The Burmese Black Giant Tortoise (*Manouria emys phayrei*) is the largest tortoise in Asia (carapace length [CL] to 600 mm and body mass to 37 kg), occurring from eastern Assam (India) and Bangladesh, eastward into Myanmar and western Thailand, and southwards to the Surat Gap near the Thailand-Malaysia border (Stanford et al., 2015). *Manouria emys phayrei* (hereafter *Manouria emys*) is considered Endangered by the IUCN (provisionally reassessed as Critically Endangered in 2011) owing to widespread poaching for commercial markets in southern China, chronic subsistence harvesting, and habitat loss (Stanford et al., 2015). In common with most range countries, the distribution and conservation status of *M. emys* in Myanmar remain poorly known (Stanford et al., 2015). Historic records are available from the Arakan (now Rakhine) Hills, Moulmein (now Mawlamyaing), southern Tenasserim (now Tanintharyi), and Kachin State (Theobald, 1876; Iverson, 1992). More recently, we documented the occurrence of *M. emys* in the lowlands along the eastern base of the Rakhine Hills (Platt et al., 2001), and in the central Rakhine Hills (Platt et al., 2007). We here present two additional records of *M. emys* from western Myanmar, comment on its conservation status within this region, and provide conservation recommendations.

Our records were obtained in conjunction with Arakan Forest Turtle (*Heosemys depressa* [Anderson, 1875]) surveys of the Chin and Naga hills in western Myanmar (Platt et al., 2013a, 2014b). The western hills (Rakhine, Chin, and Naga hills) of western Myanmar are a contiguous southerly extension of the Himalayas characterized by extremely rugged topography with steep ridges separated by deep, restricted stream valleys (Platt et al., 2010, 2014b). Plant communities consist of tropical evergreen, semi-evergreen, and temperate forests, and bamboo brakes; occurrence of a particular community is determined by a combination of elevation, slope, aspect, and anthropogenic disturbance (Terra, 1944; Platt et al., 2010). Western Myanmar experiences a tropical monsoonal climate with a wet season extending from early June into October followed by a dry season from late October to late May (Terra 1944). The western hill ranges are peopled by a variety of ethnic groups, the most prominent being Chin and Naga; both groups are swidden agriculturalists and hunting plays a central role in their cultures (Carey and Tuck, 1896; Saul, 2005). The physical and human environment of the western hills is described in greater detail elsewhere (Carey and Tuck, 1896; Thom, 1906; Diran, 2001; Saul, 2005).

We conducted fieldwork in the Chin and Naga hills during May-June 2011, February-March and November 2012, February-March 2013, and February-March 2014. Because few roads penetrate the Chin and Naga hills, most of our travel through the region was on foot. At each village along our route we conducted semi-structured, open-ended interviews (Martin, 1995) of knowledgeable persons (e.g., hunters and farmers) regarding the local occurrence and natural history of *M. emys*, *H. depressa*, and other chelonians, harvest methods, anthropogenic utilization, and perceptions of local abundance. We used a photographic guide (Platt et al., 2014a) to facilitate species identification and match vernacular names with scientifically recognized taxa. We also asked to examine any living turtles or shells that might be available in villages. We measured...
straight-line CL and plastron length (PL; measured from base of anal notch) with tree callipers, determined sex on basis of plastron morphology (but see Stanford et al., 2015), and photographed each specimen. On occasion we used local hunting dogs to search for tortoises. Geographic coordinates (India-Bangladesh datum) and elevation (above sea level [a.s.l.]) were determined with a Garmin® GPS76 and place names are in accordance with a national gazetteer currently being compiled. Our methods are fully detailed in Platt et al. (2014b).

We conducted interviews in 79 villages in the Chin and Naga hills during our surveys (Fig. 1A-B). Our informants used several vernacular names to describe *M. emys*. Vernacular names varied among villages, reflecting the diversity of local dialects in the western hills (Platt et al., 2014b), and include *Vee* (= Elephant Turtle) and *Ling Nao* (= Big Turtle), both references to the large body size of *M. emys* in comparison to other cheloniens. In some villages the latter folk name is modified to “Big Land Turtle” to avoid confusion with large softshell turtles that occur in rivers and hill streams of the region (Platt et al., 2012). When describing *M. emys*, villagers often stated the tortoises are so large that children can ride them. The large adult body size of *M. emys* and lack of similar-sized locally occurring congeners make it highly unlikely that informants would confuse this tortoise with any other species.

Village informants provided two specimens of *M. emys* during our interviews. The first specimen was an intact shell (CL = 510 mm; PL = 446 mm; sex = female) we examined in Lower Pai (25.0422°N, 93.2513°E, elevation = 362 m a.s.l.) on 9 November 2012 (Fig. 2A). This tortoise was reportedly captured “about 10 years ago” (ca. 2002) in dense riparian evergreen forest along a stream downslope from the village. We later determined the elevation at the approximate capture site to be 244 m a.s.l. The second specimen was an intact shell (CL = 516 mm; PL = 470 mm; sex = female) we

Figure 1. Map of Chin Hills (1A) and Naga Hills (1B) showing villages visited during wildlife surveys (2011-14). Yellow stars denote villages where specimens of locally collected *Manouria emys phayrei* were examined. Inset shows the location of these areas within Myanmar.
examined in Soe Nay Kanaung (21.3346°N, 93.1650°E, elevation = 606 m a.s.l.) on 18 November 2012 (Fig. 2B). This tortoise was found near the village and although the circumstances surrounding the capture were unclear, it was probably harvested in 2008. To our knowledge these two specimens constitute the first confirmed records of *M. emys* from the Chin and Naga hills, extending the distribution northwards from central Rakhine State, and completing a distributional hiatus between populations in Rakhine State (Platt et al., 2001, 2007) and historic records from northern Myanmar (Theobald, 1876). *Manouria emys* was probably at one time distributed throughout the western hills of Myanmar and these populations were almost certainly contiguous with those in neighbouring Assam, India and the Chittagong Hill Tract of eastern Bangladesh (Rahman et al., 2015).

Without exception our informants agreed that *M. emys* is either extremely rare or extirpated throughout the area we surveyed in the Chin and Naga hills. Informants in Walanpi stated *M. emys* was last seen in the 1960s. Villagers in Kyet Chaung stated their last encounter with *M. emys* occurred about 10 years ago, while residents of Archi Taung last encountered *M. emys* in 2004. Likewise, the specimens we examined in Soe Nay Kanaung and Lower Pai were the only *M. emys* encountered in recent years. Several informants stated that *M. emys* were captured alive “about 25-30 years ago” and sold in Paletwa where a market existed for tortoise meat. Tellingly, the majority of our informants had never observed a living *M. emys*, although most were familiar with the vernacular name of the species. Given that knowledge of even charismatic megafaunal species is rapidly forgotten by communities once they cease to regularly encounter them (Turvey et al., 2010), we speculate the local demise of *M. emys* has been underway for at least 50 years with some individual tortoises persisting until more recently (<10 years ago).

We attribute the decline of *M. emys* in the Chin and Naga hills to chronic subsistence harvesting by indigenous peoples. The Chin and Naga are widely noted for their hunting acumen (Carey Tuck, 1896; Saul, 2005; Aiyadurai et al., 2010) and large body size may render adult *M. emys* especially vulnerable to these skilled huntsmen (see also Platt et al., 2007). Furthermore, in contrast to the largely opportunistic harvest of smaller chelonians, hunters appear to specifically target *M. emys* owing to the large meat yield that can be obtained from a single tortoise (Platt et al., 2007). Given the life history traits of long-lived vertebrates such as tortoises, even minimal levels of harvest would have negative demographic consequences for *M. emys* populations over the long-term (Congdon et al., 1994). Additionally, commercialization of the harvest as indicated by some

Figure 2. Specimens of locally captured *Manouria emys phayrei* examined in Lower Pai (A) and Soe Nay Kanaung (B) villages in the Chin Hills of western Myanmar.
informants would have likely hastened the regional demise of *M. emys* (e.g., Eisenberg et al., 2011; Colteaux and Johnson, 2017). We regard habitat destruction as less of a factor in population declines as extensive tracts of primary and secondary forest remain in many areas of the western hills (Lemigruber et al., 2005). However, because swidden cultivation is widely practiced within the elevational range occupied by *M. emys* (600-1500 m; Stanford et al., 2016) and any tortoises encountered during field clearance are invariably harvested (Platt et al., 2007, 2012), habitat destruction may have played a greater role in population declines than suggested by the current availability of forest cover.

Protected areas are critical to the continued survival of *M. emys* throughout its global distribution (Stanford et al., 2016). Three protected areas encompassing habitat suitable for *M. emys* occur within the western hills of Myanmar (Beffasti and Galanti, 2011): Kyauk Pan Taung Wildlife Sanctuary (132 km²), Natma Taung National Park (722 km²), and Rakhine Yoma Elephant Sanctuary (1755 km²) (RYES) (Fig. 3). However, recent surveys found no evidence for the occurrence of *M. emys* in Kyauk Pan Taung Wildlife Sanctuary, Natma Taung National Park, and their adjacent buffer areas (Platt et al., 2012, 2013b). Furthermore, despite an unsourced statement to the contrary (Stanford et al., 2016), to our knowledge, the occurrence of *M. emys* has yet to be confirmed in RYES. Surveys for *H. depressa* in RYES during 2009 and 2013 failed to detect *M. emys* (Platt et al., 2010, 2014b), and none has been encountered during an on-going (2012 to present) life-history study of *H. depressa* (Hein Htet Lwin, Yangon University, pers. comm.). Admittedly, these efforts have largely been focused on forested habitat at lower elevations (<600 m a.s.l.) and logistical difficulties aside, remote tracts of higher elevation forest in RYES warrant closer scrutiny. Hukaung Valley Wildlife Sanctuary (6371 km²), where a hitherto unknown population of *Manouria impressa* (Günther, 1882) was recently discovered (Saw Htun and Platt, 2016) might also harbour *M. emys*. However, security concerns stemming from an on-going low-intensity military conflict preclude fieldwork in the sanctuary at this time.

Conservation action is urgently required if *M. emys* is to survive in western Myanmar. To this end, we recommend that future conservation efforts for *M. emys* be concentrated on RYES. This large protected area is roadless and penetrated by few trails, located in one of the most sparsely populated regions of Myanmar, and harbors populations of other globally threatened vertebrates (e.g., Asian elephant [*Elephas maximus*]) that are currently the focus of sustained conservation efforts (Platt et al., 2010). Tortoise conservation will no doubt benefit from the protective umbrella of law enforcement activities implemented to safeguard Asian Elephants inhabiting the sanctuary. As a prelude to developing a conservation program, areas of potentially suitable *M. emys* habitat within RYES should be identified and assessed for the presence of remnant populations that would benefit from protection. Additionally, the release of captive-bred offspring into the sanctuary should be given serious consideration, either to reinforce (sensu Seddon et al., 2014) the existing population or restore viable populations if *M. emys* is found to be functionally extinct in the sanctuary. Captive-bred offspring could be sourced from two existing assurance colonies in Myanmar, originally founded with tortoises of local provenance confiscated from illegal wildlife traffickers.
Long-term monitoring will be necessary to determine post-release survival and dispersal and evaluate the success of this strategy. This conservation model has already proved highly successful in restoring the Burmese Star Tortoise (Geochelone platynota [Blyth, 1863]) to protected areas in central Myanmar where the species was extirpated by rampant poaching in the late 1990s and early 2000s (Platt and Platt, 2016). In the absence of targeted conservation action, we consider it likely that M. emys will soon be regionally extinct (if not already so) in western Myanmar.

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