紅外線自動相機紀實秘辛
深山裡的特務007
The 007 in Remote Mountains
Truths about Camera Trapper

人們善用大自然這美好的素材，開創生態教育的嶄新視野。圖為玉米田的月色 /Jill Ba ttaglia 攝
People to open up new perspectives of ecology education with the beautiful material of Mother Nature./ by Jill Ba ttaglia

台灣山林各處，隱藏了許多紅外線自動相機。這些相機在協助研究的過程，揭露了許多意想不到、超出研究目標的秘密。

曾經，教科書宣揚台灣四季如春、森林常綠。動物學者因此相信，台灣草食性動物得天獨厚，和每年都得面臨寒冬考驗的溫帶動物不同，一年到頭沒有季節性的生存瓶頸。

是紅外線自動相機捕捉到的影像，意外改變動物學界對台灣氣候的刻板印象。

「颱風過後拍到的動物有些好瘦。」裴家騏是屏東科技大學野生動物保育研究所教授，同時也是台灣應用紅外線自動相機收集野生動物生態資料的先驅。許多次強烈颱風襲台，土石流推倒樹木、改變地貌，他的研究團隊事後整理照片，意外發現連日狂風暴雨過後，還能活著出來覓食的動物，普遍身形消瘦甚至受傷。

原來，台灣野生動物雖不用面對冬季的冰雪風霜，一年四季卻可能遭遇突發的氣象干擾，包括夏秋季不可預期的颱風、冬季氣溫驟降的寒流。並且，突發干擾教野生動物措手不及，無法像溫帶動物因應雪季演化出冬眠、遷徙等行為避難遷徙等行為避難。而這殘酷的真相，以往颱風來襲，研究人員趕著下山都來不及了，遑論冒險登山查探，若非紅外線自動相機風雨無阻堅守崗位，外界根本無從了解。

野生哺乳類動物，香港多過墾丁！

紅外線自動相機揭露的事實，令人意外的不只這件。出乎意料，高度商業化的香港，境內野生動物種類及數量，竟然超越墾丁國家公園。

2000到2004年，香港政府邀請裴家騏進行境內野生動物現況調查。紅外線自動相機意外拍到數量超過墾丁國家公園的野生哺乳類動物，甚至包括台灣瀕臨絕種的石虎，以及珍貴稀有的穿山甲、麝香貓。

這樣的調查結果讓港府大為驚喜。1920年代起，每年出版的《香港政府年報》，自然環境篇永遠寥寥數語，千篇一律描述香港野生動物數量稀少、自然資源貧乏。紅外線自動相機揭露的喜訊，讓《香港政府年報》隔年立刻改寫，港府甚至發行野生動物郵票開心慶賀。

Across mountains and forests in Taiwan, there hide numerous camera trappers. More than a research aid, these cameras also reveal lots of unexpected secrets.

Textbooks have taught us that in Taiwan, it's like spring all year round. Zoologists hence think that herbivores in Taiwan are privileged and lucky compared to their counterparts in the temperate zones who must adapt to seasonal changes.

Then there came the images captured by camera trappers, which changed by accident the zoologists' stereotype about Taiwan's climate.

"Some of the animals that survive a typhoon become so skinny." said Prof. Pei, who pioneered the use of camera trappers in collecting wildlife data. Following some severe typhoons with mudslides toppling trees and changing the landscape, Pei and his team unexpectedly found that animals that made it through after the raging storm tended to become thinner or even injured.

It dawned on them that wild animals in Taiwan don't have to face severe coldness but may be hit by weather patterns such as typhoons and cold fronts, which can catch the animals by surprise. Unlike animals in temperate zones that hibernate or migrate, wild animals in Taiwan can't react in time. Thanks to the camera trappers that persist in all weathers, the research team has discovered the hardship the animals have experienced.

Hong Kong Has More Wild Mammals than Kenting!

Camera trappers reveal more surprising news than just that: there are more wild animals and more species in the highly commercialized Hong Kong than in Kenting National Park.

Between 2000 and 2004, the Hong Kong SAR government invited Pei to conduct a survey on wild animals. Surprisingly, the images taken by camera trappers showed more wild mammals there than in Kenting, such as the endangered species of leopard cats, pangolins, and *Viverricula indica pallida*.

That was a pleasant surprise to the HK government. Since 1920, the Environment section of the *Hong Kong Yearbook* has always talked about the scarcity of wild animals and natural resources, but the finding turned that around, and the government launched stamps to celebrate the good news.

採訪撰文 Interview & Text ／張碧慧 Bi-hui Zhang　特別感謝 Special thanks to / 屏東科技大學野生動物保育研究所裴家騏教授 Prof. Jai-chyi Pei of the Institute of Wildlife Conservation, National Pintung University of Science and Technology　圖片提供 Photo provided by ／裴家騏 Jai-chyi Pei　翻譯 Translator ／黃詠蘭 Teresa Huang

但，高度開發的香港為什麼依然存在野生動物，數量甚至超越墾丁國家公園？同期間也在墾丁國家公園進行調查的裴家騏研究後發現，原因之一可能是出在墾港兩地，森林、草原及人類聚落等三種環境，在地景上的排列組合大不相同。

在墾丁，村落和市區主要分佈在低處，人類聚落的邊緣通常就連接著開墾過的草原帶，再往山上去才銜接到森林。因此，人類很容易穿過草原進入森林邊緣，對生活在森林邊緣和森林裡頭的野生動物造成生存壓力。

香港不同。香港森林在200年前的大規模墾荒盡遭砍除，就連陡峭山頭都闢成梯田。但距今80年前，政策轉向，港英府放棄農業主動造林，將都市範圍外的廣大廢耕地劃作郊野公園，僅白天開放戶外活動，夜晚禁止進出。

香港生態從此慢慢回復。特別是緊鄰都市的山腳下地區，因為水往低處流，山腳的土壤相對潮濕，歷經80年率先出現植被並發展成森林。反倒是森林向山頂的那一側較高海拔的山坡，相對乾燥至今只回復成草原。形塑了香港島上，都市緊鄰森林，更遠才是草原的地貌。

這種和台灣截然不同的地景分佈，讓香港民眾很難穿越茂密森林進入草原，喜歡森林和草原交會環境的野生動物（石虎、麝香貓、穿山甲……等），反而不受干擾，80年來就在草原帶生息繁衍。換句話說，歷史上的無心插柳，意外替香港野生動物阻絕人煙。

荒郊野外，四下無人，相機不會遭竊？

裴家騏在香港的研究，還碰上一項意外：有史以來最離譜的相機失竊率，竟然出現在治安良好的香港。

裴家騏沒預料到，原來香港郊野不只隱藏了野生動物，還躲著許多大陸偷渡客。這些身份不便曝光的人士，看見那些彷彿監視器的紅外線自動相機，縱然無意偷竊，也要破壞保命。最後，研究團隊不得不為每組相機加裝長鏈條，緊緊鎖上樹幹。

那麼，紅外線自動相機在台灣的失竊率又如何？這些一組要價一萬餘，從蒙大拿州從蒙大拿州引進台灣後，因地制宜改良成重量不到1公斤、體積小到一個背包裝得下好幾組的設備，拍照時閃光燈難免暴露行蹤，加上架設在荒郊野外，當四下無人，難道不會遭竊？

裴家騏表示，靠近遊樂區或平地工地的架設點，確實被偷過十幾組。不過，絕大多數相機架設在深山僻境，這些多半只有原住民出入的區域，「將近20年來，相機失竊數寥寥無幾。」原住民不習慣拿不屬於自己的東西，物品上頭只要擺根茅草就代表有主人，早年相機沒有迷彩掩護，研究人員只要在設備上頭擺根茅草，就不擔心失竊。

But why do wild animals in HK outnumber those in Kenting National Park? Pei concluded that the distributions of forests, grasslands and human habitats are very different between Kenting and HK.

In Kenting, humans dwell in low altitudes. Adjacent to their habitats are grasslands and then forests in high altitudes. Hence humans find it easy to make it to the forests through grasslands, posing a threat to the very survival of animals in the forests.

In HK it's a different story. There was a massive deforestation 200 years ago, but 80 years ago the government started to encourage forestation and designated wastelands as rural parks that allow public access during the day only.

Thus the ecology in HK began to recover. Water flew to the low altitudes adjacent to the cities, moisturizing the soil and giving rise to vegetations and then forests. The dry high altitudes, on the other hand, were only able to grow grasslands. This resulted in the landscape with urban areas next to the forests and far away from grasslands.

Such landscape distribution made it difficult for people in HK to reach grasslands via forests and reduce disturbance to the wild animals living in between such as leopard cats and Chinese pangolin, which have been propagating over the past 80 years in grasslands.

Concerns over Possible Theft of Cameras

Pei also encountered the most outrageous theft of cameras in the orderly HK society.

He didn't expect that other than wild animals, there were also many illegal Chinese immigrants, who mistook the cameras for surveillance devices and either stole or destroyed them. This forced the team to chain each camera to tree trunks.

So are these cameras easy targets for thieves in Taiwan? They cost NT$ 10 to 20 thousand per set; they were downsized to less than 1 kg following their introduction to Taiwan, and the flash may disclose their whereabouts. It seems that the cameras make good targets for thieves.

According to Pei, scores of the cameras near amusement parks or construction sites were indeed stolen, but the majority are installed deep in mountain areas where only aborigines reside and "over the past 2 decades almost none was stolen." To the aborigines, if a thatch is placed above an item, it means the item has an owner. So Pei's research team always put a thatch on their camera.

紅外線自動相機小檔案
Facts about the Camera Trapper

相機原理	紅外線自動相機由相機、紅外線感應器及控制電路等三大部分組成，利用紅外線感應器偵測環境的熱量變化來啓動相機，可藉以監測進入相機拍攝範圍內野生動物的一舉一動。利用熱感應器引發內裝高感度底片 (如 ASA400 度以上) 的相機，拍攝感應範圍內的哺乳動物與鳥類。
How It works	A camera trapper consists of three major parts: a camera, an infrared sensor, and a control circuit. The infrared sensor can detect the thermal changes nearby and trigger the camera to capture images of animals within the shooting range. Mammals and birds can be photographed by the camera loaded with high sensitive films (e.g. ASA 400) and triggered by the thermal sensor.
裝設地點選擇	設置地點以獸徑、水域旁、橫倒木邊為佳，亦可在開闊處設置誘餌吸引動物接近拍攝範圍內。
Where to Install	The best places to install a camera trapper include the paths that animals move along, somewhere near water, and lying logs. It can also be placed in a open space to lure animals to approach.
裝設要點	架設相機時盡量與拍攝點呈 45 度角，焦距設在 3 到 5 公尺處。
How It Is Installed	The camera should be installed with a 45-degree angle pointing toward the target area, with a focal length set between 3 to 5 meters.
優缺點分析	可發現隱密性高的物種，而且花費人力少，調查人員也不用滯留在調查區中，但因相機容易失竊或故障，維修費用較多，且有重複拍攝同一隻動物的可能。
Pros and Cons	Pros: It can help discover highly seclusive species with minimal manpower required. And researchers do not need to stay in the field. Cons: The camera is subject to thefts or malfunctions, and repurchases and fixing may be costly. Also, photos may be repeatedly taken of one same animal.

「倒是被動物破壞的相機，回想起來是有一些。」根據裴家騏的經驗，不論動物體積大或小，同樣具有破壞力。被黑熊咬壞的，猴子好奇拔掉的，以及蜘蛛結網或螞蟻作窩導致無法拍照的狀況，都曾發生。他過去的學生在馬來西亞進行研究，甚至意外拍下動物打落相機的完整過程。那是帶著小象的母象，眼見紅外線自動相機一再發出閃光拍照，不斷上前警告制止無效，盛怒下甩動長鼻將相機打飛了50公尺。

不過，這事純屬意外，閃光燈引發野生動物的激烈反應，其實不常見。裴家騏解釋，閃光燈就像自然界的閃電，雖突兀卻不傷人，非但不會嚇跑動物，還有動物一旦察覺閃光，會不斷好奇重返多次入鏡。許多照片中，野生動物也都直挺挺面對鏡頭，小猴子甚至緊貼相機被拍下大臉。「反而捲動底片的咖咖聲，比閃光燈更可能嚇跑牠們。」

相機捲動底片的微弱噪音，在自然界非屬尋常。紅外線自動相機有時會拍到抬起前腿，甚至轉身準備奔跑的動物照片。依據動物學，奔跑時無法觀察周邊狀態，遭受攻擊的可能性大幅增加，是故，動物在野外慢慢行走才屬正常，準備奔跑顯示受到驚嚇。

幸好，紅外線自動相機已經走入全面數位化，少掉捲動底片的噪音，更能天衣無縫融入自然界。屆時，紅外線數位相機靜靜張大眼，深山密林裡的秘密將要再少幾件。

"But there were some incidents where animals damaged the cameras." recalled Pei. Some were bitten by black bears, while others unplugged by monkeys or covered by spider webs or anthills. His former student once unexpectedly recorded in Malaysia the whole process by which a cow with calf batted the camera. The mother was annoyed by the flash. She tried to stop it but failed, so she lashed out with her trunk and batted the camera to 50 M away.

But this was merely an accident, and very rarely does flash provoke wild animals. Pei explains that flash is like lightening: abrupt but harmless, and does not frighten animals. Some animals are even intrigued by the flash. In many photos, some animals face straight to the lens or get very close to it. "Instead, it's actually the mechanical whirring of the camera motor as it winds the film that is more frightening to the animals."

Such sound is unusual in the wild. The cameras sometimes captured images of animals raising their forelegs or are about to run. When animals run, they can't pay attention to their surroundings and thus increases the likelihood of being attacked. Hence normally animals walk slowly in the wild. If they run, it means they are frightened.

Luckily, camera trappers go digital now. Without the film-winding sound, the cameras will be integrated perfectly with nature and continue to reveal more secrets of the wild.