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Lethal Lesions Caused by Propeller Cuts on the Endangered Green Turtle *Chelonia mydas* on Liuchiu Island, Taiwan

Tsung-Hsien Li[1, 2, 3], Po-Yu Wu[1], I-Chun Chen[1]

ABSTRACT

Background: Green turtle (*Chelonia mydas*) is the most common sea turtle species in Taiwan. The coastal waters of Taiwan are known to contain foraging grounds for green turtles. Boat strike has been identified as the most common causes of sea turtle mortality in several sea turtle habitats worldwide. However, no relevant studies have investigated wild green turtles with boat strike injuries in Taiwan. In this field study, we conducted morphometric characteristics of 6 endangered green turtles (*C. mydas*) with boat strike injuries in Liuchiu Island of Pingtung County, Taiwan. This is the first report of its kind on the prevalence of documented boat strike lesions on stranded wild green turtles at their near shore foraging habitat. In 2019, a total of 14 stranded green turtles were dead when first found in Liuchiu Island of Pingtung County, Taiwan. Of these 14, 6 (42.8%) turtles showing evidence of propeller impacts. Conservation strategies including speed limits in key turtle neritic foraging habitats are required to improve their survival in Taiwan.

Key words: Boat speed, *Chelonia mydas*, Endangered species, Propeller strike.

Five sea turtle species have been reported from Taiwanese waters, including the green [*Chelonia mydas* (Linnaeus, 1758)], hawksbill [*Eretmochelys imbricate* (Linnaeus, 1766)], olive ridley [*Lepidochelys olivacea* (Eschscholtz, 1829)], loggerhead [*Caretta caretta* (Linnaeus, 1758)], and the leatherback [*Dermochelys coriacea* (Vandelli, 1761)] turtles. Among the five marine turtle species recorded in Taiwan, the *Chelonia mydas* is the most common species. Green turtles (*C. mydas*) (Ong *et al*., 2019) are widely distributed in tropical and subtropical water. The *C. mydas* has been listed as globally endangered (International Union for Conservation of Nature IUCN 2016) and face many anthropogenic threats such as marine pollution, being caught in fishing nets, poaching, and injuries from boat propellers (Shigenaka 2010; Work *et al*., 2015; Phu and Palaniappan, 2019; Ramakrishnan *et al*., 2022). Boat strike has been identified as the most common causes of sea turtle mortality in several sea turtle habitats worldwide (Denkinger *et al*., 2013). Additionally, in previous mortality research in stranded green turtles in Hawaii and the insular Pacific from Work *et al*. (2015) show that shell trauma of stranded sea turtles was mostly due to boat propeller strike. However, no relevant studies have investigated wild green turtles with boat strike injuries in Taiwan (Ng and Matsuzawa, 2021). Our findings may form a basis and help inform the conservation and management of green turtles in Taiwan.

The stranding network system can provide insight into the environmental stressors causing stranding, arming government with information to mitigate negative impacts. In Taiwan, the Ocean Conservation Administration has established a Marine Animal Rescue Network (MARN) that oversees the rescue of stranded sea turtles and a stranding network system around the nation. Members of the MARN include the Coast Guard Administration, the county government, research institutes (including National Museum of Marine Biology and Aquarium), and local organizations and volunteers. This study included a total of 14 green turtles that were identified through the official reporting system of the MARN during the period from January to December 2019.

In 2019, a total of 14 stranded green turtles were dead when first found in Liuchiu Island of Pingtung County, Taiwan. Of these 14, 6 (42.8%) turtles (Panel A: adult *C. mydas*, Curved carapace length (CCL) = 101 cm; Panel B: juvenile *C. mydas*, CCL = 66 cm; Panel C: juvenile *C. mydas*, CCL = 60 cm; Panel D: juvenile *C. mydas*, CCL = 43 cm; Panel E: *C. mydas*, the life stage could not be determined, CCL was unavailable; Panel F: *C. mydas*, the life stage could not be determined, CCL was unavailable) (Ng *et al*., 2018) had carapace damage (Fig 1) showing evidence of propeller impacts (Work *et al*., 2015; Phu and Palaniappan, 2019).

[1]National Museum of Marine Biology and Aquarium, Pingtung, Taiwan.
[2]Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung, Taiwan.
[3]Institute of Marine Ecology and Conservation, National Sun Yat-sen University, Kaohsiung, Taiwan.

Corresponding Author: Tsung-Hsien Li, National Museum of Marine Biology and Aquarium, Pingtung, Taiwan.
Email: lith@nmmba.gov.tw

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Fig 1: In 2019, a total of 14 stranded green turtles were dead when first found in Liuchiu Island of Pingtung County, Taiwan. Of these 14, 6 (42.8 %) turtles had carapace damage showing evidence of propeller impacts.

The data in this study clearly indicates that boat strikes has an important anthropogenic threat on the Liuchiu Island green turtle population. A paper from Denkinger *et al*. (2013) does show that 16-20% of sea turtles found showed lesions from boat strikes. In Hawaii, 2.5% of green turtles found dead on the beaches during 1982-2003 had been killed by boat strikes (Chaloupka *et al*., 2008). A paper from Hazel *et al*. (2007) show that marine turtles cannot evade boat collisions unless boats would lower their speed to 4 km/h. So far there are no regulations for strict boat speed limits and control in the Liuchiu Island. Liuchiu Island, a coral reef island (22°20′19.12″N 120°22′11.34″E), is an important foraging area for endangered *C. mydas* (Cheng *et al*., 2019; Li *et al*., 2020; Ng and Matsuzawa). This study presents information on boat strike impacts on endangered *C. mydas* in Taiwan that might help increase the public awareness toward boat speed limits in sea turtle habitats.

CONCLUSION

Coastal areas in Liuchiu Island contain major nesting and foraging sites for endangered green turtles. To the best of our knowledge, this short communication provides the first description of the incidence of documented boat strike injuries affecting green turtle populations within Liuchiu Island waters. The anthropogenic threats identified in this study should be considered when developing green turtle conservation strategies.

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Conflict of interest: None.

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