

陸蟹的棲地與人重疊，常與人車熙攘的馬路搏鬥，需要保育人士伸出援手。/Jonathan 攝
Habitats of the land crabs often overlap those of humans, so land crabs have to compete with people and the traffic on the road all the time; they need the helping hands from conservationists.
/ by Jonathan

專訪螃蟹博士劉烘昌

珍愛 蟹逅之情

Compassion for Land Crabs

An Interview with Crab Expert Hung-chang Liu

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螃蟹，在一般人眼中或許只是餐桌上的食物，但對靜宜大學生態學系助理教授的劉烘昌來說，這些生物，是生態世界中不應被忽略的要角之一。

劉烘昌從 1988 年開始正式走入螃蟹的研究世界。世界地理雜誌在當年介紹澳洲聖誕島上，數千萬隻大陸蟹從陸地跑到海邊繁殖的壯觀情形令劉烘昌心生嚮往；1994 年，在陪同國外學者至墾丁國家公園採集的機緣下，劉烘昌發現了陸蟹的存在。最後，在一公頃的面積中，竟然就能找到多達 20 幾種的陸蟹。

原來，陸蟹天堂就處於近在咫尺的南台灣，有著這樣豐富歧異度的生態資源讓劉烘昌埋頭栽入陸蟹的研究，這一栽，就栽了將近 20 年。

In the eyes of most people, crabs may be nothing more than a dish, but to Hung-chang Liu, assistant professor in the Department of Ecology at Providence University, crabs are so important that they shouldn't be treated as such.

Liu's research into crabs dates back to 1988, when he was fascinated by an article in World Geography Magazine describing the spectacle at Christmas Island, Australia, where tens of millions of land crabs travel from land to sea to lay their eggs. Later in 1994, he accompanied foreign scholars to Kenting National Park (KTNP) to collect samples. There they found the presence of as many as 20 species of land crabs within just one hectare of land.

Pleasantly surprised by this land crab paradise with rich and diverse ecological resources, Liu soon threw himself into the research on land crabs and has remained consistent all along for nearly 20 years.



冷門研究 熱心執著

不似明星保育物種已有較完整的資源調查，過去國內對於陸蟹的基礎研究是付之闕如的，因此在生物基礎資料的建立上，更要加倍付出心力。

從過去 10 多年的研究，劉烘昌知道墾丁的陸蟹繁殖高峰期多集中在雨季，而且不同種類的陸蟹，降海繁殖時間亦不同。

在 2009 年劉烘昌接下了墾丁國家公園陸蟹資源調查計畫的委託案。為了完整調查國家公園範圍內的陸蟹，他與研究團隊每個月都前往墾丁進行調查，7 至 9 月間更是從月圓起就在墾丁駐紮兩週，太陽一下山就分批到國家公園內多處海岸林外處潮間帶反覆巡邏，統計從海岸林爬出的抱卵母蟹，直至最後一隻母蟹結束釋放幼才結束工作。

由於不同陸蟹的釋放時機不同，有些種類甚至在凌晨進行幼蟲釋放。為了研究陸蟹劉烘昌多在夜晚出動，甚至半夜出門。在 2005 年以前，他大多是單身一人前往海邊進行研究，由於必須背負大型探照燈與大型電池，再加上相機、攝影機、腳架、採集箱等更是少不了，身上負著將近 20 公斤的裝備重量是常有的事。一個人行走跳躍在崎嶇不平、高度落差頗大的漆黑海岸與珊瑚礁岩間，汗如雨下是必然之事，甚至還有幾次驚險的意外，但總算都是平安渡過。

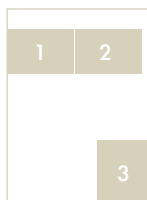
Zeal for a Cold Topic

Unlike well-known protected species whose data are more complete, basic research into land crabs is still sparse in Taiwan, and efforts had to be multiplied in the collection of their biological information.

Backed by his decade-long research, Liu noted that the rainy season marks the peak of breeding season for land crabs in Kenting, and different species visit the sea to lay eggs at different times.

Commissioned by Kenting National Park for a research project on land crabs, Liu's research team had to, in addition to the monthly field trips, quarter for two weeks in Kenting following the full moon. They patrolled tidal flats repeatedly after the sunset and counted every single female land crab traveling from coastal forests to bear her eggs on the shore.

As the egg-laying time differs considerably among different species of land crabs, Liu had to adjust his schedule accordingly. He used to conduct research all alone, carrying arduously all sorts of heavy gear of up to 20 kg in the dead of the night and walking between the rugged and bumpy uplifted coral reefs and the dark coasts with great drop height, not to mention the many close calls he survived.



1. 兇狠圓軸蟹正在吃車子碾斃的中型仿相手蟹。前者乃大型陸蟹，易遭人為捕捉 / 劉烘昌提供
Cardisoma carnifex is eating a *Sesarmops intermedius* crushed by a car. The former is a large-sized crab on the land, and tends to be captured by humans easily. / Photo provided by Hung-chang Liu
2. 圓形圓軸蟹正在海水中釋放幼蟲 / 劉烘昌提供
Discoplax rotundum is releasing the larva into the sea. / Photo provided by Hung-chang Liu
3. 澳洲聖誕島以數量驚人的紅地蟹聞名，但島上蟹類僅 21 種，多樣性不如墾丁 / 劉烘昌提供
Christmas Island in Australia is famous for its innumerable *Gecarcoidea natalis*, but there are only 21 crab species on the island. The diversity is much lower than that of Kenting. / Photo provided by Hung-chang Liu



就這樣，劉烘昌拿著生命作為研究的賭注，為他換回了豐碩的研究成果。劉烘昌多年來已陸續發表了墾丁國家公園範圍內的4種新種及6種新紀錄種陸蟹(註1)。而與其研究團隊在2009年在墾丁國家公園記錄到的陸蟹6科30種(註2)則是目前世界上海岸林棲地陸蟹多樣性的最高紀錄。

棲地是天堂 卻也曾淪為地獄

位於墾丁國家公園中的香蕉灣海岸林，是台灣森林中最接近熱帶雨林性質的森林，其林底為珊瑚礁岩環境，躲藏地點多；林內有湧泉，豐富的淡水水源很適合外殼缺乏蠟質、易失水的陸蟹生活。因此僅在漁港南邊的一小片約一公頃的海岸林範圍，就可發現到6種地科蟹陸蟹(全世界地蟹科陸蟹種類為20種)；及3種「陸方蟹屬」蟹類(全世界「陸方蟹屬」蟹類僅有4種)，如此歧異度在全球已知的陸蟹棲地中高居世界第一，堪稱研究陸蟹者珍貴的天堂樂園。

然而，棲地的破壞、人為捕捉與環境氣候變遷，導致陸蟹族群一再面臨減少的危機。其中人為捕捉，對大型陸蟹尤其致命，劉烘昌提起1998年的墾丁捕捉事件，想起來，仍舊心痛。

1999年，中部流行賭博式的釣龍膽石斑活動，由於這些龍膽石斑反覆被釣，因此需要不斷的更換釣餌。1999年四月間，有釣餌供應商開出每隻50元的價格蒐購大型陸蟹做為釣餌。於是恆春半島人扶老攜幼進入海岸林，帶著圓鋤與各種工具，短短兩週就捕捉販賣了上萬隻的大型陸蟹。

劉烘昌表示，相較於能一、兩年長成的海蟹，以樹葉為主食的陸蟹生長較為緩慢。大型陸蟹生長尤其緩慢，需4-5年才性成熟，更須花上15-20年才

But his all-out effort eventually paid off. Over the years, he has identified 4 new species and 6 new record species of land crabs (see Note 1) within KTNP. Moreover, Liu and his team recorded 6 families and 30 species (see Note 2) of land crabs in KTNP in 2009, setting the world record for the most diverse species of land crabs found in the habitat of coastal forests.

Land Crabs' Habitat: Paradise Once Lost

Of Taiwan's forests, the coastal forests in KTNP's Banana Bay are most akin to tropical forests. The ground of the forests is covered by uplifted coral reefs that offer plenty of hiding places, while inside the forests are springs offering abundant sources of fresh water. These conditions make the coastal forests a perfect dwelling place for land crabs, whose shells are devoid of wax and are thus susceptible to water loss. It's thus no wonder as many as 6 of the world's 20 species of Gecarcinidae land crabs and 3 of the world's known 4 species of *Genus Geograpsus* can be found here, which makes Banana Bay the world's most diverse known habitat of the creatures.

However, habitat destruction, fishing by humans and climate change have threatened the very survival of land crabs. Among these factors, fishing by humans has proven most devastating for large land crabs. In particular, the mass hunting for crabs in 1998 still makes Liu's heart sore whenever he talks about it.

In 1999, a gambling type of fishing on the giant grouper (*Epinephelus lanceolatus*) caught on in central Taiwan, thus increasing the need for the baits--- large land crabs. Back then some bait merchants offered NT\$50 for each such crab; therefore, the lucrative deal led to the mass hunt and trade of tens of thousands of large land crabs in Hengchun Peninsula within just two weeks.

Compared to sea crabs, which take only a year or two to mature, leaf-eating land crabs grow a lot more slowly. Large land crabs, in particular, need 4 to 5 years to reach maturity and 15 to 20 years to reach their maximum size. The mass



能達到最大體型。1998年的瘋狂捕捉，導致大型陸蟹幾乎消失殆盡，所幸當地居民在陸蟹減少後降低捕捉意願，再加上墾管處的嚴格取締，保護幼蟹休養生息，使其族群數量與平均體型逐漸恢復。

點燃星星之火 護育之心不滅

跟陸蟹一路結下來的二十二載情緣，劉烘昌想起來盡是感慨。年輕時的他曾為了保護和尚蟹（註3），參與「香山保衛戰」，反對開發工業區，然而微薄的力量依舊阻止不了填海造陸的發展，使得西海岸潮間帶陸蟹生存棲地的破壞瀕臨臨界點。

還好，保育的這條路不會全然是絕望的。

墾管處從2003年開始，每年暑假皆會利用月圓前後，舉辦「護送母蟹過馬路」的活動，除了委請警察隊維持台26線的交通，亦在陸蟹最常出沒的香蕉灣加強宣導，呼籲駕駛人在夏天月圓之際放慢速度，「讓路」給陸蟹媽媽。

過往民衆提著布袋捕抓陸蟹、一隻賣取50元的景象已不復見，取而代之的是當地生態旅遊業者，帶領遊客在公路上觀察母蟹降海繁殖的生態之旅。這樣的景象看在劉烘昌眼中，是滿滿的感動。

和劉烘昌同時期進入生命科學領域的研究者，大多投身當紅的生物科技，而他卻選擇了最傳統的生態學，一路走來陪伴著陸蟹的生死存亡。劉烘昌說，今年起將把保育重心移到西海岸海濱，帶著同於墾丁國家公園護育陸蟹的努力成果，將那星星之火點燃於西海岸，期望有朝一日，我們也能看到陸蟹橫行霸道於其中。📷

(註1) 此4類新種包括兩種棲息在樹上的新種陸蟹——樹蟹與林投蟹。樹蟹、林投蟹這兩種陸蟹平常都在植物上活動，以嫩芽、樹葉、果實、小蟲為食，非必要絕不下樹以避開林底眾多敵人。

(註2) 此6科30種包括，除了在台灣首次發現的圓額螳臂蟹，以及頭一回在園區現身的霍氏新脹蟹

(註3) 和尚蟹(又名兵蟹)是一種在潮間帶生活的螃蟹。

hunt in 1998 nearly wiped out the entire population of large land crabs. Fortunately, the local residents ceased the hunting and KTNP put a strict ban on crab hunting; therefore, the crab's population and average size were gradually restored.

A Little Effort That Makes a Great Difference

Liu's life has been closely intertwined with land crabs for over 22 years. He also once stood up for soldier crabs (*Mictyris brevidactylus*, see Note 3) to protect their habitat from destruction of industrial development. Though he eventually failed, some like-minded people joined the force, and KTNP is just one of them.

In 2003, KTNP initiated an activity designed to escort land crabs across the roads. This event takes place before and after the full moon during the summer months. Besides controlling the traffic on the highway during these times, the police put up warning signs at Banana Bay to alert drivers to slow down and to yield to mother crabs.

After years of public education, the scene of people catching and selling crabs has been replaced by the sight of local ecological tourism providers guiding visitors along the highways to observe land crabs breeding. To Liu, it's heartwarming to witness such a change.

Unlike the majority of Liu's contemporaries who throw themselves into the popular biotechnology, Liu committed himself to the cause of land crab protection. He also noted that starting this year, more effort will be put in the conservation of land crabs on the coastal area in western Taiwan. By doing so, he hopes to see more land crabs roaming the area one day. 📷

(Note 1) The 4 new species include the two tree-dwelling tree crabs and *Scandarma lintou*. Both move about on plants and eat shoots, leaves, fruits and bugs and usually don't leave the trees so as to shun their enemies.

(Note 2) These include the *Chiomantes obtusifrons*, which were found for the first time in Taiwan, and *Neosarmatium fourmanoiri*, which appeared for the first time in KTNP.

(Note 3) *Mictyris brevidactylus*, or soldier crabs, live on tidal flats.



1-2. 陸蟹的研究調查雖冷門，但劉烘昌與研究團隊仍堅守著熱忱，為陸蟹的保育之路持續奮鬥 / 圖1 劉烘昌提供，圖2 墾管處提供)

The research on land crabs are not in popular demand, but Liu and his team still insist on fighting for the conservation of land crabs with enthusiasm. / Photo (1) provided by Hung-chang Liu, Photo (2) by KTNP

3. 墾管處於從2003年開始，每年暑假皆會舉辦陸蟹的保育活動，讓民衆實際體會珍貴的生態意義 / 墾管處提供 KTNP has held activities every summer to promote the conservation of land crabs since 2003. The activities aim to let the public experience how precious these creatures and ecologies are. / Photo provided by KTNP

1. 螃蟹和陸蟹有何不同？

廣義來說，只要能在陸上維持一定活力，包括在潮間帶及內陸生活的螃蟹，都叫陸蟹。最狹義的陸蟹定義則專指「地蟹科」蟹類。至於劉烘昌研究上的習慣是把居住在陸地上，但日常活動不受潮汐影響的種類；亦即住在高潮線以上，包括海岸林及內陸森林裡的螃蟹稱為陸蟹。

2. 為何研究陸蟹須多在半夜出動？

除了沙岸潮間帶的招潮蟹、大眼蟹、股窗蟹以外，一般陸蟹大多是夜行性，在夜晚時才外出活動。因此要進行行為的觀察等研究都必須要在夜間進行。海岸林陸蟹一般在潮濕的夜晚即會出來活動，因此只要晚上出門即可，不用在半夜出門。但若是研究紫地蟹、奧氏後相手蟹這兩種蟹類的繁殖，由於其在凌晨釋放幼蟲，就必須要在半夜出門。又如果研究岩礁海岸潮間帶的蟹類就必須配合潮汐，若乾潮時間在半夜，就必須在半夜出門。

3. 環境氣候的變遷帶給螃蟹的影響與改變？

氣候變遷到底將帶給螃蟹什麼影響目前沒有人切確知道。劉烘昌的觀點如下：

A：氣候變遷影響蟹類的棲地：氣候變遷使各種氣候災難變得更嚴重。在劉烘昌的個人研究中，發現在2000年之前的香蕉灣海岸林茂密繁盛，然後出現的強烈颱風、劇烈鹽霧，使海岸林樹冠層變為稀疏。陽光可直射海岸林下，導致海岸林下濕度降低，林下灌叢減少，陸蟹數量也逐漸降低。另外內陸的陸蟹棲地也因洪水及土石流而受到破壞，使得溪流型陸蟹數量減少。

B：氣候變遷改變陸蟹地理分佈：暖化使熱帶型的陸蟹往北分佈。例如這幾年在台灣發現到的幾種熱帶招潮蟹、新脹蟹及相手蟹，其在台灣的分佈有愈來愈北的趨勢。不過此地理分佈改變因為缺乏過去的詳細調查數據，所以我們目前無法確認這些蟹類是原本在台灣就有，還是因為這幾年的氣候變遷導致其分佈往北擴增至台灣。

4. 根據國家公園法第13條規定：

「不可帶走任何生物資源」，民眾只要捕抓螃蟹，一旦被員警查獲，可累積開罰，最高處罰緩1萬5,000元，並依「竊取國有物」移送法辦。(檢舉電話：08-8861331 墾丁國家公園警察隊)



林投蟹正在吃榕樹類植物的果實。林投蟹平常棲息在植物上，非必要不下地 / 劉烘昌提供
Scandarma lintou is eating the fruits of Marabutans plants. It usually perches on the plants and only goes down to the land when necessary. / Photo provided by Hung-chang Liu



陸蟹有多種繁殖方式。台灣特有種黃灰澤蟹，直接孵出小螃蟹，不需到海邊釋卵，可生活在較內陸 / 劉烘昌提供
Land crabs have various ways of reproduction. Take Taiwan's endemic species *Geothelphusa albogilva* Shy Ng and Yu for example. It directly hatches its baby crabs without laying any eggs at the seaside, so they can live more deeply inland. / Photo provided by Hung-chang Liu

1. What's the difference between crabs and land crabs?

In a broader sense, crabs that live on tidal flats and on land are land crabs, while a narrow definition equates land crabs with those in the Gecarcinidae family. In Liu's definition, land crabs are terrestrial crabs living above the high water mark and in coastal forests and land forests.

2. Why do land crabs act mostly at night?

Except for fiddler crabs, *Macrophthalmus* and sand bubbler crabs, most land crabs are nocturnal. As a result, observation of these creatures has to take place during the night. In particular, *Gecarcoidea lalandii* and *Metasesarma aubryi* lay their eggs in the dead of the night, so observation of them has to be carried out during midnight. Furthermore, observation of crabs living on tidal flats of rocky coasts has to be conducted in accordance with the tidal flows.

3. What is the impact of climate change on crabs?

It still remains unknown as to what impact climate change could bring to crabs, but Liu's points are as follows:

A: Impact on the crab habitat: climate change aggravates all kinds of natural disasters. Liu's research revealed that coastal forests of Banana Bay were dense and thick prior to 2000, but strong typhoons and sea fogs thereafter thinned out the forests, exposing the coastal forests to direct sunlight and causing the moisture content to drop, which has led to a gradual decrease in the bushes and then in the number of land crabs. In addition, the habitats of land crabs have also been damaged by floods and debris flows.

B: Climate change has changed the geological distribution of land crabs: it seems that more land crabs such as fiddler crabs, *Neosarmatium meinerti* and *Lithoselatum pulchrum* now can be found in northern Taiwan. However, the lack of previous research and data means the claim can't be fully supported, as no one can be sure as to whether these crabs have already been in existence in northern Taiwan or spread into the area due to climate change.

4. Article 13 of the National Park Law describes:

"No living thing may be taken out of the national parks." Anyone caught capturing land crabs will be fined up to NT\$15,000 and prosecuted for the theft of national property. (Complaints line: 08-8861331, Kenting National Park Police.)

簡介 *Profile*

劉烘昌 Hung-chang Liu

現任靜宜大學生態學系助理教授，專長為甲殼類生物學、生態學。長期投入冷門的陸蟹研究，多年來陸續發表許多新種及新紀錄種陸蟹及陸蟹生態研究報告。

Liu is the assistant professor of the Department of Ecology at Providence University. He specializes in Crustacean Biology and Ecology. Though the researches of land crabs are not in popular demand, he has invested most of his lifetime in it and has published many reports about new breeds of crabs and crab's ecology for many years.

