a means of "ordination": arranging the entities (sites, species or whatever) in low-dimensional (usually 2-dimensional) space so that similar entities are close together and dissimilar entities far apart. In many cases the first two principal components will account for much more of the variation than subsequent ones and a scatter plot of the scores for the entities on

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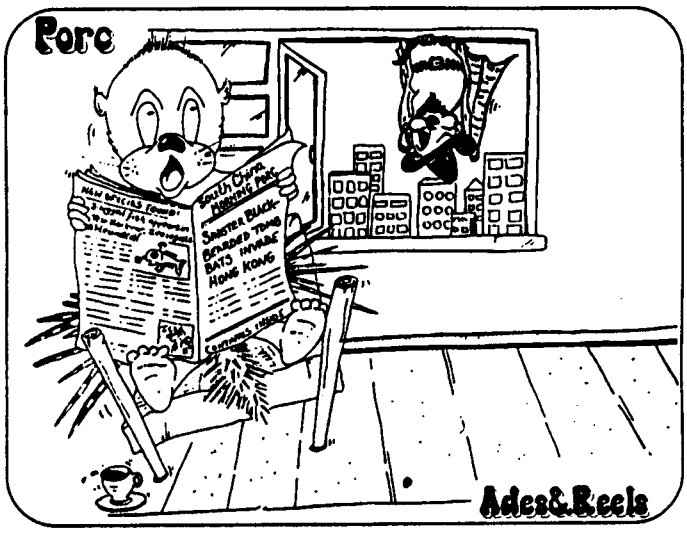
these two components gives a clear visual picture of the similarities. Such an ordination may also help in explaining the pattern of variation. For instance, a PCA ordination of secondary forest plots in Singapore showed a clear trend along the first principal component from the youngest to the oldest forests, i.e. age is the major factor determining floristic composition. In this case, neither the second nor the subsequent principal components could be interpreted, but this is not always the case.

The principal components can also be used, like any other variable, in subsequent analyses - regression, correlation etc. The advantage of using them rather than the original variables is that there are fewer and that each one summarises more of the original variation. A PCA of the characteristics of bird fruits in Hong Kong shows that the major trend in the data is from small-seeded, watery, sugar-rich fruits with a high pulp-to - seed ratio, to larger-seeded, lipid-rich fruits with a low pulp-to-seed ratio. Since birds presumably consider all variables simultaneously when making a fruit choice it makes sense to compare bird fruit preferences, at least initially, with fruit scores on the first principal component rather than with each fruit variable separately.

Does PCA sound like the answer to all your problems? It isn't. There are a number of snags, only one of which I will mention here. With all statistical techniques, the output will only make sense if the input matches (more or less, in most cases) the mathematical model on which the analysis is based. A familiar example of this is the requirement with most of the well-known statistical tests that the population under study has a normal distribution. Some deviation from normality is tolerated, but not too much. With PCA, one assumption of the mathematical model is that the relationship between each measured variable and the underlying factor is linear. This is fine in many cases and considerable deviation from linearity is tolerated. Unfortunately for the ecologist, however, the relationship between the abundance of a species and an environmental gradient is typically more or less bell-shaped, with a maximum at one point on the gradient and a decline on either side. For instance, a plant may be rare at a particular site because the soil is too acid *or* too alkaline in comparison with the optimum. Except at the optimum, the abundances of individual species do not uniquely define the position of the site on an environmental gradient. In practice this means that a single, simple underlying gradient (e.g. altitude in vegetation studies) may not be completely "captured" by the first principal component.

For species abundance data, only use PCA if a relatively short section of an environmental gradient is included - that is, the extreme sites or samples are fairly similar in species composition. Over short sections of an environmental gradient, species responses are often more or less linear. Longer gradients require alternative methods, such as Detrended Correspondence Analysis (DCA) - but that is another story■



FRESH SEAWEEDS WANTED

for the identification of Hong Kong seaweeds and the construction of an herbarium for the Swire Marine Lab.

Please place seaweed in plastic bag with a little seawater, and a note detailing where found (locality and position on shore) and date. Any samples would be gratefully received by Dr Gray Williams (Swire Lab/Botany) or Dr Sue Saunders (Botany).

Andrew Benton, a Botany postgraduate at KARC, would be very grateful for sightings of any bamboos still in flower, as he wishes to collect seed for use in micropropagation and for studying environmental effects on the growth and development of young bamboo plants. Tel. 4889554.

Postgrads, lecturing staff and natural history enthusiasts: you are cordially invited to submit articles about your work in Hong Kong for inclusion in future issues of **Porcupine!**

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