

The extinction-in-progress in the wild of the Barusan Shama *Copsychus (malabaricus) melanurus*

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Unsustainable wildlife trade across South-East Asia has contributed significantly to the extinction threats faced by many songbirds. The Barusan Shama *Copsychus (malabaricus) melanurus*, a highly-prized songster from the West Sumatran Archipelago, is one of the most threatened taxa in Asia's songbird trade crisis, yet its predicament is often overlooked because some taxonomists treat it as a mere subspecies of the widespread White-rumped Shama *C. malabaricus*. Here, we provide the first modern comprehensive assessment of the on-the-ground status of Barusan Shammas across all major islands of the West Sumatran Archipelago based on visual and bioacoustic surveys, mist-netting activity, as well as community interviews covering approximately the last five years. A lack of ornithological field records across many years as well as documented drops in local capture rates indicate that increasing poaching pressure and market value have likely driven the Barusan Shama to extinction in the wild on all islands except Siberut. Even on Siberut, we document a drastic population crash and estimate impending extinction in the wild within perhaps five years in the absence of considerable changes in human behaviour. The decline and presumed extermination of some Barusan Shama island populations was so precipitous that it became evident even within our five-year monitoring period. Although our field efforts and those of others must continue, this bird's future now likely hinges on *ex situ* conservation efforts. The Barusan Shama occurs in four described subspecies, each endemic to its own island group, further complicating conservation efforts. Although the nominate subspecies *melanurus* remains relatively common in captivity on Nias and Mentawai, the other three subspecies are currently known from captive populations of a magnitude of about 100 for *hypolizus*, a handful for *opisthochrus* and zero for *mirabilis*, casting doubt on whether *ex situ* efforts can be initiated fast enough to assure the survival of individual subspecies.

INTRODUCTION

The South-East Asian songbird trade has become one of the major agents of bird extinction in the past decade. Unsustainable poaching of target birds for a constantly growing volume of consumer demand, driven by a combination of long-established cultural practices and a more recent increase in affluence across the region, has led to a precipitous decline and—in some cases—extinction in the wild of native birds, especially in the western part of Indonesia, where these pressures are particularly intense (Eaton *et al.* 2015). In recognition of this growing crisis, the International Union for the Conservation of Nature (IUCN) has set up the Asian Songbird Trade Specialist Group (ASTSG), tasked with devising urgent conservation strategies to facilitate the survival of affected bird species (Lee *et al.* 2016). Much of this songbird trade is targeted at very specific species known for their pleasing vocalisations, with the White-rumped Shama *Copsychus malabaricus* (Plate 1) being one of the most highly valued birds in terms of market price (Chng *et al.* 2015).

Against the backdrop of its vast distribution range reaching parts of Asia minimally affected by the songbird crisis, the White-rumped Shama as a composite species appears secure. However, this species complex exhibits pronounced plumage variability across its range, which has prompted disagreement in taxonomic authorities' treatment of the White-rumped Shama as anywhere between one and five individual species (Rasmussen & Anderton 2005, Clements *et al.* 2007, Eaton *et al.* 2016, Gill & Donsker 2017, Collar & Kirwan 2019). Bioacoustic information, which is otherwise so indispensable in judging species limits in songbirds (e.g. van Balen *et al.* 2013), has been nearly impossible to analyse given these birds' renowned vocal variability even within populations or individuals.

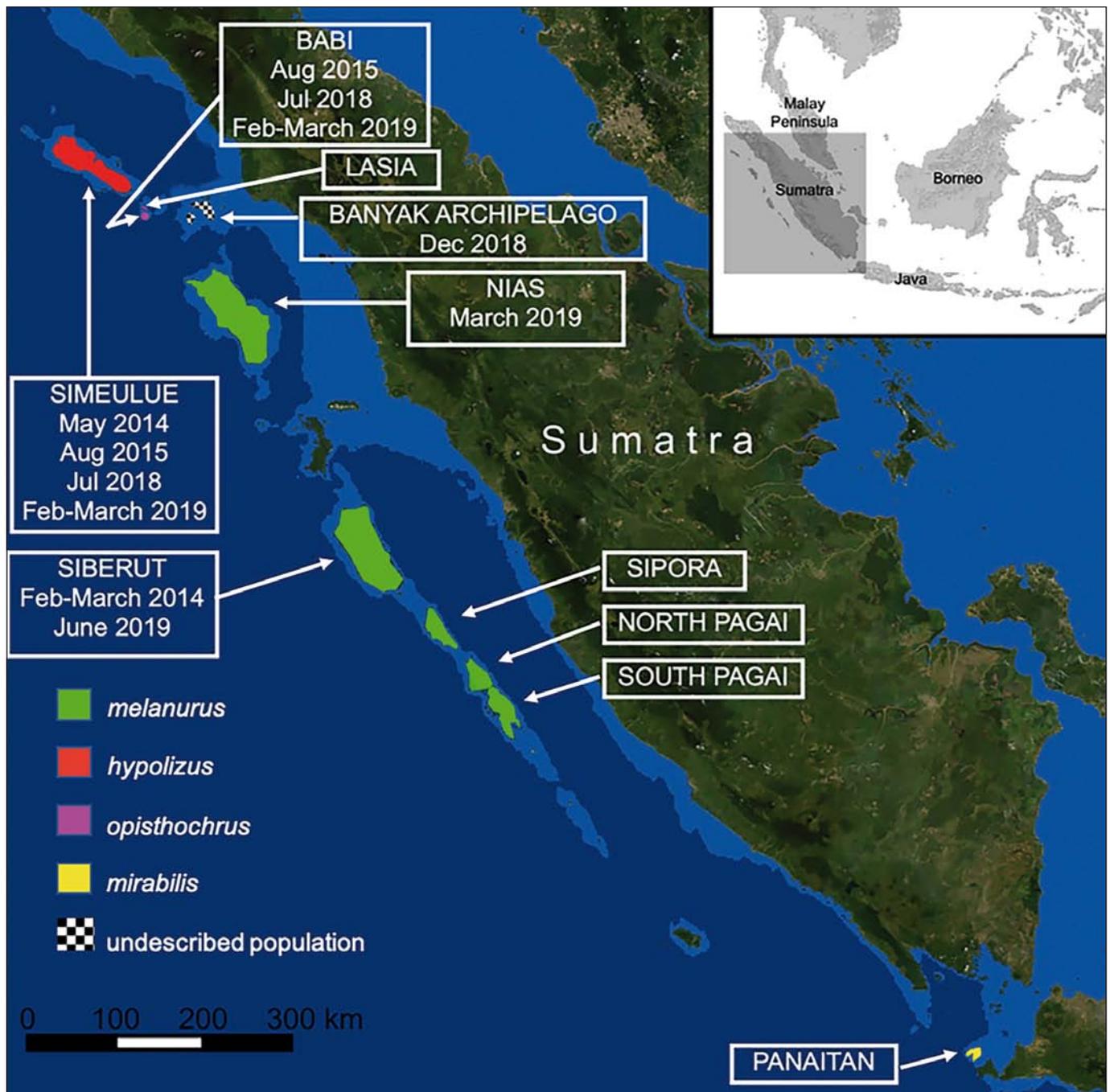
While Birdlife International (2019), following del Hoyo *et al.* (2019), are comfortable with a division of only the Andaman Shama *C. albiventris* as a species distinct from the main Asian form of White-rumped Shama, other experts have recognised up to three additional 'peripheral species' in the west Indonesian archipelago on the basis of strong plumage differences, sometimes in combination with genetic evidence (Eaton *et al.* 2016, Lim *et al.* 2017, Chua *et al.* 2015). Two of these peripheral species, the Maratua Shama *C. (malabaricus) barbouri* and Barusan Shama *C. (malabaricus)*

melanurus, are restricted to small island groups (Eaton *et al.* 2016) and have likely reached critical stages in the endangerment process, whereby their future continued survival in the wild must be in serious doubt. However, given the lack of species recognition by Birdlife International, neither of these two forms are afforded conservation status in the IUCN Red List of Threatened Species (IUCN 2019). Here we follow the taxonomy of Eaton *et al.* (2016).

The present contribution documents the ongoing extinction-in-progress in the wild of the Barusan Shama, a small-island denizen of the West Sumatran Archipelago, also known as the Barusan Archipelago (Eaton *et al.* 2016; Figure 1). Although described as a separate species more than 130 years ago (Salvadori 1887), this shama was soon merged with the widespread White-rumped Shama, and recognition of its distinct plumage sank into oblivion until Eaton *et al.* (2016) re-elevated it to species level. The Barusan Shama's main difference from the White-rumped Shama is its completely black tail. An increase in melanin pigmentation in the tail renders the rectrices sturdier and may be an adaptation to the requirement for increased dispersal capability in these insular populations, as has been shown in other Australasian island songbirds (Uy *et al.* 2009). However, despite its great importance, the all-black tail is not the only difference between Barusan and White-rumped Shammas. Ripley (1944) added much detail to the Barusan Shama's original diagnosis by pointing to its darker red (less orange) underparts and its less pronounced sexual dimorphism. These important differences have been overlooked in more modern plumage-based re-assessments of shama taxonomy that have labeled a split of Barusan Shammas as 'not [being] serious suggestions' (Collar 2004, p.85).

The Barusan Shama has four described subspecies (Eaton *et al.* 2016), each of which differs from one another and from the White-rumped Shama in additional morphological characters: (1) nominate *melanurus* on Nias and presumably on the Mentawai island group (i.e. Siberut, Sipora, North and South Pagai), (2) *hypolizus* on Simeulue, (3) *opisthochrus* on Babi and Lasia, and (4) *mirabilis* on Panaitan (Figure 1). However, not all of these subspecies are universally recognised. Our fieldwork in the Barusan Islands over the last few years has helped gain a better understanding of the field status of each of the different island populations, pointing at their likely extinction in the wild on all islands except Siberut,

Figure 1. Distribution of the four subspecies of the Barusan Shama *Copsychus (malabaricus) melanurus* on the West Sumatran Archipelago (or Barusan Archipelago). Light blue colour of the sea represents water depths of 120 m or less; these regions have been exposed as land in cyclical sea level recessions during Quaternary glaciations, forming repeated land bridges, most recently only around 18,000 years ago. Months and years mentioned below some of the islands reflect the duration of our field efforts on these islands. We label populations on the islands of Siberut, Sipora, North and South Pagai (collectively the Mentawai island group) as nominate *melanurus* although it is likely that these pertain to an undescribed taxon.



where a small remnant population may face imminent extirpation without urgent intervention. The present contribution presents our field data, outlining the extinction-in-progress in the wild of this charismatic bird.

METHODS

Our group has visited islands in the range of the Barusan Shama on eight occasions since 2014 (in chronological order): (1) birdwatching visit to Siberut between 27 February–1 March 2014 (FER, James A. Eaton); (2) birdwatching visit to Simeulue between 10–13 May 2014 (FER); (3) birdwatching visit to Simeulue and Babi between 7–10

August 2015 (FER); (4) birdwatching visit to Simeulue and Babi between 22–26 July 2018 (FER, PB, CYG, Elize Ng, Gabriel David); (5) research visit to Bangkaru Island between 8–11 December 2018 (FER, CYG, PB, TSR, Elize Ng); (6) research visit to Simeulue and Babi between 18 February–8 March 2019 (PB, CYG, TRF, TSR); (7) research visit to Nias between 8–16 March 2019 (FER, CYG, PB, TSR, Haminuddin); (8) research visit to Siberut between 22–29 June 2019 (FER, PB, CYG, RR, Haminuddin).

All visits labeled as ‘research visits’ were carried out as part of a scientific collaboration between Syiah Kuala University (Banda Aceh) and National University of Singapore under RISTEK research permit 312/SIP/FRP/E5/Dit.KI/X/2018. However, we additionally provide information from a number of recreational



KEITA SIN

Plate 1. White-rumped Shama *Copsychus malabaricus interpositus*, Khao Yai National Park, Thailand, 7 January 2020.

'birdwatching visits' with no research objective, which nevertheless add important data points to the reconstruction of the extinction in the wild of individual Barusan Shama island populations.

During 'birdwatching visits', opportunistic birdwatching using standard binoculars was carried out across islands with a view to finding the shama and other island endemic taxa. During research visits, we carried out mist-netting along forest trails, processing and collecting blood samples of captured birds. During each field session, a range of 6–12 mist-nets was erected over a period of 2–3 days at each locality across an area of 1–2 hectares. Mist-nets were opened between 06h00 and 18h00. Mist-netting sessions were always accompanied by birdwatching activity aided by binoculars and playback units in compliance with permit regulations.

Being so highly valued on the local market, Barusan Shammas are well known to all local people on the Barusan Islands. During our visits, locals were frequently asked about the population status of the shama on particular islands or in particular areas within an island. These conversations were purely casual during 'birdwatching visits' but were more systematic and targeted during research visits. On our most recent research visit (trip 8 to Siberut in June 2019, see above and Figure 1), we conducted a video interview (Supplementary Material posted online at <https://www.youtube.com/watch?v=wc6CmQGcWCs&t=232s>) with two of our local helpers who have in the past trapped shammas and are intimately familiar with the field status of shammas on Siberut.

RESULTS

In the following, we report on the findings of our fieldwork regarding the field status of the Barusan Shama on all major islands of occurrence, starting with Simeulue in the north and going southwards. Each of the following chapters refers to what we consider a separate conservation unit.

Simeulue (subspecies *hypolizus*)

Simeulue is the northernmost major island of the Barusan chain. It is a deep-sea island that has not been connected to the Sumatran mainland during Quaternary episodes of low sea levels (Figure 1). This isolation has resulted in unusual levels of endemism for an island its size (2,310 km²; see e.g. Rheindt 2016). Not surprisingly, it is inhabited by an endemic subspecies of Barusan Shama, *Copsychus melanurus hypolizus*, described by Harry C. Oberholser in 1912 in a publication dated a year later (Oberholser 1913). The subspecies is not universally recognised today, but was originally described as being smaller than the nominate form (*melanurus*) from Nias and having a lighter rufous belly. During a visit with a shama breeder

in Sinabang (Simeulue) on 10 August 2015, FER found it easy to distinguish a captive male Nias (*melanurus*) individual from multiple caged Simeulue males (*hypolizus*) on the basis of its larger size and belly colour. Therefore, we advocate the recognition of *hypolizus* as a valid subspecies.

During four visits to Simeulue between 2014 and 2019, each lasting between 4 and 19 days, we were unable to find any shammas in the wild, whether through observation, acoustic surveys or mist-netting. In conversations with locals, respondents either declared the species as extinct on the island or asserted that it would be very rare by now. Being intimately aware of the high price that a Barusan Shama would fetch on the market, all locals cited intense poaching as the sole reason for its decline. Understandably, many locals were aware of the disapproval that the extinction of this bird may elicit with interviewers, and would have therefore provided overly optimistic responses as to its survival.

Most notably, regular contact with the only shama breeder on the island (name and address withheld) suggested an unfortunate timeline of the demise of Barusan Shammas on Simeulue. During the May 2014 visit, the breeder asserted that he received approximately 1–2 individuals per week from local poachers and trappers. Only 15 months later, on 10 August 2015, the breeder showed FER 10 captive *hypolizus* individuals and explained that the rate of receipt of wild individuals from local trappers had declined to approximately one individual per month. At that time (around 2015), locals who were eager to show the species to foreign birdwatchers told FER that a few places of occurrence may remain at the most remote sites of Simeulue in the highest hills, none of which are further than two hours away from the closest road. Apart from perhaps a few additional breeders, this breeder's population might constitute the entire world population that can be trusted to refer to *hypolizus*. While the chance of isolated wild surviving individuals of *hypolizus* at the time of writing (late 2019) cannot be entirely discounted, the small size of Simeulue and the fact that almost all of its remaining forests are a short distance from the nearest settlement make it clear that *hypolizus* is likely extinct in the wild, and an optimistic maximum of 100 individuals might survive in captivity. The most viable route for its global survival lies in establishing a captive breeding program.

Babi and Lasia (subspecies *opisthochrus*)

Babi is a small, round-shaped island, approximately 8.5 km by 7 km in size. About 3 km to its north, Babi is joined by an oval-shaped satellite called Lasia, roughly 6 km by 3 km in size (Figure 1). The two of them form one paleo-island as they have repeatedly been united with each other during the ice ages of the Quaternary of the last two million years or so, yet there has never been a land bridge connecting them either to Simeulue or to the Sumatran mainland. As such, Babi-Lasia is one of the smallest deep-sea paleo-islands in the west Indonesian archipelago, enjoying an unusual amount of avian endemism for a pair of islands of this minute size. Oberholser (1913) described the shammas of Babi and Lasia as an endemic subspecies, *Copsychus melanurus opisthochrus*, on the basis of their belly being lighter rufous than that of both *hypolizus* and nominate *melanurus*. Again, most modern sources have synonymised *opisthochrus* with *melanurus*, although FER was instantly able to tell apart a single *opisthochrus* male (said to have been trapped 2–3 years earlier on Lasia) from a single nominate *melanurus* male and approximately 10 *hypolizus* individuals in side-by-side comparisons of cagebirds held by a Sinabang (Simeulue) breeder on 10 August 2015. The *opisthochrus* male made the most distinct impression among all three subspecies, being notably larger and longer-tailed than the other two, and having a distinct whitish suffusion to the rufous belly. Hence, we advocate full recognition of this subspecies.

Babi and Lasia are both officially uninhabited, although Babi has a tall Telkom antenna with an adjacent building that we found

occupied by 1–5 permanent human dwellers during each of our three visits. Both islands were constantly found to have one to three dozen fishermen's boats anchored off traditional fishing spots around their perimeter, with fishermen frequently landing ashore and engaging in extractive activities. During three visits to Babi between August 2015 and February 2019, each lasting 2–3 days, we were unable to see, hear or mist-net any shamas in the wild despite targeted searches including sound recordings. During these visits, survey forays were made going up to approximately 2 km into the interior of Babi.

Given Babi-Lasia's remoteness and uninhabited status, one may hope that isolated individuals of shama survive in the most interior parts of either island. However, already during FER's visit on 9 August 2015, the local antenna warden confirmed that hundreds of Javanese trappers had descended onto Babi and Lasia about 5–7 years prior, catching thousands of shamas and local Hill Mynas *Gracula (religiosa) robusta* for the market. In the meantime, poaching pressure would have been sustained by local opportunistic trappers who learnt from the Javanese trappers who had come before them. Given the small size of both islands, the shamas' survival in the wild must be uncertain, and *ex situ* breeding efforts are urgently needed for the conservation of this distinct form, with a handful of remnant individuals that may be found in captivity.

Bangkaru (Banyak Archipelago; undescribed population)

Barely larger than Babi, the island of Bangkaru is the most isolated member of the Banyak archipelago. This archipelago is a group of shelf islands in close geographic proximity to Sumatra and situated on the Sundaic continental shelf (Figure 1), which ensures frequent terrestrial connectivity with Asia during Quaternary ice ages. Shelf islands such as the Banyak and Batu archipelagos used to be inhabited by populations of the widespread White-rumped Shama, which is replaced on deep-sea islands by the Barusan Shama (Eaton *et al.* 2016). Unusually, second-hand reports indicated that the shelf island of Bangkaru may be inhabited by a Barusan-like population of shamas, perhaps on account of its far-western location in the archipelago most distant from Sumatra.

In December 2018 we visited the islands of Tuangku and Bangkaru, which are the two largest members of the Banyak Archipelago, in a bid to find remaining shama populations. Tuangku is dotted by several villages, with incipient large-scale forest conversion and intense poaching pressure. During our three-day visit, local inhabitants were adamant that shamas had gone extinct quite a while ago. Bangkaru, on the other hand, is covered with primary forest and is uninhabited, with the exception of a local ranger station staffed by 4–5 wardens and funded by private organisations to oversee turtle breeding activities. Before our five-day visit, we had been hopeful that Bangkaru may be a remnant stronghold of the Barusan Shama. The work by our team of five researchers, accompanied by local staff, comprised mist-netting and extensive acoustic cross-island searches covering all elevations and the entire cross-section of micro-habitats of the island, including the most likely locations previously inhabited by shamas according to the longest-serving warden. All these searches resulted in a complete lack of encounters.

The most senior warden on Bangkaru with the longest field experience, Pak Tamsil, explained that the shamas were still regular on the island as little as about two years prior, especially on the seaward side where the ranger station was located, and where local poachers penetrated less regularly in fear of the rangers. However, his last encounter with a shama was around one year before our visit. He attributed their disappearance to constant pressure by poachers from Tuangku who land ashore and extract birds without the rangers' knowledge. In fact, en route to and from the ranger station on Bangkaru we saw multiple smaller boats ashore on the eastward-facing side of Bangkaru from where poachers approach. Given the small size of the island, it is likely that the Bangkaru population is now extinct in the wild.



CHYIYIN GWEE

Plate 2. Caged Barusan Shama *C. (malabaricus) melanurus*, Gunung Sitoli, Nias, Indonesia, 9 March 2019.

In the town of Singkil on the adjacent Sumatran mainland, we sourced a hobby breeder who showed us what he claimed was a pure Bangkaru male, with intense chestnut underparts reaching the vent and limited white splotches on some of the rectrices of its long tail (but importantly, no white on any of the outermost rectrices). While the tail colouration of this supposed Bangkaru bird was not entirely black, it was—at the same time—characterised by only a fraction of the amount of white typical for a White-rumped Shama. Unless we were shown a captive hybrid (which is unlikely because of the unique belly colour), shamas on Bangkaru may have been of a unique introgressed nature, with most of the genotype derived from Barusan Shamas but a distinct admixture from White-rumped Shamas. This hypothesis requires urgent confirmation from genomic data on the last surviving individuals of this unique population. Unfortunately, the continued survival of this population is unlikely even in captivity: the breeder we visited, who is a government employee, was in the process of cross-breeding the Bangkaru male with a White-rumped Shama female.

Nias (subspecies *melanurus*)

At 5,120 km², Nias is the largest island of the Barusan chain, but at the same time the landmass that has undergone the most complete environmental degradation. Covered by a dense mosaic of villages, roads and rubber plantations, remnant patches of degraded secondary forest may occupy no more than about 5% of the island, with virtually all hill forest gone. Given its early conversion and development, Nias is also the island that has received the most historic attention by ornithological explorers, leading—amongst many other discoveries—to Salvadori's (1887) description of the Barusan Shama as a new species to science on the basis of the Nias population.

We visited the island once, during an intense nine-day mist-netting excursion in 2019 that took us to the most remote parts of the island, concentrating our mist-netting and survey activities to search for this species among several other endemic targets. We did not find any wild shamas, and were not surprised by this negative outcome given the degraded state of the island. As on other inhabited islands, locals knew the shama well and were aware of its elevated price on the market. Dozens of local villagers, town inhabitants and shop owners in the capital Gunung Sitoli were found in possession of caged Barusan Shamas (Plate 2) that had allegedly been captured multiple years prior, although one villager claimed that his shama had been caught only 1–2 weeks earlier. We doubt the latter villager's statement as his descriptions contained inconsistencies, although it does raise the possibility that isolated individuals may persist in some of the least accessible parts of the



Plate 3. Immature Barusan Shama *C. (malabaricus) melanurus* caught during a mist-netting session, West Siberut, Indonesia, 27 June 2019.



Plate 4. Immature Barusan Shama, same as in Plate 3.

island. However, given equal or even higher poaching pressure here as compared with other Barusan islands, combined with a much denser human population and a more degraded state of the habitat, we consider it likely that Nias no longer harbours any wild shamas.

Siberut (presumed subspecies *melanurus*)

The second-largest Barusan island (at 4,030 km²), and dubbed the wildest on account of its remnant forests, Siberut was recently described as providing ‘...the best survival chances for *melanurus*...’ in the wild (Eaton *et al.* 2015). Shamas and other birds on Siberut did not enjoy the same level of early taxonomic attention as the birds of Nias. It is perhaps because of their more remote distribution that the taxonomic status of shamas on Siberut was never investigated more closely. Instead, Siberut’s shamas were merged with *melanurus* from Nias, even though the two islands have never been connected by land bridges (Figure 1).

Our two visits to Siberut, a three-day birdwatching trip in early 2014 and a more comprehensive eight-day mist-netting expedition in June 2019, attest to rapid developments on the island detrimental to the fate of wild shamas. During the earlier visit, we only penetrated as deeply as the surroundings of Mangorut and Rokdok, approximately 8 km from the coastal capital of Muara Siberut, where we briefly heard a single individual on 27 February 2014 in disturbed forest. At that time, we encountered many captive individuals in cages across the island, and locals told us of hundreds of Javan trappers who had come in previous years to extract thousands of shama individuals.

In June 2019, in turn, we encountered an island that had thoroughly changed over five years. Habitat degradation had proceeded apace, with the construction of the new Trans-Siberut Highway having commenced in November 2018. More than a handful of respondents in Muara Siberut unanimously agreed that no shamas survive anywhere other than the most remote patches of remnant forest in the western half of the island. Partly as a response to this assessment by local people, we set out to visit a remote area of remnant hill forest in western Siberut roughly two thirds of the way towards the west coast (exact location withheld) following a two-day hike from Muara Siberut. On this occasion, we carried out a video interview with two of our porters/local guides (see Supplementary Material posted at <https://www.youtube.com/watch?v=wc6CmQGcWCs&t=232s>), both of whom are familiar with shama poaching and trade. One of them explained how only 1–2 years prior, villagers were catching shamas in these remote hills ‘...by the thousands...’, when Palembang traders offered them around US\$1–2 per individual. He asserted that a person was easily capable of a daily catch rate of 30–50.

In the end, our fieldwork did uncover one shy silent immature Barusan Shama (Plates 3 & 4) individual at an undisclosed location in one of the remotest parts of West Siberut. Details about this encounter were not shared with our porters at the time, but do raise the hope that scattered individuals have survived the most recent poaching spree. However, new waves of poaching activity will doubtless occur in the same area soon, spoiling hopes of long-term survival of this island population in the absence of a change in human behaviour.

Sipora, North Pagai and South Pagai (presumed subspecies *melanurus*)

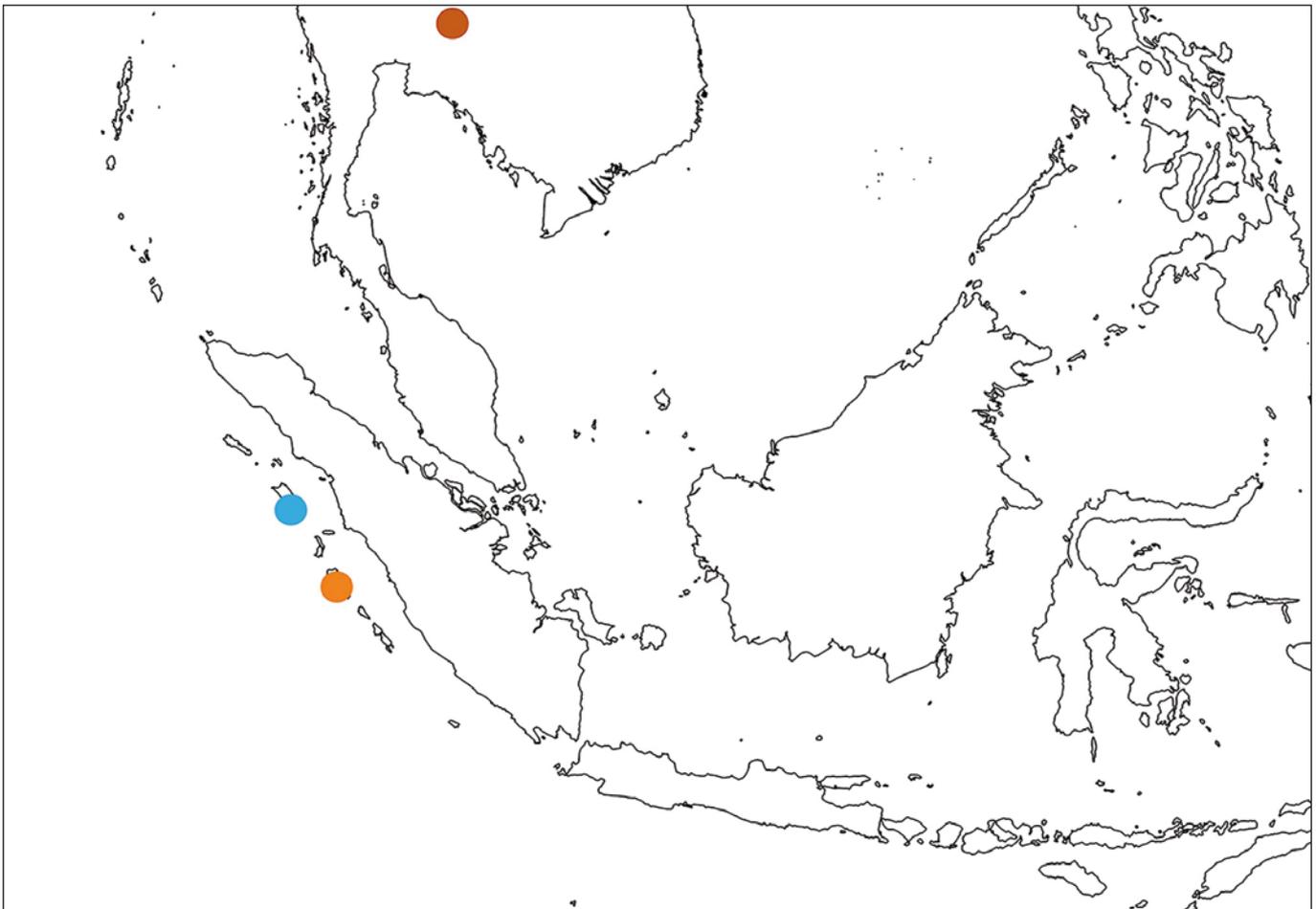
Together with Siberut, these three islands form the Mentawai archipelago, although each of them is roughly only one sixth the size of Siberut. All Mentawai islands are regularly connected with one another through land bridges during the sea level lows of the Quaternary ice ages, although the glacial land connection to Sumatra is very narrow and leads to Mentawai’s general classification as a deep-sea paleo-island. The shamas on these three islands are likely to have an identical taxonomic affinity with those on Siberut. While we have never visited these islands ourselves, their size and location along with indirect evidence from other visitors suggest that shamas are now extinct in the wild. A visit to Sipora in 2015 located 37 captive *melanurus* individuals in 12 houses, with both sellers and trappers saying that wild birds are now ‘very rare’, some trappers not having encountered birds for 1–2 years (C. Naza Bocos *in litt.* 2015). Given that all three islands are intersected by a network of logging roads, with virtually no land further than about 4 km from the next village, coast or road, shamas’ survival into 2020 is extremely unlikely, although field efforts to disprove this supposition would be highly welcome.

Panaitan (subspecies *mirabilis*)

Panaitan does not form part of the Barusan chain, but is adjacent to it across the Sunda Straits off the western tip of Java. Local shamas with all-black tails had been described as an endemic subspecies *Copsychus malabaricus mirabilis* by Hoogerwerf (1962), who recognised their close resemblance to *melanurus* from the Barusan chain. They were diagnosed on the basis of their smaller bill, longer wings and tail, as well as tiny white tips on the smaller quills of the undertail. The somewhat disjunct geographic occurrence of *mirabilis* and the similarly black-tailed *nigricauda* from Kangean has confused museum taxonomists (Hoogerwerf 1962, Collar 2004) and requires additional inquiry, but we here simply follow Eaton *et al.*’s (2016) placement of *mirabilis* within the Barusan Shama.

We have not visited Panaitan ourselves. The shama was still reported as present on the island in the 1980s but has not been

Figure 2. Map showing colour-coded localities of individuals depicted in Plates 1–4: Khao Yai National Park, Thailand (brown dot), Gunung Sitoli, Nias, Indonesia (blue dot), and West Siberut, Indonesia (orange dot).



encountered during two ornithological visits that have taken place in the meantime (Bas van Balen, *in litt.*). Given the close proximity of Panaitan to Java, where poaching pressure is arguably the highest in Indonesia and possibly in the world, its extinction in the wild is extremely likely.

DISCUSSION

Our fieldwork across the Barusan Island chain over a five-year period has helped document the ongoing extinction-in-progress in the wild of the Barusan Shama. Previously distributed across ten larger islands of the Barusan chain, as of September 2019 the species is likely to have survived in the wild on only one landmass. The three non-nominate subspecies, *hypolizus* from Simeulue, *opisthochrus* from Babi and Lasia, as well as *mirabilis* from Panaitan, have not been encountered in the wild with certainty in many years amidst an environment of intense poaching pressure, sometimes coupled with habitat degradation. Their survival in the wild is extremely unlikely. In a similar vein, an unnamed population on Bangkaru, likely of an admixed origin with a majority contribution from Barusan Shamas, may well have slipped into extinction in the wild some time in or around 2018. Despite the large size of the island of Nias, the nominotypical population of *melanurus* there is likely to have gone extinct in the wild as a response to the extremely degraded state of habitat and high human population density, although isolated individuals may have survived into 2019. Last but not least, populations on the Mentawai chain which are usually attributed to nominate *melanurus* but as yet taxonomically little-studied are unlikely to survive in the wild on any island but Siberut.

As the second-largest but one of the least environmentally degraded islands of the Barusan chain, Siberut has been put forward as the last hope for the survival in the wild of the Barusan Shama (Eaton *et al.* 2015, 2016). However, recent fieldwork in June 2019 proves these hopes to be unfounded. Habitat degradation has proceeded apace on the island over only five years or so, and the accompanying poaching pressure has led to an extirpation of shamas from all but the most remote sites on the island. Even in extremely remote areas, our interviews with local trappers help document intense poaching pressure that has led to the removal of thousands of shama individuals over short time scales. Given our experience on the ground, combined with a close inspection of satellite maps, we do not believe that the population size of shamas on Siberut will be more than a few dozen individuals at the time of writing (September 2019), and their removal is only a matter of time in a climate of continuing poaching sprees amidst a constantly deteriorating landscape.

Our study validates that an immense demand for shamas in the bird market (Chng *et al.* 2015, Eaton *et al.* 2015, Lee *et al.* 2016) has led to the critical endangerment of the Barusan Shama on the West Sumatran islands. The price of a shama in the market has been reported to range from US\$37–370 per individual in an online trade group (Iqbal 2015) and approximately US\$210.3 in Pramuka bird market in Jakarta (Chng *et al.* 2015). Since Barusan Shamas have not been universally recognised at the species level, their market price has not been reported separately. However, our conversations with a breeder in Nias have revealed that Barusan Shamas are thought to be poorer song performers and fetch lower prices than White-rumped Shamas from Sumatra. In Singkil on the Sumatra mainland and on Nias, we observed that breeders are hybridising Barusan Shamas and

White-rumped Shamas to increase the market value of the former, thereby further threatening the Barusan Shama's genetic integrity.

As much as we encourage and practice continuing fieldwork and community engagement on the ground, the future of the Barusan Shama clearly lies in *ex situ* captive breeding. The biggest question is whether breeding programs can be devised to save each of the distinct subspecies individually, or whether it is too late for that and birds of different island provenance should be deliberately admixed in captive breeding. The nominate subspecies *melanurus* can still be seen in hundreds of roadside cages on Nias, rendering a breeding program dedicated to nominate *melanurus* possible. Similarly, Mentawai birds attributed to *melanurus* are common in village cages across Siberut and Sipora at least, potentially facilitating a program dedicated to these island populations. In contrast, subspecies *hypolizus* on Simeulue is rarely seen in cages around local villages, although with effort, caged *hypolizus* individuals can still be found in the island capital, Sinabang. We estimate that surveys of captive birds in the private possession of Simeulue's villagers and inhabitants of Sinabang may result in a maximum of about 100 individuals. The situation is even more critical for the distinct long-tailed and pale-bellied race *opisthocbrus* from Babi and Lasia, of which we have only ever encountered a single male in the possession of a Sinabang breeder, although the same breeder assured us of a handful of additional captive individuals. We have never visited Panaitan, but we consider it likely that all efforts are too late for its endemic *mirabilis*, which must have disappeared so long ago that the detection of any pure captive survivors is unlikely. However, as with all cases of supposed extinction, we encourage further field surveys that may prove these assumptions wrong. Additionally, community and government engagement, changes in the shamas' legal protection status and stringent protection of potential sites of reintroduction are crucial prerequisites for all other conservation methods to be successful.

In late 2019, a group of stakeholders, including Wildlife Reserves Singapore (WRS), Ecosystem Impact Foundation (EIF) and the present authors—under the auspices of the IUCN Asian Songbird Trade Specialist Group (ASTSG)—convened to plan the implementation of *ex situ* conservation measures, aiming at the conservation of individual island taxa and units. This approach was consciously taken to attempt to facilitate the survival of a large number of individual island subspecies, even though multiple smaller and separate *ex situ* breeding programs may carry the risk of higher failure because of reduced levels of genetic diversity in the founder populations. The construction of a holding facility on Simeulue has commenced, where the keeping and eventual breeding of a high percentage of the remaining world populations of *hypolizus* and *opisthocbrus* will be attempted under guidance by conservation-genomic analysis. Similar measures for other island populations and taxa are also planned.

The Barusan Shama affords an urgent conservation opportunity at a crucial nexus of time. We suggest the IUCN category Critically Endangered for the species based on criteria CR A2, B2a, b(ii) (iii) (iv) (v), C1, 2a(i) and D of the IUCN (2019) Red List criteria for threatened species (version 3.1; available at www.iucnredlist.org). Although perhaps pessimistic, our assessment in the current climate of increasing market demand is that the Barusan Shama's fate in the wild is already sealed. With any further immediate delays, captive-breeding efforts to safeguard some of its distinct island taxa will quickly become futile. With any further medium-term delays, *ex situ* efforts to save the entire species may be too little, too late.

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