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A new locality of presence for the world's rarest turtle (*Rafetus swinhoei*) gives new hope for its survival

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ABSTRACT

Rafetus swinhoei is the world's most threatened turtle with only two known specimens remaining, with high probability both males. The species is therefore on the brink of extinction and discovering new individuals in the wild is crucial for the survival of the entire species. Despite the almost-extinct status, field research aimed at locating new individuals has been unsatisfactory at least. The present study brings exciting new discoveries in Vietnam about the historical presence of *R. swinhoei* in Vietnam as well as the potential new locality of presence in the wild. We hope these research results will help to accelerate scientific endeavors in order to save *Rafetus* from extinction.

1. Introduction

The Swinhoe's softshell turtle (*Rafetus swinhoei*) is a large softshell turtle (> 160 kg) recorded along large river systems in Vietnam and China (Pritchard, 2005; Pham et al., 2020), and also the world's rarest turtles with only two surviving males being known in Vietnam and China (Pham et al., 2020; Stanford et al., 2018; Stanford et al., n.d.), therefore finding new specimens in the wild is crucial for the survival of the species. Despite significant cultural importance of *Rafetus swinhoei* in Vietnam (Bettelheim, 2012), the species' ecology such as habitat niche and diet is little known (Le Duc et al., 2020; Pham et al., 2020), which, combined with lack of standardized methodological approaches of various researchers and logistical constraints, makes search for new individuals in the wild extremely complicated. Favorite habitat of *R. swinhoei*, based on the previous studies (Wang, Shi, Wen, & Han, 2013) and the results of our own research (Le Duc et al., 2020; Pham et al., 2020), appears to be relatively shallow waters with a muddy bottom and high density of vegetation coverage. Mainly due to its size and diet, *R. swinhoei* might possibly be an apex predator that serves as a keystone species in its habitat, but due to lack of possibilities for observations and studies in the wild, this assumption is not verifiable. This notion only underlines the need to save the species from extinction in order to learn more about this magnificent aquatic turtle.

Since 2018, we have conducted a series of standardized interviews with local fishermen and turtle-hunters across north Vietnam, mainly in the Red River and Da River watersheds (see Pham et al., 2020), in order to:

a) find new evidence for *Rafetus*' potential contemporary presence in the wild, and

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Table 1
Study sites and *Rafetus swinhoei* presence data obtained from an interview survey in December 2019, Vietnam.

Site number	Site name	Location	New or old site	Lat	Lon	Notes
1	Minh Quan Lake	Minh Quan communes, Tran Yen district, Yen Bai Province	old site	21.64367	104.9028	*Rafetus* maybe still present (sighting in October/November 2019)
2	Mong Hoi Lake	Lam Loi commune, Ha Hoa district, Phu Tho Province	old site	21.57958	104.9548	*Rafetus* maybe still present (rumor)
3	Hai Luong Lake	Au Lau commune, Tran Yen district, Yen Bai Province	new site	21.69507	104.836	No historical presence
4	Y Can Lake	Y Can commune, Tran Yen district, Yen Bai Province	new site	21.7349	104.8228	Undetermined softshell turtle spotted 5–7 years ago
5	Goc Gao swamp	Y Can commune, Tran Yen district, Yen Bai Province	new site	21.73876	104.826	No more *Rafetus*
6	Khe Vai Lake	Xuan Ai commune, Van Yen district, Yen Bai Province	new site	21.8166	104.7226	No historical presence
7	Dam Beo swamp	Hoang Thang commune, Van Yen district, Yen Bai Province	new site	21.81612	104.751	No more *Rafetus*
8	Van Hoi Lake	Hien Luong commune, Ha Hoa district, Phu Tho Province	old site	21.58998	104.895	No more *Rafetus*
9	Chiem Lake	Bang Gia commune, Ha Hoa district, Phu Tho Province	new site	21.54559	104.9878	No historical presence
10	Ao Chau Lake	Ha Hoa town, Ha Hoa district, Phu Tho Province	old site	21.5688	105.0126	No more *Rafetus*
11	Tho Xuyen swamp	Tho Van commune, Tam Nong district, Phu Tho province	new site	21.26069	105.2471	- A new skull of *Rafetus* found - Important future conservation habitat
12	Nam Cuong Lake	Noi Quang commune, Tam Nong district, Phu Tho Province	new site	21.33522	105.2543	No historical presence

b) to assess potential future conservation sites based on the historical presence records.

Here we describe some crucial potential presence data obtained through these interviews and report on a new *Rafetus* skull that came from a waterbody previously unexplored by scientists.

2. Methods

In the current study, semi-structured informal interviews were conducted by randomly selecting fisherman and elderly people at 12 different sites (Table 1) that are situated near the lakes and swamps along the Red River in Phu Tho and Yen Bai provinces, Vietnam. These sites covered a narrow part of the Vietnam known range of the species (Fig. 1), but are especially interesting because they have remained virtually unexplored during previous studies devoted to assessing *R. swinhoei* distribution. New study sites were selected based on the *R. swinheoi* preferred habitat characteristics, the main identifier was the presence of large vegetation cover on the water body (e.g. floating grasses, aquatic trees etc.). Four 'old' sites that have confirmed the historical presence of *R. swinhoei* were also included in order to re-assess whether there were any recent sightings of the turtle by local people (Le Duc et al., 2020; Pham et al., 2020; Pritchard, 2012).

The interview questions included:

1) Do you think there were large softshell turtles living in this lake/swamp before?
2) If yes, what is the local name and what are its main characteristics for recognizing the species?
3) How big was the animal in kilograms or shell size?
4) If people did catch it in the past, when (years) have people caught them? Where did they catch? How were they catching large softshell turtles?
5) Have you observed/heard about a large softshell turtle still remaining in the lake/swamp? When? Where? What does it look like?

It should be considered that there are specific names for all the large softshell turtle species in northern Vietnam; in the study area, for instance, *R. swinhoei* is consistently named 'Con Giai' by local people. Although confusions cannot be excluded by some persons, in general hunters and fishers are very well able to distinguish adult *R. swinhoei* from any other turtle species in northern Vietnam based on both morphological and behavioural characteristics (Le Duc et al., 2020; Pham et al., 2020). On the other hand, since the only other sympatric softshell turtle species in the area is *Pelodiscus sinensis*, that never exceeds 4–5 kg, it is clear that no confusion with any other species was possible.

3. Results

The most recent interview survey conducted in December 2019 along the Red River in Yen Bai and Phu Tho provinces took place at 12 different sites (Table 1), eight of which were never visited by researchers before. A total of 31 interviews with local fishermen and elderly people living in the study area were conducted. Among these eight new sites (3, 4, 5, 6, 7, 9, 11 and 12), four sites (3, 6, 9 and 12) reported never having *Rafetus* in the area. Three sites (5, 7 and 11) reported the historical presence of *Rafetus*. Site no. 11 (Tho Xuyen swamp) proved to be of great interest, as a previously undocumented skull of *R. swinhoei* was discovered, making it the first concrete proof of the historical presence of the species in the area. The skull belongs to a *R. swinhoei* specimen caught by a local turtle-hunter in the 1970s, which reportedly weighed around 40 kg (Fig. 2). The median value of *R. swinhoei* weight in Vietnam was exactly 40 kg (Pham et al., 2020). The locality of origin of this skull was previously unexplored by scientists, but our interviews revealed that local hunters and fishers knew very well about the presence of *R. swinhoei* since decades. Interestingly, this

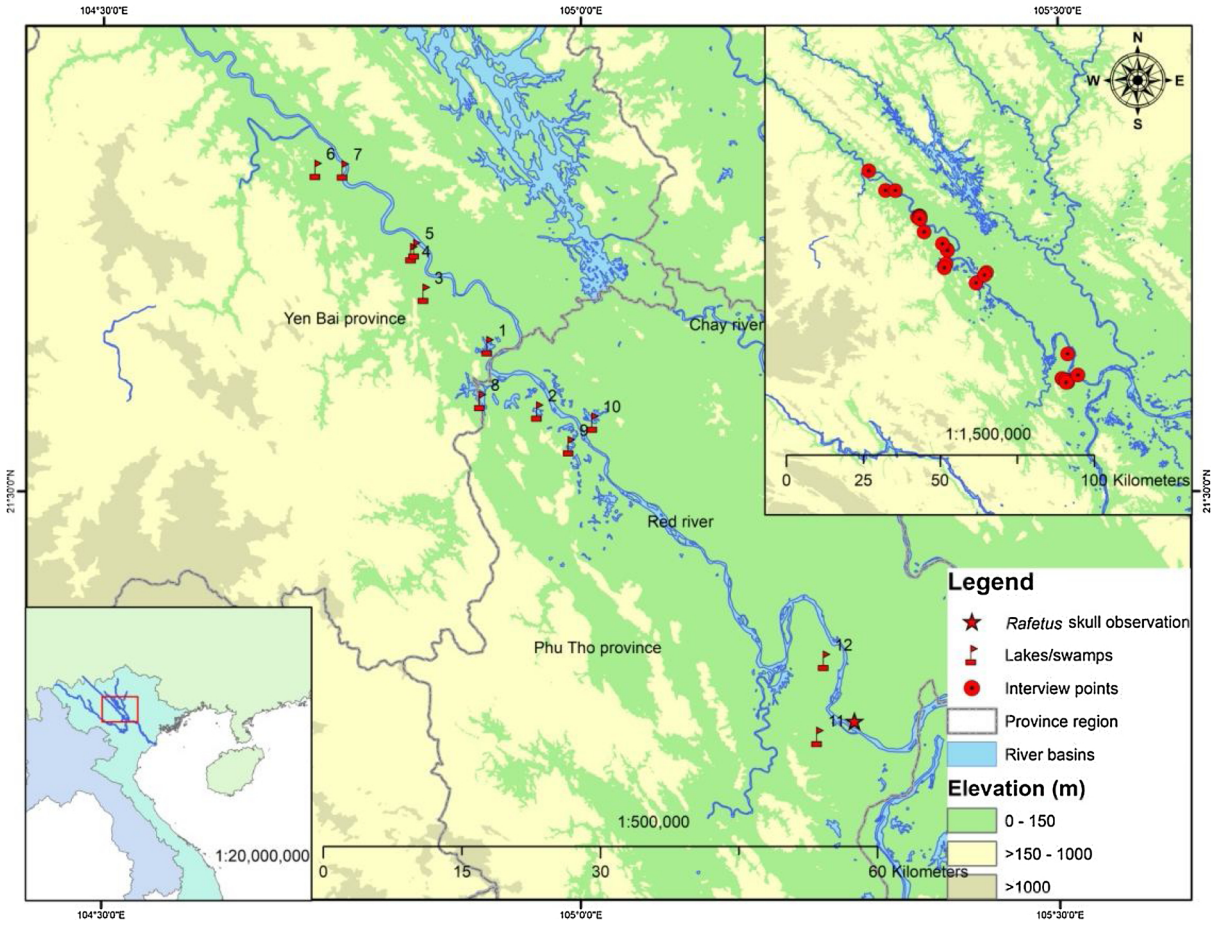

Fig. 1. Map of the study area in northern Vietnam, showing the sites where interviews were conducted and the locality where the skull of *Rafetus swinhoei* was observed.

lake has remained practically unaltered since the time of capture of that individual, with still abundant aquatic vegetation and apparently good ecological conditions for the persistence of the species. Thus, sites 5, 7, and 11 should be a focus of further studies in order to eventually find new living individuals of this semi-extinct species of turtle.

3.1. Recent sightings

Conducted interviews revealed two recent *R. swinhoei* sightings and one instance of a possible presence. 'New' site no. 4 reported sightings of 'Con Giải' (local name for *R. swinhoei*) about 5–7 years ago, and, most importantly, one fisherman at the 'old' site no. 1 claimed to see 'Con Giải' in October or November 2019. Furthermore, two fishermen at the 'old' site no. 2 reported hearing rumors about at least two 'Con Giải' living in the lake, albeit not witnessing the animals by themselves. Based on these reports, a conclusion can be made that there is still a chance to discover *R. swinhoei* specimen in these two areas and further research is urgently needed.

3.2. Future conservation

As mentioned above, our study provided the discovery of a previously unknown skull and of a novel distribution record for *R. swinhoei* in northern Vietnam (Tho Xuyen swamp in Tho Van commune, Tam Nong district, Phu Tho province, Vietnam). Tho Xuyen swamp has an area of about 60 ha, is 3 − 4 m deep with thick muddy layer on the bottom, and features a complex vegetation ecosystem consisting of floating grasses and aquatic trees. Six independent interviewees reported large numbers of 'Con Giai' in the swamp from the 1960s to the 1980s. At least 50 individuals of *R. swinhoei* have been caught in the given period, weighing 20 − 160 kg. Turtles were hunted by local fishermen for local consumption using fish hook lines. According to the unsubstantiated opinion of two interviewees, the disappearance of *R. swinhoei* from the swamp was not caused by excessive hunting, but rather by emigration – interviewees reported that all *R. swinhoei* "escaped" from the swamp to the nearby Red River during floods in the 1980s. Obviously, it is very unlikely that this explanation may be true, as the waterbody is relatively small, and so the hunting pressure was likely the main cause in the disappearance of the species.

Because of the new skull record and the apparently good environmental conditions, Tho Xuyen swamp in Tho Van commune, Tam Nong district, Phu Tho province, Vietnam) should be considered as an important priority site for possible future conservation efforts for *R. swinheoi*, including trapping for the eventual identification of new individuals, eDNA analyses, and also possible in-situ management actions.

Conflict of interest

Authors do not have any conflict of interest related to this research.

Fig. 2. A new *R. swinhoei* skull discovered at Tho Xuyen swamp. Skull has length 16 cm and belongs to a specimen that reportedly weighed 40 kg when caught in the 1970s.
Photo: Olivier Le Duc.

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