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SHORT NOTE
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Diversity and conservation potential of captive chelonian colonies at temple ponds in north-east India

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INTRODUCTION

Temples play an important role in socio-religious activities in north-east India. The rulers of ancient Assam (Kamarupa kingdom), mainly Ahoms (the ethnic group of Assam state), built many temples dedicated to various Gods and their incarnations, including Siva, Sakti, Vishnu, and Surya (Choudhury, 1985). Rivers and water bodies were considered sacred and the digging of ponds and building of reservoirs and dams within the kingdom was regarded by the Ahom monarchs as a sacred duty (Saikia, 1997). Thus, most of the temples built centuries ago in Assam have ponds on their premises (Fig. 1A).

The temple ponds are mainly used by priests for performing rituals, but also act as a means of flood control and groundwater recharge. Furthermore, these temple ponds are focal points for many cultural and religious activities (Agarwal & Narain, 1997). One of the significant religious rituals associated with temple ponds is 'merit release' or 'prayer release'. This ritual, originally an Indo-Buddhist practice, involves releasing wild animals such as birds, turtles, fishes, crabs or even ants for religious and spiritual purposes. This historical practice is also carried out on a large scale in other parts of India and throughout east and south-east Asia (Ahmed, 1997, Liu et al., 2012). In modern practice, it is usually birds and turtles that are released (Shiu & Stokes, 2008). In Indian mythology, turtles are revered as kurma, the incarnation of Lord Vishnu (Shiu & Stokes, 2008; Panigrahy et al., 2002), and are a symbol of stability (Miller, 1974). A traditional belief held by many people is that releasing animals such as turtles in a temple pond and feeding them (mostly with biscuits, and bread crumbs) (Fig. 1B & C), will benefit the creature, and ultimately improve the karma of the releaser and their loved ones and remove potential obstacles from their lives. The release of turtles is also thought to result in the individual and their family living a long life (Shiu & Stokes, 2008; Liu et al., 2012). The tradition of releasing wild-caught turtles into temple ponds has resulted in the ponds acting as a refuge for many turtle species (Purkayastha et al., 2013). A total of 29 chelonian species have been recorded in India, of these 21 species (3 tortoises and 19 freshwater turtles) have been reported from north-east India and are listed in the Supplementary Material.

Figure 1. Temple ponds in north-east India - **A.** Pond of Nagshankar temple, **B.** Devotees feeding biscuits to turtles, **C.** Black softshell turtle *Nilssonia nigricans* with biscuits offerings

In this study, we have updated the inventory of temples housing chelonians and present data on the diversity of chelonians at different temples across north-east India. Moreover, we discuss the role of temple ponds as an important resource for recovering wild populations of endangered species.

METHODS

Temples in the states of Assam, Tripura and West Bengal (India) were surveyed from 1 June 2018 to 30 July 2019, under PCCF (Wildlife) Assam Research Permit vide No: WL/FG.31/Pt/Technical committee 2018 dated 19 May 2018 and Office Order No: 97 dated 16 July 2018. A total of 29 temple ponds (Fig. 2; Table 1) were surveyed extensively. An average of six surveys were conducted in each temple pond during

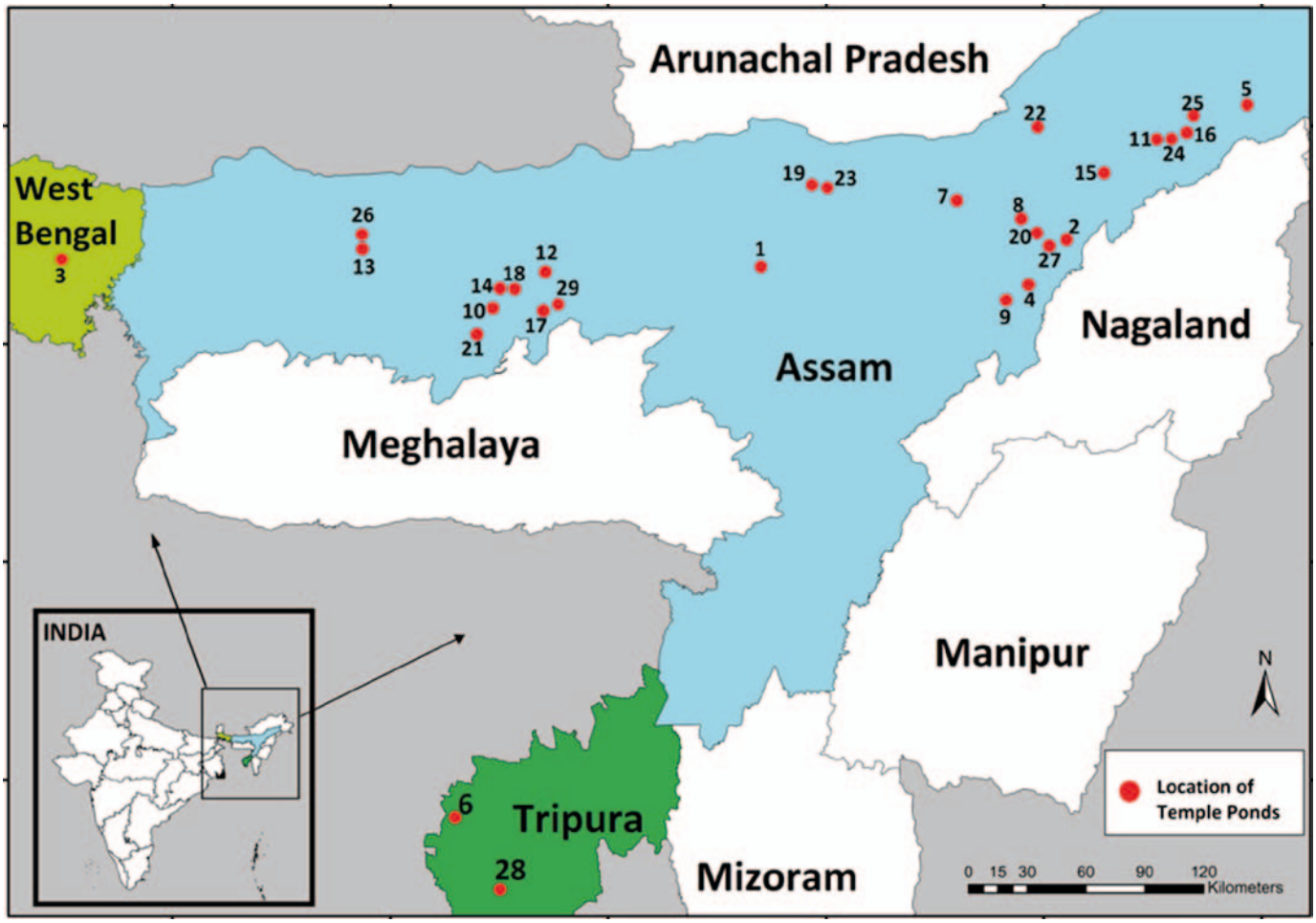

Figure 2. Locations of temple ponds in north-east India surveyed for chelonians, further details of each location are presented in Table 1

the study period. Visual encounter surveys using binoculars (Crump & Scott, 1994) were used to record the turtles present in the mornings (09:00 h to 11:00 h) and in the evenings (17:00 h to 19:00 h). In the case of ponds with extremely large areas, the species of turtle present was determined by showing turtle photos to the local people; the relevant ponds are marked with an asterisk in Table 1. Turtle species were identified following Smith (1931), Ahmed et al. (2009), and Purkayastya (2013). Unstructured interviews were held with 30 male temple committee members in relation to 16 temple ponds and, when available, records of the turtle donations were noted. Devotees offering turtles to the temple ponds were asked about the source of their turtles.

RESULTS

A total of fifteen species of freshwater turtles and one species of tortoise were recorded from the 29 temple ponds (Table 1). Particularly large numbers of different turtle species (9 to 13) were observed in the Haigrib Madhab, Nagshankar, Gorokhiya Gohain Than, and Ugrotara temples. Trionychidae was the most abundant turtle family (52.5 % of species) followed by Geoemydidae (46.8 %). There were wide differences between species in the frequency with which they occurred in temples (Fig. 3). Nineteen of the temples (65.5 %) had *Nilssonia hurum* (Fig. 4B), nineteen (65.5 %) had

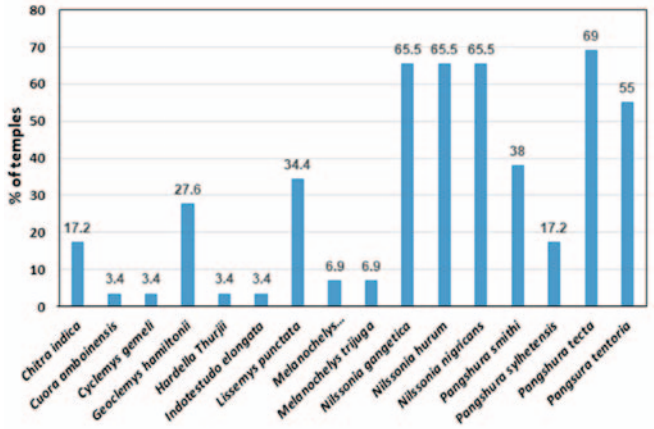

Figure 3. Percentage frequency of various turtle species in temple ponds of north-east India (same species abbreviations as Table 1)

Nilssonia gangetica (Fig. 4C) and *Nilssonia nigricans* (Fig. 4A) and twenty (69 %) had *Pangshura tecta* (Fig. 4F); in contrast the following species *Cuora amboinensis* (Fig. 4O), *Cyclemys gemeli* (Fig. 4N), *Hardella thurjii* (Fig. 4 K) and *Indotestudo elongata* (Fig. 4L) where found in only in 3.4 % of temples.

At the temple ponds, the turtles and tortoises do not receive their natural diet instead consuming food such as biscuits, bread crumbs, wheat balls, puffed rice etc. (Fig. 1A & B). It is likely that this has negative consequences for

Table 1. Temple ponds in north-east India and the chelonian diversity observed in them

	Temple	District/locality	Area m²	Location	Turtle species observed
1	Amlapatty Shiva	Nagaon, Assam	18	26° 21'37.1"N, 92° 42'00.5"E	Lp, Ng, Nh, Ps, Pt
2	Athkheliya Namgarh	Golaghat, Assam	763	26° 28'22.7"N, 94° 05'54.7"E	Nn, Pt, Ptn
3	Baneshwar Shiva	Cooch Behar, West Bengal	5,766	26° 23'53.7"N, 89° 29'53.4"E	Nh, Nn
4	Barokheliya Namghar	Golaghat, Assam	1,680	**26° 15'48.4"N, 93° 55'26.0"E**	**Nn, Pt, Ptn**
5	Bor Pukhri	Siva sagar, Assam	1,121	27° 04'51.9"N, 94° 55'49.7"E	Nh, Ptn
6	Chandan Pukur mandir	Agartala, Tripura	1,275	23° 50'10.4"N, 91° 16'48.0"E	Gh, Lp, Ng Nh
7	Chikan ata Than	Bokaghat, Assam	3,541	26° 39'59.0"N, 93° 36'47.9"E	Ci, Gh, Ng, Nh, Ptn
8	Chinatoli bor Namghar	Golaghat, Assam	56	26° 34'14.6"N, 93° 55'05.0"E	Ci, Ng, Nh, Nn
9	Deopani	Karbi Anglong, Assam	1,920	26° 13'09.3"N, 93° 49'40.8"E	Nn, Pt, Ptn
10	Dhareshwari devalaya	Siliguri , Assam	2,244	26° 10'35.8"N, 91° 28'36.5"E	Ng, Nn, Psy, Pt, Ptn
11	Gauri Sagar*	Siba Sagar, Assam	482,865	26° 56'39.5"N, 94° 32'13.9"E	Lp, Ng, Nh, Ptn
12	Gopeshwar	Guwahati, Assam	3471	26° 19'05.8"N, 91° 42'57.4"E	Ng, Nh, Pt, Ptn
13	Gorokhiya Gohain Than	Sarbog, Assam	3174	26° 29'16.0"N, 90° 52'52.0"E	Ci, Gh, Ie, Mtr, Ng, Nn, Psy, Pt, Ptn
14	Haigrib Madhab	Hajo, Assam	14,693	26° 14'39.9"N, 91° 31'35.2"E	Ca, Ci, Cg, Gh, Ht, Lp, Mtj, Ng, Nh, Nn, Ps, Psy, Pt, Ptn
15	Hatigarh Dewalay	Jorhat , Assam	6,823	26° 46'39.0"N, 94° 15'56.2"E	Nn, Ptn
16	Joy Sagar*	Siba Sagar, Assam	418,404	26° 57'09.7"N, 94° 37'22.7"E	Lp, Ng, Nh, Ps, Pt
17	Kamakhya	Guwahati , Assam	1,102	26° 09'56.2"N, 91° 42'17.8"E	Ng, Nh, Nn, Ps, Pt, Ptn
18	Kedar	Hajo, Assam	792	26° 14'30.6"N, 91° 32'38.5"E	Nn, Ps, Pt, Ptn
19	Madhab	Jamuguri ,Assam	3,026	26° 44'11.2"N, 92° 56'05.1"E	Lp, Nh, Nn, Pt
20	Mandir Devalaya	Golaghat, Assam	1720	26° 30'7.81"N, 93° 58'45.93"E	Nn
21	Mata Chandika Devi Mandir	Guwahati, Assam	62	26° 03'39.6"N, 91° 24'08.8"E	Gh, Lp, Ng, Nh, Ps
22	Monkey	Lakhimpur, Assam	1,252	27° 00'07.2"N, 93° 59'03.2"E	Nh, Nn, Ps, Psy, Pt
23	Nagshankar Mandir	Biswanath, Assam	9,350	26° 43'30.4"N, 92° 59'40.9"E	Ci, Gh, Lp, Mtj, Mtr, Ng, Nh, Nn, Ps, Psy, Pt
24	Rudra Sagar*	Siba Sagar, Assam	326,252	26° 56'59.9"N, 94° 35'01.9"E	Ng, Nh, Nn, Ps
25	Siva Sagar*	Siba Sagar, Assam	448,079	26° 59'30.1"N, 94° 38'00.8"E	Gh, Lp, Ng, Nh, Nn, Pt
26	Sorbhog Station Shiv Mandir	Sarbog, Assam	2,323	26° 29'41.6"N, 90° 53'02.3"E	Lp, Ng, Nh, Pt
27	Srimanta Shankardev Namghar	Golaghat, Assam	1,088	26° 28'0.91"N, 93° 59'59.22"E	Ng, Pt, Ptn
28	Tripureshwari	Udaipur, Tripura	28,748	23° 30'34.2"N, 91° 29'58.9"E	Ng, Nh, Nn, Pt, Ptn
29	Ugrotara	Guwahati, Assam	10,880	26° 11'21.9"N, 91° 45'11.8"E	Cg, Gh, Lp, Ng, Nh, Nn, Ps, Pt, Ptn

Abbreviations used; Ci- *Chitra indica*, Ca- *Cuora amboinensis*, Cg- *Cyclemys gemeli*, Gh- *Geoclemys hamiltonii*, Ht- *Hardella thurjii*, Ie- *Indotestudo elongate*, Lp- *Lissemys punctate*, Mtj- *Melanochelys trijuga*, Mtr- *Melanochelys tricarinata*, Ng- *Nilssonia gangetica*, Nh- *Nilssonia hurum*, Nn- *Nilssonia nigricans*, Ps - *Pangshura smithi*, Psy- *Pangshura sylhetensis*, Pt- *Pangshura tecta*, Ptn- *Pangshura tentoria*. *Ponds with extremely large area, where turtle diversity was recorded by showing photos to the locals.

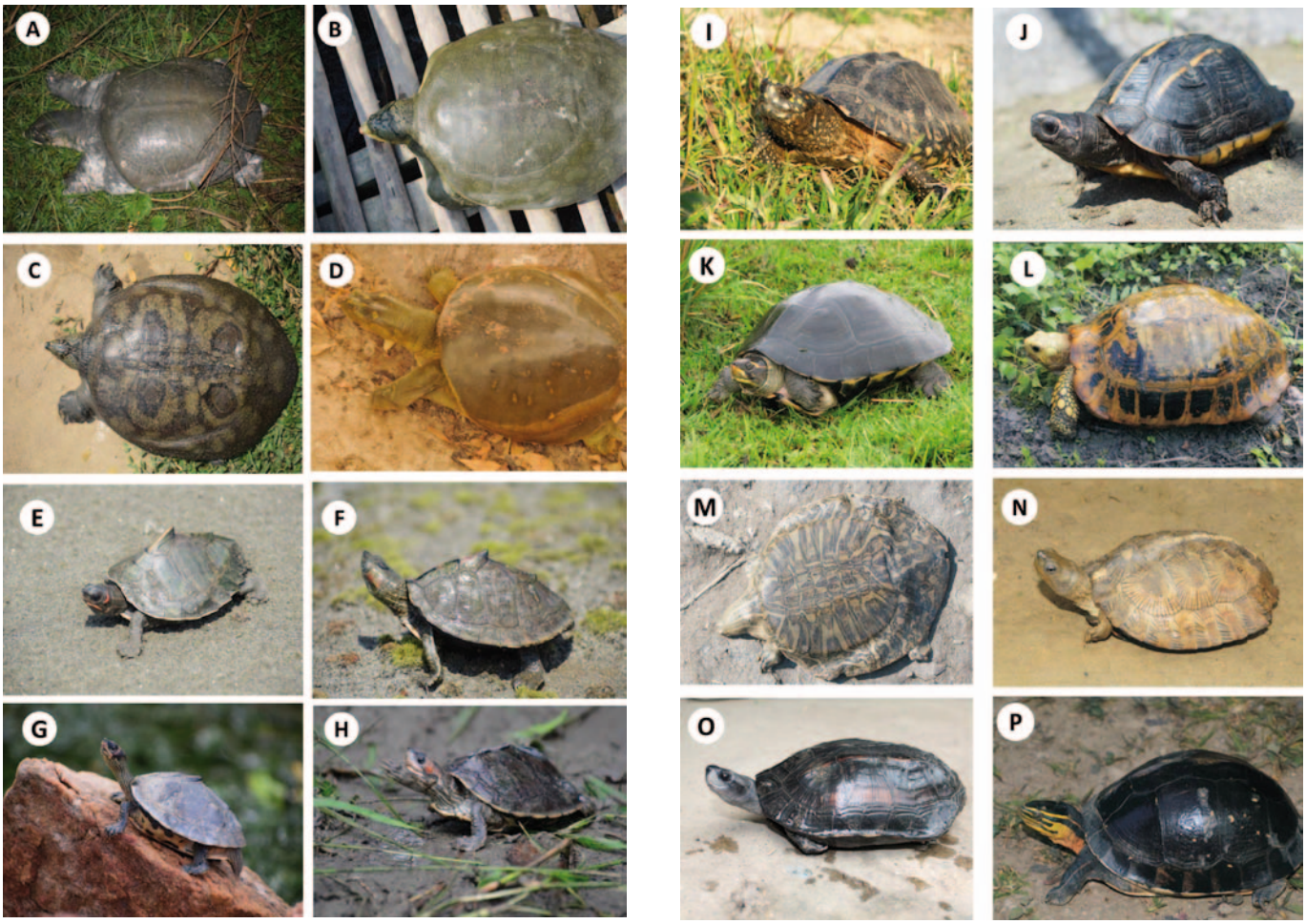

Figure 4. The 16 chelonian species observed during the temple pond survey- **A.** *Nilssonia nigricans*, **B.** *Nilssonia hurum*, **C.** *Nilssonia gangetica*, **D.** *Lissemys punctate*, **E.** *Pangshura sylhetensis*, **F.** *Pangshura tentoria*, **G.** *Pangshura tecta*, **H.** *Pangshura smithi*, **I**. *Melanochelys tricarinata*, **J.** *Geoclemys hamiltonii*, **K.** *Hardella thurjii*, **L.** *Indotestudo elongata*, M. *Chitra indica*, **N.** *Cyclemys gemeli*, **O.** *Cuora amboinensis*, **P.** *Melanochelys trijuga*

their health. Furthermore, this food contaminates these rain-fed ponds which were generally not cleaned regularly, have limited opportunity for oxygenation, and many ponds were found to be littered with large amounts of discarded polythene. In over 70 % of temples, the management committees had made masonry embankments and steps for beautification, to control erosion, and to provide easy access for rituals. Often such concrete embankments had resulted in injuries to the chelonians as they crawled on the cemented substrate or jumped from a steep gradient. Furthermore, in over 50 % of temple ponds there were insufficient basking areas. This is believed to have has an effect on chelonian health, with many suffering from discoloration of the carapace and severe skin infection (Fig. 5A). Most of the surrounding soil of temple ponds is hard clay so that the chelonians find it difficult to dig and lay eggs at a suitable depth. During the survey, some turtle eggs were found to be either laid on inappropriate substrate such as gravel due to lack of sand/nesting areas or depredated by stray dogs and monitor lizards (*Varanus bengalensis*). A few colonies were recorded with unintended hybridization between closely related species of Nilssonia. In spite of sustained efforts by certain environment organisations and individuals, temple committee members appeared to be over-possessive about their turtles and were often reluctant to participate in sustained husbandry, welfare, and conservation recovery programmes.

Informal questions about turtles put to the community members at temple ponds yielded little information about the turtles or their origins. The community only differentiated turtles as either large or small. Half the respondents were aware of turtle attempts to nest near the edges of the ponds. More positively, in the case of two temples (Haigrib Madhab and Ugrotara) there were dedicated caretakers employed to assist with nest translocation and the care of sick turtles. Using knowledge of the status of various temple ponds and their potential for turtle conservation, modest improvements have been made by various non-profit organisations. These have included the construction of basking substrates and sandy nesting banks. Make-shift hatcheries have been developed at Haigrib Madhab, Ugrotara and Nagshankar temples and selected clutches have been translocated to Assam State Zoo/Botanic Garden to increase the survival of neonates. In 2018 and 2019, a total of 12 turtle nests and 252 eggs were protected, and artificially incubated. Consequently, 197 hatchlings (Fig. 5B & C) were released in a protected area of Pobitora wildlife sanctuary (Assam) to supplement the wild populations.

Taken together, the 29 temple ponds surveyed were found to contain 16 of the 21 species of chelonians known from north-east India. These ponds are considered as a repository for some resilient threatened turtles such as *N. nigricans* (Fig. 4A), *Pangshura sylhetensis* (Fig. 4E), *Chitra indica* (Fig. 4M), *Lissemys punctata* (Fig. 4D) whose natural habitats are being destroyed. The five species not found in the ponds were *Cuora mouhoutii*, *Morenia petersii*, *Manouria impressa*, *Manouria emys* and *Amyda cartilaginea*. *Amyda cartilaginea* and both species of *Manouria* are comparatively rare in the area of study and elsewhere, furthermore *C. mahouti* and *M. petersii* are habitat specialists and they may not survive in the captive condition presented by the temple ponds.

Figure 5. Turtles in temples - **A.** Skin discoloration in black softshell turtle *Nilssonia nigricans*, **B.** Turtle eggs being incubated in plastic boxes; **C.** Softshell turtles hatched in the care of temple authorities prior to release into the wild

DISCUSSION

From this study we have found that ponds in temples located close to urban settings, such as Haigrib Madhab temple, Nagshankar temple, Gorokhiya Gohain Than temple, and Ugrotara temple, have greater turtle diversity than those in remote areas such as Mandir Devalaya and Hatigarh Devalaya. The reason for this would appear to be that temples in urban areas are visited by larger numbers of people at times of festivals when a wide range of turtle species are donated to the temples.

We found that local people have a positive religious association with turtles as the incarnation of Gods, these sentiments can be used to the benefit of conservation. While the population of certain species such as *N. nigricans* (Fig. 1C; Fig. 4A) has already been decimated in its natural range, temple ponds actually provide important resources for research on their recovery and conservation in the wild. Furthermore, temple ponds with turtles also provide aesthetic pleasure for the local people, who often feed and watch the turtles (Fig. 1B). This may generate awareness of the need for turtle conservation among the youth and other stakeholders.

The way forward

To enhance the conservation potential of temple ponds in the region requires an inclusive network of all those temples with ponds. This should be established so that temple authorities can learn from, and support, each other in conservation practices. Simple guidelines for monitoring nesting activities and translocating eggs are warranted to ensure maximum survival and recruitment of hatchlings. Hatchlings should be raised to a certain minimum size in enclosures where they are separated from the adults. Larger size of hatchlings on release will ensure better survival rates and also facilitate the attachment of tracking devices that can be used to map dispersal and record survival in natural habitats. Disease monitoring in ponds is urgently required to safeguard turtle populations.

Temple ponds themselves are in need of improvement and to achieve this requires support to temple committees and local communities so that they can play a significant role in strengthening and cleaning temple ponds in association with conservation organizations. Finally, to reduce the capture and illegal trade of turtles, temples should be discouraged from accepting future donation of wild turtles.

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