A Giant Exotic Speckled Longfin Eel (*Anguilla reinhardtii* Steindachner, 1867) Captured from the Sun Moon Lake

日月潭大型外來魚種寬鰭鰻發現紀要

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Abstract

A giant speckled longfin eel (*Anguilla reinhardtii* Steindachner, 1867) measuring 175 cm and weighing 18 kg was captured from the Sun Moon Lake of Central Taiwan on 23 January 2008. This was the first record of this exotic species from inland waters of Taiwan, and the largest of the kind outside its native ranges of New Guinea and East Australia. Probably, this eel was one of the live eels imported from Australia and sold as the mottled eel (*Anguilla marmorata*) in Taiwan. It was released to the lake for religious belief, or escaped from aquarium or restaurant. Finding this giant exotic eel in the natural inland waters raises a concern on the requirement for strict regulation of commercial importation of exotic fishes to Taiwan.

摘 要

2008 年 1 月 23 日，1 尾體長 175 cm、體重 18 kg 的大型外來魚種寬鰭鰻 *(Anguilla reinhardtii* Steindachner, 1867) 在台灣中部的日月潭被當地民眾釣獲，這是台灣天然內陸水域的新紀錄種，也是在寬鰭鰻原產地新幾內亞和澳洲東岸以外區域所發現的最大個體。顯然地，該個體應是人爲自澳洲活體引進台灣，欲以保育類魚種鱸鰻 (*Anguilla marmorata*) 名義販售，後來因宗教放生行爲，或是由養殖場及當地餐廳逸逃進入日月潭。大型外來魚種寬鰭鰻在台灣天然內陸水域出現，顯示加強外來種魚類商業輸入相關管制措施應受到更多的關注。

Key words: speckled longfin eel, *Anguilla reinhardtii*, Taiwan

關鍵詞：寬鰭鰻、台灣

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In the early morning of 23 January 2008, about two weeks before the celebration of Chinese New Year of Golden Rat, Mr. Kou-Ong Huang, who resided in Kaoshung and returned to his native village of Toshe for vacation, operated a long-line fishing in the waters near the public pier in the Ghei-yah Bay of Sun Moon Lake. The long-line fishing was set two days earlier by his cousin Mr. Yehn-Nin Huang who resided in Toshe. The long-line had 50 Number-6 hooks; each with a 1.2m Number-10 (15 lb) line, tied to a 150m 40 lb main line at intervals of 3m. Loach was used as the bait. The target fish was the top-mouth culter (*Culter alburnus*), the largest carnivorous cyprinid fish locally known as “president fish”. It was considered as a delicacy by local people with a market price of about NT$800.00/kg (equivalent to about US$25.00/kg).

That morning, however, the fish that was caught was unexpected. When Mr. Huang pulled up the line, he hooked up a giant freshwater eel that he had never seen before. He struggled for nearly an hour but failed to land it into his fishing boat. He called his friend Mr. Chia-Lung Lieu for help. They eventually managed to land the eel into the boat using a large dip net (2 feet in diameter). They roughly measured the eel to be 178 cm long. They tried to remove the hook from the mouth, but due to too much bleeding, they cut the line and left the hook inside the mouth. They brought the eel to the Mr. Kuo-Tai Huang’s (eldest brother of Mr. Kou-Ong Huang) house in Toshe, and kept it in an old small steel boat (about 8 feet long) filled with water.

At first sight they thought they caught a monstrous Japanese eel (*Anguilla japonica*),

locally known as “white eel”. They were surprised and wondered whether the eel was a monster or “the Spirit” of the lake. We heard that next morning one of the brothers went to the fishing site and offered incense and paper money to the gods of the lake.

The news of the monstrous eel from the Sun Moon Lake spread. Some one offered NT$ 40,000.00 (US$ 1,300.00) to buy it, but the offer was rejected. On 13 February 2008 Mr. Kuo-Tai Huang telephoned us and expressed the wish of the three brothers to donate the eel to the Endemic Species Research Institute for research and educational purposes.

On 16 February 2008 we went to Mr. Huang’s house to meet the three brothers. The eel was still in the old steel boat, lying down quietly on the bottom of 6 inch deep muddy water. Occasionally, it turned its body upside down with the white belly upward. The hook was still in the mouth cavity, and about 10-inch long line came out from its right gill opening. One of the brothers mentioned that the eel often made the body upside down, but it would turn to the normal posture with a small touch. We took the water quality in the boat: pH 6.4, water temperature 15.3°C, DO 6.5 mg/l and conductivity 166.3 μs/cm. We removed a small piece of the tip of caudal fin for DNA analysis. We accepted the eel from the brothers with our gratitude, transferred the eel into a 50-gallon tank, and brought it to the institute. The eel had been kept in the small boat for 26 days. They said that they put minnows and loaches in the boat, and the eel apparently ate them.

At the institute, the eel was kept in a 600-gallon circular fiberglass tank (160 cm in diameter) provided with flow-through water at the depth of about three feet. The water temperatures were 13.9-19.3°C, and water qualities were pH 7.5-8.3, DO 6-8.3 mg/l, and conductivity 394-423 μs/cm. Ten large loaches, each about 15 cm, were provided as the food. The eel showed no appetite. The 24-hour continuous observation was conducted with the CCD monitoring system.

It was intended to anesthetize the eel to remove the hook, but the eel was so weak that the hook removal operation was postponed. Each day, the eel lay down on the bottom and often turned its belly upward, the same behavior observed at Mr. Huang’s house. There were injury and inflammation on the pectoral fin base and right gill opening area, so that the right pectoral fin extended outside with little movement, unlike that of left pectoral fin. The operculum ventilation rate was about 18/min.

On 21 February the hook was found in the tank; apparently the lesion at the hooked area had spoiled, so that the hook was automatically separated from the injury area and pushed out of the gill opening by the oral ventilation. The eel showed some improvement; the right pectoral fin moved like that of left one, but the eel still showed no appetite. It lay down on the bottom often with the belly upward, an unhealthy sign for the fish.

On 25 February a fungus infection was observed on the dorsal skin, particularly in the predorsal area where there were some skin lesions. The eel still showed no appetite. The operculum ventilation reduced to about 8/min, often with the belly turned upward. It died at 08:00 am, 3 March 2008.

After death, its picture and the x-ray were taken (Fig. 1). Also, some measurements were taken. They were total length 175 cm, weight18 kg; head length 7.44, body height at dorsal origin 8.79, preanal length 2.26, predorsal length 3.06, distance between gill opening and dorsal origin

5.04, and distance between dorsal origin and anus 9.18 in standard length; and snout length 3.09, mouth length 3.47, suborbital length 3.58, interorbital width 3.56, and eye diameter 15.85 in head length. The number of vertebrae was 110. The DNA sequence obtained was compared to those of the known species of freshwater eels obtained from GenBank. Based on the DNA analysis and morphometric characters, the eel was identified as the speckled longfin eel (*Anguilla reinhardtii* Steindachner, 1867), native to New Guinea and East Australia (Allen 1989). Morphologically, *A. reinhardtii* is distinguishable from the native eels, *A. japonica* and *A. marmorata*. *A. reinhardtii* has the number of vertebrae 104-109 and the origin of dorsal fin closer to anus than the origin of pectoral fin base, whereas *A. japonica* had the number of vertebrae 112-119 and *A. marmorata* has the origin of dorsal fin closer to the origin (Ege 1939; Tzeng and Tabeta 1983; Watanabe *et al*. 2005).

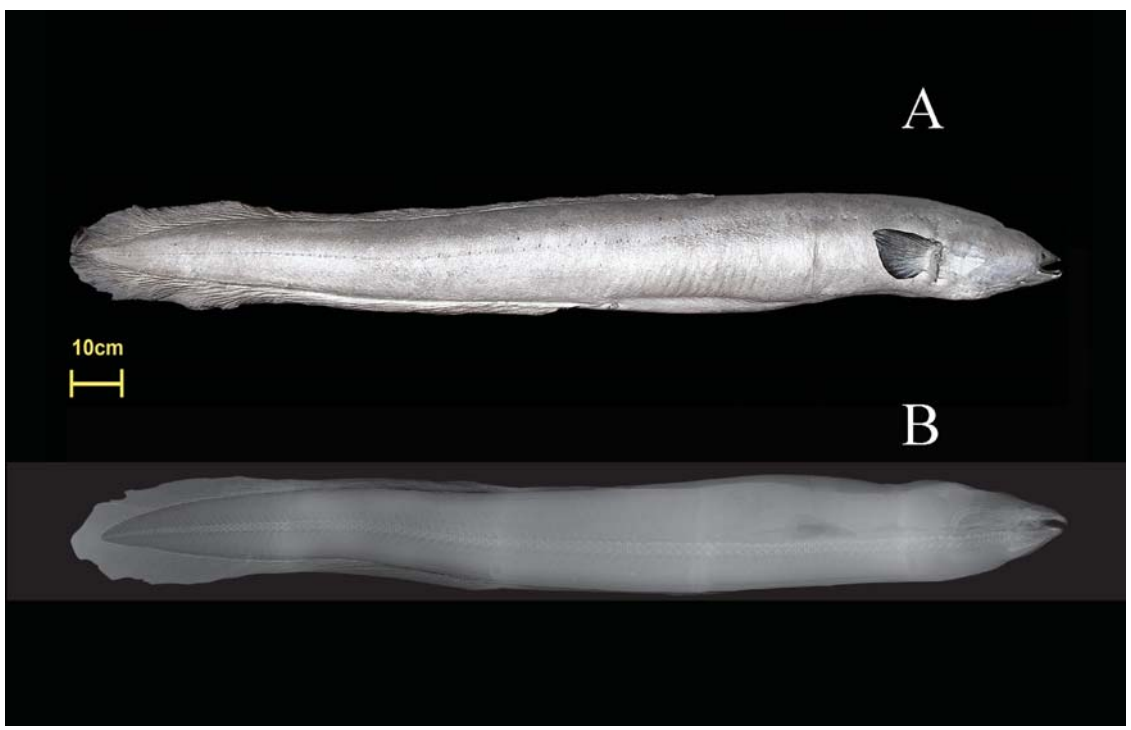

Fig. 1. Lateral view (A) and x-ray (B) of the giant speckled longfin eel (*Anguilla reinhardtii* Steindachner, 1867) caught from the Sun Moon Lake.

It is interesting to note that the eel had light blue dorsum like that of *A. japonica*, unlike mottled dorsum described for *A. reinhardtii*. This made us feel that *A. reinhardtii* has the mottled dorsum like *A. marmorata* when young and becomes plain blue color like *A. japonica* when old. Such shift in coloration with ages needs further observation.

The maximum size of *A. reinhardtii* that has been reported was 200 cm for male (Merrick and

Schmida 1984) and 158 cm for female (Kailoia *et al*. 1993). The maximum weight reported was 16.3 kg (Merrick and Schimida 1984) but they might grow up to 22 kg. The eel from the Sun Moon Lake was not the largest of the species in the world. However, it was the largest eel reported from the inland waters of Taiwan and also the largest of the species found outside its native range.

There were two unreported preserved specimens of the speckled longfin eel at the Institute of Fisheries Science of National Taiwan University. They were purchased in March of 2003 at a local bazaar near the Shumun Reservoir in the northern Taiwan. They were sold as the mottled eel (*A. marmorata*) captured from the reservoir. Recently we observed that the giant speckled longfin eels were often sold at local bazaars in the towns of Shuili and Rokan. They were sold as the mottled eels claimed to be caught from local rivers or reservoirs. It seems that the two preserved specimens at the National Taiwan University were more likely the ones imported from Australia or cultured in Taiwan rather than ones actually caught from the natural waters of Taiwan.

In addition to the exotic speckled longfin eel, six mature females of exotic American eel (*Anguilla rostrata*) with the ovaries fully grown were caught from the Kaoping River from July 1999 to February 2001 (Han *et al*. 2002). It has been known that the American eel and European eel (*Anguilla anguilla*) had been imported for the eel cultures in Taiwan as early as the 1970s. In 2008 African eel *Anguilla mossambica* was also imported for the culture in Taiwan. This made the total of four exotic eels (American eel, European eel, Australian speckled longfin eel and African eel) on the list of Taiwanese eel cultures. Of them, American eel and Australian speckled longfin eel have been found in the natural inland waters. The speckled longfin eel is a tropical eel that may well adapt to live in the open waters of Taiwan. In Australia, it spawns all the year round (Shen and Tzeng 2007). Besides the above four species of the cultured exotic eels, there are four species of the native freshwater eels in Taiwan, *A. japonica* Terming & Schlegel, *A. marmorata* Quoy & Gaimard, *A. celebesensis* Kaup and *A. bicolor pacifica* Schmidt (Tzeng and Osame 1983).

In Japan, the European eel was imported for the eel culture in the 1970s and have been found to escape to natural streams (Miyai *et al*. 2004; Okamura *et al*. 2008). It grew fast in the wild (6.3 cm/year), became mature, and migrated downstream with Japanese eels to the sea. This has raised a concern for their possible hybridization that would affect the Japanese eel resources in Japan (Miyai *et al*. 2004).

The capture of this giant exotic speckled longfin eel in the Sun Moon Lake and American eels in the Kaoping River (Han *et al*. 2002), raises concern for the requirement of more strict regulation on commercial importation of exotic fishes for marketing and culturing in Taiwan.

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