

## SPECIES COMPOSITION OF TORTOISES AND FRESHWATER TURTLES IN NINH THUAN PROVINCE, SOUTHERN VIETNAM

Nguyen Tai Thang, Tran Thi Tuyet Dung, Hoang Van Ha,

Timothy E. M. McCormack, Nguyen Thanh Luan\*

*Asian Turtle Program (ATP) of Indo-Myanmar Conservation (IMC)*

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### SUMMARY

Chelonian diversity of Ninh Thuan province, South Central Coastal Vietnam, is still poorly understood. In this study, we conducted a semi-structured interview survey (2019) in 5 districts of Ninh Thuan province and a 7-day long field survey (2021) in Phuoc Binh National Park, Bac Ai district, Ninh Thuan province, as preliminary surveys to help contribute to current knowledge on the species diversity of tortoises and freshwater turtles in the province. As a result, 11 species of tortoise and freshwater turtle belonging to three (03) families account for 42.31% of the 26 total number of native tortoise and freshwater turtle species in Vietnam are likely to be distributed in Ninh Thuan province based on our findings. Of these, 9 species are threatened with extinction according to the IUCN Red List 2021 at the levels of Vulnerable (VU) (2 species), Endangered (EN) (3 species), and Critically Endangered (CR) (4 species). While 8 are listed in the Vietnam Red Book 2007, 5 VU, 2 EN, and 1 CR. Initial survey results also show that it is likely that the endemic and Critically Endangered Southern Vietnam Box Turtle (*Cuora picturata*) occurs in Phuoc Binh National Park, based on a shell specimen found in the wild for which genetic analysis is pending verification. Further surveys are still urgently needed to confirm *Cuora picturata* and other species in the wild and to better complete the list of tortoise and freshwater turtle species and their distributions within Ninh Thuan province.

**Keywords:** Chelonian, conservation, research, taxonomy, Testudines.

### 1. INTRODUCTION

Vietnam is home to 26 native tortoise and freshwater turtle species (TFT) (Hendrie *et al.*, 2022). Like other biological resources, Vietnam's TFT wild populations are facing a high risk of extinction by trade and habitat loss; 24 of these species are listed as either Endangered or Critically Endangered on the IUCN Red List (IUCN 2022) and 16 of these species are listed in the Vietnam Red Book (VAST, 2007).

Ninh Thuan province is located in the South-Central Coast region, bordering Khanh Hoa province to the North, Binh Thuan province to the South, Lam Dong province to the West, and East Sea to the East. Ninh Thuan has a total natural area of 335,534 ha, of which 83,618 ha is agricultural land; 188,997 ha is forestry land; 2,028 ha is aquaculture land; 3,809 ha is salt production land; 19,512 ha is specialized land; 4,948 ha is residential land; and 5,262 ha is streams and specialized water surfaces; with the remaining land categorized as unused (Ninh Thuan Portal, 2022).

Historical information and research data on turtles in Ninh Thuan province are limited, no in-depth focused studies focused on TFT has

\*Corresponding author: [nguyentuanbio@gmail.com](mailto:nguyentuanbio@gmail.com)

been undertaken. Existing TFT data available has come from broader herpetological surveys. (Nguyen & Nguyen, 2007) reported 4 species of TFT in Nui Chua National Park (NP), Ninh Hai district (*Indotestudo elongata* (Blyth), *Cuora* cf. *amboinensis* (Daudin), *Heosemys grandis* (Gray), and *Amyda ornata* (Gray)), none of which were recorded through specimen observation. Nguyen *et al.* (2009) recorded the *Indotestudo elongata* in Ninh Hai district. Therefore, there are four species of TFT have been recorded in Ninh Thuan province.

### 2. RESEARCH METHODOLOGY

Two surveys were undertaken in Ninh Thuan province in 2019 and 2021: a semi-structured interview method was carried out in all five districts of Ninh Thuan province (Thuan Nam, Tuan Bac, Ninh Son, Bac Ai, and Ninh Hai districts) from the 24<sup>th</sup> – the 30<sup>th</sup> of May 2019 (Figure 1). A field survey was undertaken in Phuoc Binh NP, Bac Ai district, from the 3<sup>rd</sup> – the 10<sup>th</sup> of April 2021 (Figure 1). Geographic coordinates were obtained using a Garmin GPSMAP 64 GPS receiver (Garmin Ltd, Olathe, Kansas, USA) and recorded using the WGS84 datum. The map was produced using QGIS Desktop software (version 3.18.3, <https://www.qgis.org>).

All encountered turtle specimens were photographed and measured using a standardized TFT Field Record Report provided by the Asian Turtle Program (ATP) of Indo Myanmar Conservation (IMC) (available from <https://asianturtleprogram.org/turtle-field-record-form/>). Data from each observed individual including location details, measurements, and photographs were taken and deposited in the database of the ATP/IMC under numbers IMC 3346–3351 and IMC 3621. The shell of one specimen of Southern Vietnam Box Turtle (*Cuora picturata* (Lehr, Fritz, and Obst)) observed in the wild was transferred to Phuoc Binh National Park Fauna Collection.

Three measurements were taken using a dial calliper (SHAN™ 1 – 300 mm, model 186-314S, China) to the nearest 0.1 mm: Vertebral carapace length (VCL), measured down the vertebrae; Middle width of carapace (MidW.Ca), measure the middle part of the carapace; and maximum carapace height (CH, if available), measure the highest part of the carapace. Body weight (P) was recorded to the nearest 1 g using 2500 g Pesola® spring scales (Pesola AG, Schindellegi, Switzerland).

Systematics, common names followed Turtle Taxonomy Working Group (2021). Vietnamese name followed Hendrie *et al.* (2022). Species distribution followed Taxonomy Working Group (2021) and Hendrie *et al.* (2022). Conservation status followed Vietnam Red Data Book (2007) (VNRB) and IUCN Red List (IUCN, 2022).

### 3. RESULTS

Based on the findings from interview and field surveys, we have identified 11 species of TFT of three families that are likely to be distributed in Ninh Thuan province (Table 1, Figures 2 and 3).

#### 3.1. Family Geoemydidae

##### **Southern Vietnam Box Turtle – *Cuora picturata* Lehr, Fritz, and Obst**

*Specimen:* A turtle carapace sample was observed in forest near a hunter camp within Phuoc Binh NP, Bac Ai district on the 5<sup>th</sup> of April 2021 (IMC 3621, Figure 2A, B). This sample is now housed by Phuoc Binh NP Fauna Collection. The specimen consisted of a carapace only, no plastron was present and

scutes with identification markings were absent from the specimen. *Measurement:* VCL = 170.6 mm ( $N = 1$ ); MidW.Ca = 130.6 mm ( $N = 1$ ). *Weight:* P = 185 g ( $N = 1$ ). *Identification feature:* Based on interview survey results, no serrations to the carapace marginals. Shell is yellow-brown, with black stripes. The middle of the shell, vertebrate, has a yellow stripe running its length with black stripes on either side. The posterior of the carapace has intermittent black streaks. The plastron is hinged, able to close completely at the front and rear. The plastron is pale yellow with large black spots on each scute. Based on the location of the recorded specimen, which is a box turtle of the *Cuora* genus, and the surrounding interview accounts for *Cuora picturata* we have tentatively identified this specimen as *Cuora picturata* but are waiting for the results of DNA analysis for confirmation (in progress).

*Distribution:* This is an endemic species in Vietnam and is distributed in south-central Vietnam in Khanh Hoa and Phu Yen provinces (Hendrie *et al.*, 2022). The record for this specimen in Phuoc Binh NP in Ninh Thuan province would be a significant range extension for this very range-restricted and endemic species and would be the first record for the species from a protected area. *Conservation status:* VNRB 2007: Endangered (EN); IUCN: Critically Endangered (CR) (McCormack *et al.*, 2016).

##### **Keel Box Turtle – *Cuora mouhotii* (Gray)**

*Specimen:* One photograph was provided for a specimen from a local hunter in Bac Ai district, who claimed to have caught the animal in Phuoc Binh NP, Bac Ai district in 2021. Another photo was provided by a local hunter in Ninh Hai district in 2021, which contains 13 adult individuals of this species (Figure 3C). All have been confirmed from the wild in Ninh Hai district. *Identification features:* carapace is light brown to yellow, sometimes grey/black. The anterior and posterior marginals of the carapace are serrated with the carapace having three distinct flat surfaces and a raised keel along the vertebral line. The plastron is hinged but does not close completely. The plastron has yellowish colour with large black spots on each scute. The eyes are black, or sometimes reddish orange.

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**Table 1. List of tortoise and freshwater turtles recorded in Ninh Thuan province, southern Vietnam**

No.	Scientific name	English name	Vietnamese name	Conservation status		Observation type		References
				IUCN Red List 2022	VNRB 2007	Specimen observed	Interview information	
<b>I</b>	<b>Geoemydidae</b>	<b>Old World pond turtles</b>	<b>Họ rùa đầm</b>					
1	<i>Cuora amboinensis</i>	Southeast Asian Box Turtle	Rùa hộp lưng đen	EN	VU		X	X
2	<i>Cuora picturata</i>	Southern Vietnam Box Turtle	Rùa hộp trán vàng miền Nam	CR	EN	X	X	
3	<i>Cuora mouhotii</i>	Keeled box Turtle	Rùa sa nhân	EN		X	X	
4	<i>Cuora cyclornata</i>	Vietnamese Three-striped Box Turtle	Rùa hộp ba vạch Việt Nam	CR	CR		X	
5	<i>Cyclemys pulchristriata</i>	Eastern Black-bridged Leaf Turtle	Rùa đất Pul-kin	EN		X	X	
6	<i>Heosemys grandis</i>	Giant Asian Pond Turtle	Rùa đất lớn	CR	VU			X
<b>II</b>	<b>Testudinidae</b>	<b>Tortoises</b>	<b>Họ rùa núi</b>					
7	<i>Indotestudo elongata</i>	Elongated Tortoise	Rùa núi vàng	CR	EN	X	X	X
8	<i>Manouria impressa</i>	Impressed Tortoise	Rùa núi viền	EN	VU	X	X	
<b>III</b>	<b>Trionychidae</b>	<b>Softshell turtles</b>	<b>Họ rùa mai mềm</b>					
9	<i>Amyda ornata</i>	Southeast Asian Softshell Turtle	Ba ba Nam Bộ	VU	VU	X	X	
10	<i>Palea steindachneri</i>	Wattle-necked Softshell Turtle	Ba ba gai	CR	VU			X
11	<i>Pelodiscus variegatus</i>	Vietnamese Softshell Turtle	Ba ba bụng đốm				X	

\*Abbreviation details see in the text



**Figure 1. Map showing interview survey in Ninh Thuan province and field survey location in Phuoc Binh NP**

(See the legend on the map. Map source provided by QGIS produced by IMC/ATP)

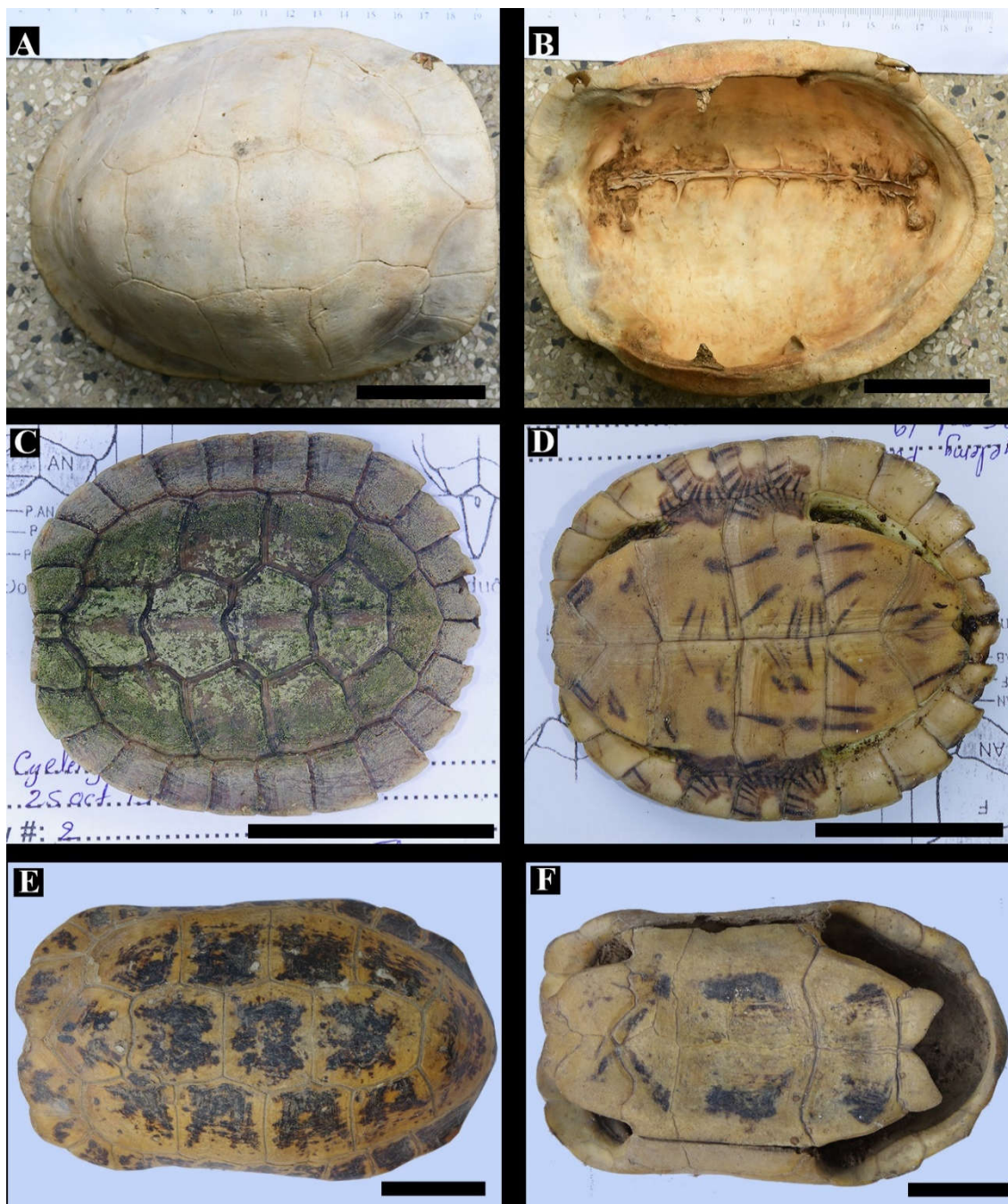
**Distribution:** In Vietnam, this species has been recorded in the North to Khanh Hoa province (Hendrie *et al.*, 2022). Two subspecies of *Cuora mouhotii* are recognised, with the current intergrade believed to be in Quang Tri province (Das *et al.*, 2016, Struijk *et al.*, 2016) with the Southern Keeled Box Turtle (*Cuora mouhotii obsti* Fritz, Andreas, and Lehr) found in the south of this range and the Northern Keeled Box Turtle (*Cuora mouhotii mouhotii*)

found in the North. Elsewhere, this species is known in China, India, Myanmar, and Laos (Turtle Taxonomy Working Group, 2021). **Conservation status:** IUCN: EN (Ahmed *et al.*, 2020).

**Eastern Black-bridged Leaf Turtle – *Cyclernys pulchrestriata* Fritz, Gaulke and Lehr**  
**Specimen:** Five specimens were observed in Bac Ai district, Ninh Thuan province (IMC 3346–3347, 3354–3356, all unknown sex,

Figure 2C, D). *Measurement*: ( $N = 5$ ), VCL = 70.4–174.3 mm ( $N = 5$ ), MidW.Ca = 55.4–143.2 mm ( $N = 5$ ); *Weight*: P = 40–820 g. *Identification features*: carapace is usually black to brown with serrations to the posterior. The plastron is yellow, often with short rays on the scutes, adult turtles have a partial hinge but cannot close completely. The head and neck

have alternating orange and yellow stripes. *Distribution*: In Vietnam, *C. pulchristriata* has been recorded from Da Nang city to Ba Ria-Vung Tau province (Hendrie *et al.*, 2022). Elsewhere, this species is found in the eastern parts of Cambodia (Turtle Taxonomy Working Group, 2021). *Conservation status*: IUCN: EN (Timmins *et al.*, 2021).



**Figure 2.** Tortoises and freshwater turtles recorded in Ninh Thuan province. (A and B) *Cuora picturata* dorsal and ventral view of carapace, respectively of IMC 3621. (C and D) *Cycllemys pulchristriata* carapace and plastron, respectively of IMC 3346; (E and F) *Indotestudo elongata* carapace and plastron, respectively of IMC 3349

(Scale bar is 10 mm). Photos by Nguyen Thanh Luan (A, B) and Nguyen Tai Thang (C–F)



**Figure 3.** Tortoise and freshwater turtles recorded in Ninh Thuan province (A) *Amyda ornata*. (B) *Manouria impressa*. (C) A photo provided by a local trader in Bac Ai district showing three species were keeping in his house including (1) *Cyclemys pulchristriata*, (2) *Cuora mouhotii*, and (3) *Indotestudo elongata*. Photos by local people (A and C) and Phuoc Binh NP staff (B)

### 3.2. Family Testudinidae

**Elongated tortoise – *Indotestudo elongata*** (Blyth)

**Specimen:** Six specimens were observed in local houses in Thuan Nam and Ninh Hai districts (IMC 3348, a juvenile; IMC 5349–3353, four males. Figure 2E, F). **Measurement:** VCL = 111.5 ( $N = 1$  juvenile); 184.2–253.9 mm ( $N = 5$  males); MidW.Ca = 85.5 ( $N = 1$

juvenile); and 115.4–148.0 mm ( $N = 5$  males). **Weight:** P = 260 g ( $N = 1$  juvenile) and 410–1330 g ( $N = 5$  males). **Identification features:** carapace is elongated in shape and without serrations, yellowish with black spots in the centre of each scute. Some individuals have black carapace with light brown margins. The caudal scute is fused into a single scute. The plastron is a mix of yellow with black spots, a

yellow head, and large strong limbs with large horny scales. *Distribution*: In Vietnam, *I. elongata* has been recorded from Ho Chi Minh City to the North (Hendrie *et al.*, 2022). Elsewhere, this species is known from Bangladesh, Laos, Myanmar, Cambodia, China, India, Malaysia, Nepal, and Thailand (Turtle Taxonomy Working Group, 2021). *Conservation status*: VNRB 2007: EN; IUCN: CR (Rahman *et al.*, 2019).

**Impressed tortoise** – *Manouria impressa* (Günther)

*Specimen*: One photograph of an adult individual (unknown sex, Figure 3B) was provided by a staff of the Science Department of Phuoc Binh NP, Bac Ai district. Reportedly observed by Phuoc Binh NP's staff while patrolling near Botany Garden in Phuoc Binh NP. *Identification features*: carapace is a pale yellow to brown or grey, with serrated edges at the posterior and anterior. The dorsal carapace is flat with each scute concaved. The head is a pale yellow to dark grey. Large strong legs with large scales. The plastron is yellowish with some black spots. The two hind legs have two protruding spurs on either side of the tail, so they are often called the three-tailed turtles (Rùa ba đuôi in Vietnamese). *Distribution*: In Vietnam, *M. impressa* has been recorded from Ho Chi Minh City to the North (Hendrie *et al.*, 2022). Elsewhere, this species is from Laos, Myanmar, Cambodia, China, Malaysia, and Thailand (Turtle Taxonomy Working Group, 2021). *Conservation status*: VNRB 2007: EN; IUCN: EN (Rahman *et al.*, 2019).

### 3.3. Family Trionychidae

**Southeast Asian Softshell Turtle** – *Amyda ornata* (Gray)

*Specimen*: One photograph of an adult individual (unknown sex, Figure 3A) was provided by a local hunter in Thuan Nam district, the animal was reportedly collected by local people in Tan Giang Dam, Phuoc Ha commune, Thuan Nam district. *Identification*: reportedly weighing up to 30 kg. The carapace is brown or grey, and smooth when adult. The

anterior margin of shell has very prominent tubercles. The head has a long nose and a yellow pattern, the pattern is very clear in young individuals. The plastron is white or off-white. *Distribution*: In Vietnam, *A. ornata* has been recorded from some provinces in the Central (Binh Dinh and Phu Yen provinces) to the South (Hendrie *et al.*, 2022). Elsewhere, this species is known from India, Cambodia, Laos, Thailand, Brunei, Malaysia, and Singapore (Turtle Taxonomy Working Group, 2021). *Conservation status*: VNRB 2007: VU; IUCN: VU (under *Amyda cartilaginea* (Boddaert)) (Asian Turtle Trade Working Group, 2000).

## 4. DISCUSSION

Based on our findings from this survey we would consider that at least 11 TFT species belonging to 3 families are distributed in Ninh Thuan province. Of these, 6 species were recorded through observation of specimens, including *Cuora picturata*, *C. mouhotii*, *Cyclemys pulchristriata*, *Indotestudo elongata*, *Manouria impressa*, and *Amyda ornata*. Two species of turtles recorded through interviews with strongly supported information include the Vietnamese Three-striped Box Turtle (*Cuora cyclornata* Blanck, Mccord, and Le), and Vietnamese Softshell Turtle (*Pelodiscus variegatus* Farkas, Ziegler, Pham, Ong, and Fritz). Three species have been recorded based on the previous report without clearly information (*Cuora amboinensis*, *Heosemys grandis*, and *Palea steindachneri*). Further research is needed to confirm these species in Ninh Thuan province.

Seven turtles newly recorded for Ninh Thuan province including *Cuora cyclornata*, *C. picturata*, *C. mouhotii* (which is likely to be the *C. m. obsti* subspecies), *Cyclemys pulchristriata*, *Manouria impressa*, *Amyda ornata*, and *Pelodiscus variegatus*.

We consider the range extension of the Critically Endangered and highly range-restricted endemic, the Southern Vietnam Box Turtle (*Cuora picturata*) with this first record for Ninh Thuan province, an approximate range

extension of 50 km south for the species as important. The location of this specimen's shell within the protected area of Phuoc Binh NP, Bac Ai district, would also be the first protected area for which the species is confirmed.

Our key recommendations for TFT conservation within the province would include the completion of additional field surveys to confirm the presence of all species identified within this report. In addition, other species should be considered, such as the Mekong Snail Eating Turtle (*Malayemys subtrijuga* (Schlegel and Müller)) which may occur in some wetland areas within the province. For the Southern Vietnam Box Turtle (*Cuora picturata*) more extensive surveys should be completed focused on this species to determine its relative abundance, threats, and distribution within Phuoc Binh NP and surrounding areas with the site potentially becoming a priority for the conservation of this species.

## 5. CONCLUSION

We would consider the biodiversity of TFT in Ninh Thuan Province as high, with 11 species accounting for 42.31% of the species composition of TFT in Vietnam. With many rare and endangered turtles, there are 9 species listed in the IUCN Red List (4 species listed as CR, 3 species listed as EN, and 2 species listed VU). Eight species are listed in the Red Book of Vietnam 2007 (1 CR, 2 EN, 5 UV).

Initial survey results also show that it is likely that the endemic and Critically Endangered Southern Vietnam Box Turtle (*Cuora picturata*) occurs in Phuoc Binh National Park, based on a shell specimen found in the wild for which genetic analysis is pending verification. Further research is needed to discover other species and confirm uncertain species of TFT in Ninh Thuan province.

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## ĐA DẠNG CÁC LOÀI RÙA CẠN VÀ RÙA NƯỚC NGỌT TẠI TỈNH NINH THUẬN, MIỀN NAM VIỆT NAM

Nguyễn Tài Thắng, Trần Thị Tuyết Dung, Hoàng Văn Hà,  
Timothy E. M. McCormack, Nguyễn Thành Luân\*

Chương trình Bảo tồn Rùa châu Á (ATP) – Tổ chức Indo-Myanmar Conservation (IMC)

### TÓM TẮT

Thông tin về đa dạng khu hệ rùa cạn và rùa nước ngọt ở tỉnh Ninh Thuận, duyên hải Nam Trung Bộ Việt Nam, vẫn còn nhiều hạn chế. Chúng tôi tiến hành một đợt khảo sát phỏng vấn bán cấu trúc vào năm 2019 trên địa bàn 5 huyện của tỉnh Ninh Thuận và một chuyến khảo sát thực địa 7 ngày vào năm 2021 tại Vườn Quốc gia Phước Bình, huyện Bác Ái, tỉnh Ninh Thuận để tìm kiếm thông tin về các loài rùa cạn và rùa nước ngọt. Kết quả, có 11 loài rùa cạn và rùa nước ngọt thuộc ba (03) họ chiếm tới 42,31% tổng số loài rùa bản địa của Việt Nam có ghi nhận phân bố tại Ninh Thuận. Bảy loài được xác nhận là những ghi nhận bổ sung cho tỉnh Ninh Thuận. Trong số 11 loài ghi nhận, 9 loài bị đe dọa tuyệt chủng theo Danh lục Đỏ IUCN ở các mức độ VU (2 loài), EN (3 loài) và CR (4 loài). Theo Sách Đỏ Việt Nam 2007, Ninh Thuận có 5 loài ở tình trạng VU, 2 loài EN và 1 loài CR. Kết quả khảo sát ban đầu cũng cho thấy nhiều khả năng loài rùa hộp trán vàng miền Nam (*Cuora picturata*), một loài đặc hữu và rất nguy cấp có phân bố tự nhiên ở Vườn Quốc gia Phước Bình dựa trên một mẫu mai được tìm thấy ngoài tự nhiên trong quá trình khảo sát thực địa. Tuy nhiên, để xác nhận kết quả này cũng như hoàn thiện danh lục khu hệ rùa cạn và rùa nước ngọt của tỉnh Ninh Thuận, việc phân tích di truyền với mẫu mai rùa hộp và các đợt khảo sát trong tương lai là rất cần thiết.

**Từ khóa:** Bảo tồn, Bộ rùa, đa dạng rùa, nghiên cứu, phân loại học.

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