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Does the fishing cat inhabit Sumatra?

Debate in the 1930s about whether fishing cat *Prionailurus viverrinus* inhabited Sumatra effectively ceased in 1940 when one key reference stated that it did. No cogent reasons were given, but most subsequent secondary sources set the island within the species's range. Several cautious authors stressing the lack of verifiable Sumatran records went largely unheeded. Modern claims from Sumatra are misidentifications or, at best, cannot be objectively confirmed: the single certain identification is of a zoo animal of unknown provenance. Survey has been inadequate to assert that fishing cat does not inhabit Sumatra, so for now the question remains open. Fishing cat is classified on the 2008 Red List as Endangered: surveys are urgent on Sumatra and on Java, the only documented Sundaic population.

The fishing cat inhabits much of mainland tropical Asia and the large islands of Sri Lanka and Java (e.g. Corbet & Hill 1992). A further large island, Sumatra, is generally included in the range, despite several past cautions. To mobilise information from camera-trap 'by-catch' (photographs of non-target species), JWD and SIR were invited by the Wildlife Conservation Society (WCS) Indonesia Program in June 2008 to run a capacity-building workshop in small-carnivore identification using the Sundaic country programmes photographic holdings. The Museum Zoologicum Bogoriense, Cibinong, Bogor, Indonesia (MZB), holding the chief training resource – a skin collection – was the other partner, through GS and Yuli Sulistya Fitriana. Four photographs, from Bukit Barisan Selatan National Park [= NP], Sumatra, were labelled as fishing cat. Our cursory search for verifiable records of fishing cat in Sumatra found the comment in Van Strien (1996: 172) that "Sumatra is usually included in the [fishing cat's] range, but there are no substantiated records". Hence, the four photographs were scrutinised by workshop participants and then externals, followed by a deeper investigation of museum holdings, published photographs and literature, and correspondence concerning the animal on the island. Sanderson's (2009) interim account of the topic overlooked various key literature and specimen sources. Figure 1 shows the location of sites and areas referred to in the text.

Historical information concerning fishing cat in Sumatra

Influential, generally authoritative, pre-1940 sources on tropical Asian mammals, such as

Pocock (1939), did not consider fishing cat to inhabit Sumatra, and Sody (1931: 153) specifically stated (in translation) that "it is not known from Sumatra, Borneo or any other island [than Java] in Indonesia". Delsman (1932), however, figured a fishing cat shot in Java with the comment that the hunter, Mr Pieters, told him that (in translation) "at the mouths of the Way Tulang Bawang, Way Mesuji and Way Sekampung [all in today's Tulangbawang district] and other rivers in South Sumatra the fishing cat was repeatedly seen and shot, while he was hunting for crocodiles", information he repeated in his overview of animals in Indonesia (Delsman 1951). Brongersma's (1935) comprehensive review of Sundaic cat distribution, referred, for fishing cat in Sumatra, only to this Delsman (1932) statement, and summed up with "its presence in Sumatra has not yet been definitely proved" (p. 13). Jacobson (1933) erroneously presented Delsman (1932) as photographic evidence of fishing cat in Sumatra, a mistake pointed out by Sody (1936), who reiterated that there remained no firm evidence of the species in Sumatra, and alluded to a parallel saga of hunters' claims of leopard *Panthera pardus* on the island. This is an informative comparison: over 70 years later there remains no evidence that leopard has lived in Sumatra in historical times, despite subfossil remains there (Whitten et al. 2000); yet leopard is more morphologically distinctive to game hunters than is fishing cat.

Sody (1936) mentioned two fishing cats in the Naturhistorisches Museum, Bern, Switzerland (NMBE), labelled as from Padang, but (without giving reasons) did not consider them proof of the species in Sumatra. The

relevant specimens are NMBE 1031761 (a female, 20 October 1913, from Padang) and NMBE 1031294 (a male of unknown date and locality), both donated by Zoo Rotterdam. P. Schmid (in litt. 2009) confirmed their identification, adding that they came through Johann Büttikofer (1850–1927), who had worked at NMBE from 1876 to 1878, and who from 1897 to 1924 directed Rotterdam Zoo. The provenance of objects received by NMBE from Büttikofer after 1897 is not always clear, and Padang was a significant trading point at this time. In such light, Sody's doubts guide the only justifiable treatment of these specimens.

Ending this 1930s flurry of discussion, Chasen (1940) listed fishing cat for Sumatra, citing only Pocock (1939) and Brongersma (1935) for the species, yet neither included the island in its range (see above). Sody (1949: 180) reiterated that he found the contention that fishing cat occurred in Sumatra to be "unfounded", and warned against trusting localities of zoo-mediated animals. Nonetheless, nearly all other post-1940 compilations with sufficient range detail placed Sumatra in the species's range (Carter et al. 1945; Ellerman & Morrison-Scott 1966; Lekagul & McNeely 1977; Van der Zon 1979; Corbet & Hill 1992; Sunquist & Sunquist 2002, 2009; Suyanto et al. 2002; Wozencraft 2005; Sanderson et al. 2008). None cited specific references for fishing cat on Sumatra; all may stem from Chasen (1940), and none is explicitly an independent opinion that fishing cat inhabits Sumatra. G. B. Corbet (in litt. 2008) stated that, for a species of uncontroversial species-level taxonomy, listing by Chasen (1940) would have been sufficient for Corbet & Hill (1992) to include Sumatra; Van der Zon (1979) explicitly based his treatments strongly upon Chasen (1940); and Suyanto et al. (2002: v) "obtained much ... species distributional information from their [Corbet & Hill 1992] treatment".

Van Strien's (2001) final output on Indonesian mammal distribution listed Sumatra for fishing cat, citing only Delsman (1932) and Sody (1936). This does not, however, imply his belief of natural occurrence there: he also listed, for Borneo, the mounted Pontianak specimen held in the Raffles Museum of Biodiversity Research, Singapore, and generally assumed to be a trade specimen (K. Lim in litt. 2008). None of these historical commentators seem to have been aware of a key specimen, # 922 B, at the Institut Royal des Sciences Naturelles, Brussels, Belgium. Suyckerbuyck donated the skeleton, including skull, of an adult male cat

to IRSNB on 24 July 1877 within 'general inventory' # 4008, a batch of 32 mammal, and c.4000 other, specimens. It is labelled 'Sumatra', but no localities are mentioned on the original card for 4008 or on any other available contemporary documentation; the mammals have been labelled as from Java, Borneo, Sumatra and 'no locality', but how so is not known. They may have been added by S. Freckkop when the specimens were identified; then, this animal was catalogued as a leopard cat *P. bengalensis*, and only in 1971 was it determined to be a fishing cat (by PS; background information from G. Lenglet in litt. 2009). The ambiguous collection location forestalls this specimen proving fishing cat occurrence on Sumatra.

Van Bree & Mohd Khan (1992) stated that no museum specimens of fishing cat are yet known for Sumatra. Other than the equivocal Bern and Brussels material, neither we nor A. Wilting (in litt. 2009) found any in 15 museums checked (AMNH, CAS, FMNH, HNM, LACM, MZB, NHM, NRM, RMBR, RMNH, SMF, SMNS, USNM, ZMB, ZSM; acronyms expanded in Supporting Online Material Appendix 1), and all institutions linked to MaNIS (search in August 2008); Van Strien (2001) had already checked some additional collections important for Indonesian mammals.

Recent claims of fishing cat in Sumatra

Nowell & Jackson (1996: 74) mapped fishing cat across Sumatra, marking five "protected areas where the species occurs": Way Kambas, Berbak, Gunung Leuser, Kerinci Seblat and Bukit Barisan Selatan NPs. These spots are not linked to source, but "the information on occurrence in protected areas was gathered from a wide variety of sources, including IUCN protected area directories ... with reported occurrence independently confirmed where possible, the voluminous files of the Protected Areas Data Unit of the World Conservation Monitoring Centre in Cambridge, databases maintained by national government and institutions, the literature and, most importantly, data provided by correspondents" (Nowell & Jackson 1996: 1–2). K. Nowell (in litt. 2008) highlighted the impossibility of confirming, in this global review of the entire family Felidae, each record from such a large, disparate, range of sources. She stated that the spot-markings should not be taken as confirmed records. In fact, this trawl brought in, for Sumatra, more records of fishing cat than of any other small cat (K. Nowell in litt. 2008), a statistic that

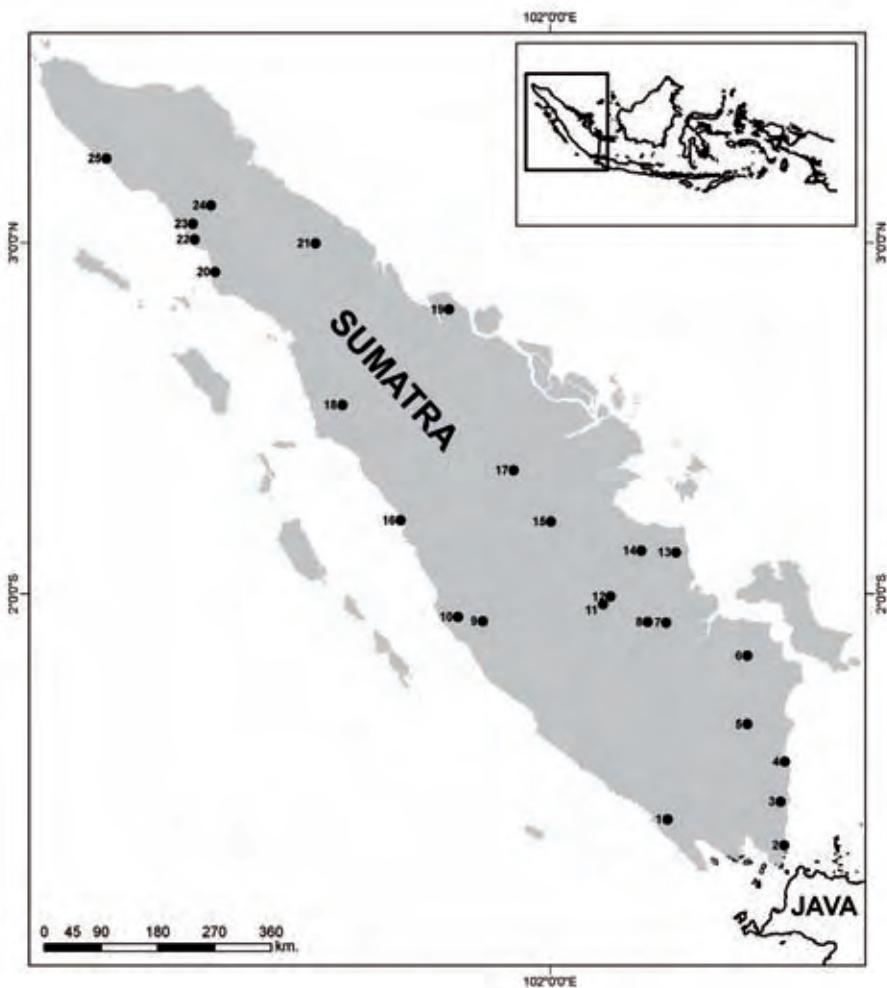


Fig. 1. Sumatra, showing localities mentioned in the text: 1, Bukit Barisan Selatan NP; 2, Way Sekampung; 3, Way Kambas NP; 4, Way Tulang Bawang; 5, Way Mesuji; 6, Padang Sugihan Wildlife Reserve; 7, Bentayan Wildlife Reserve; 8, Dangku Wildlife Reserve; 9, Kerinci Seblat NP; 10, Sindang Silaut; 11, Harapan Rain Forest; 12, Asiatic Persada; 13, Berbak NP; 14, Muara Jambi; 15, Bukit Tiga Puluh NP; 16, Padang; 17, Tesso Nilo NP; 18, Batang Gadis NP; 19, Senepis Buluhala; 20, Rawa Singkil; 21, Siantar; 22, Suak; 23, Kluit Selatan; 24, Gunung Leuser NP; 25, Meulaboh.

suggests that at least most of these records were mistaken. We have not traced sources for records at three of the five sites. The Kerinci Seblat listing seems to relate to a 1996 set of footprints found in Sindang Silaut (Lunang, West Kerinci), an area of swamp forest 30 km south-west of Tapan (Holden 2001). No camera-trapping was undertaken here or in any similar nearby habitat. The plaster casts made are lost, but surviving line-drawings and notes indicate clear webbing on the toes (JH). The Berbak spot relates to an adult female cat found dead in the Buntu Besar River on 22 August 1991 (HIMBIO 1992). No reasons are given for the identification as fishing cat, the accompanying photograph [photo 10] is unidentifiable, and we cannot locate any preserved parts. In 1985, Nash & Nash (1985) identified footprints in Padang Sugihan Wildlife Reserve (= WR) as from a fishing cat, but did not secure plaster-casts. Despite

airing both the latter records (Nash & Nash 1985; HIMBIO 1992), Melisch et al. (1996: 315) evidently considered them unsatisfactory because they wrote that "due to the only marginal distribution overlap (possibly in the north of the Malay Peninsula) and the preference for wetland environs, we tentatively conclude that [flat-headed cat] *P. planiceps* replaces *P. viverrinus* in Borneo, Sumatra and most of peninsular Malaysia". In addition, Holden (2006) referred to fishing cat in Muara Jambi; this concerned an animal seen, briefly, on a forest trail: the record is here withdrawn by JH. This sighting was given in Maddox et al. (2007), which also stated that fishing cat faeces were identified eight times in the area; these reports, based merely on visual inspection, should be disregarded. Despite high camera-trapping effort in several Sumatran sites since the early 1990s (Table 1), no identifiable photographs of fishing cat



Fig. 2. Captive fishing cat, Siantar, Sumatra, 17 July 2008 (Photo C. R. Shepherd).

06 seem to have been generated. Kawanishi & Sunquist (2003) cited records from Kerinci Seblat and Bukit Barisan Selatan NPs, to ML and TGO respectively. The latter were based upon four photographs from 1998, 2000 and 2003, the former upon a single one. Because many features which distinguish fishing cat from leopard cat are somewhat subjective (e.g. shorter tail, thicker neck, different posture) or are imprecise through photographic

flash (e.g. warmth of body tone), these photographs were examined by S. Christie, A. Hearn, T. Maddox, K. Nowell, J. Ross, Sunarto Sunarto and M. Sunquist, as well as the authors, resulting in concurrence that all five images show leopard cats. The identification of those from Bukit Barisan Selatan NP was covered, with reproduction of the images, by Sanderson (2009). A further Sumatran camera-trap photograph labelled 'fishing cat' is

in a 2009 grey literature report; this animal, from Way Kambas, is an obvious leopard cat. In July 2008, CRS and V. Nijman found, during a random visit, a live fishing cat at a small zoo in Siantar (2°55'N, 99°05'E; Fig. 2). This small-town zoo has only limited holdings of species not native to Sumatra, but a wild origin on the island cannot be assumed, because zoos exchange species within Indonesia (CRS personal observations). Wildlife trade surveys across Sumatra have not yielded any other fishing cat record, although leopard cats are very common (Shepherd et al. 2004; also E. Rood, I. Singleton and S. Wich in litt. 2009). Attempts to clarify the origin of this animal are ongoing.

Attempting to resolve the status of fishing cat in Sumatra

Chasen (1940) was the key authority quashing controversy whether fishing cat lives in Sumatra. His absence of discussion, despite the previous decade's public controversy, suggests that his inclusion of Sumatra was a slip. That he published no correction does not argue against this: he died in 1942 (Corbett & Hill 1992). His working notes cannot be re-evaluated: "the greater part" sank with his ship during evacuation from Singapore in World War Two (Weitzel et al. 1988). If Chasen had in fact found out something, the text of Sody (1949) indicates that it did not make it onto the local 'bush telegraph'.

Table 1. Camera-trap studies in Sumatra reviewed for fishing cat photographs. For all the listed studies the lack of photographs of fishing cat is known, for other studies undertaken on the island it is not known. Effort figures are for guidance only and are not closely comparable between studies.

Nr in Fig. 1	Location name	Trapping effort	References
1	Bukit Barisan Selatan NP	10 years	O'Brien et al. 2003; this study
3	Way Kambas NP	13,297 trap-hours	Franklin et al. 1999; Franklin 2002
7	Bentayan WR	495 trap-nights	Maddox et al. 2007
8	Dangku WR	573 trap-nights	Maddox et al. 2007
9	Kerinci Seblat NP	132,000 trap-hours	Holden et al. 2003; Linkie et al. 2003
11–12	Asiatic Persada*/ Harapan Rain Forest	6,000+ trap-nights	Maddox et al. 2007
13	Berbak NP	823 trap-nights	Maddox et al. 2007
15	Bukit Tiga Puluh NP	2,028 trap-nights	Maddox et al. 2007
17	Tesso Nilo NP and immediate surroundings	12,773 trap-nights	Sunarto Sunarto in litt. 2009
18	Batang Gadis NP	1,728 trap-nights	H. T. Wibisono in litt. 2009
24	Gunung Leuser NP	3,800+ trap-nights	M. Griffiths in litt. 2009
24	Gunung Leuser NP	three years	D. Priatna in litt. 2009

* A plantation and logging concession landscape centred on Asiatic Persada and the adjacent (then) logging concession Asialog, now the Harapan Rain Forest.

A lack of records of a species does not prove its absence. That we have traced only one trade or captive fishing cat in Sumatra in recent decades may reflect partly the paucity of systematic survey. It does not indicate that it is not native there, because CRS, despite many market visits and active correspondence with other people undertaking them, knows of only one such record from Java, unquestionably fishing cat native range, during his 18 years association with the country: at a private dealer's house in Surabaya on 14 August 2005 (Fig. 3; M. Auliya in litt. 2009). By a similar process of comparison, the absence of fishing cat camera-trap photographs from Sumatra is not informative: a global review of records of flat-headed cat, which is also a denizen of lowland wetlands, found that it has been camera-trapped on the island only few times (A. Wilting, pers. comm.).

For several reasons fishing cat might be overlooked in Sumatra. Firstly, the island is large and only patchily surveyed, so species of localised geographical and/or ecological distribution could be readily overlooked: e.g. the highly distinctive Sumatran Ground Cuckoo *Carpococcyx viridis* was 'lost' for decades until its recent rediscovery (Brickle 2007). On neighbouring Java, fishing cat seems to be almost restricted to tidal forests with sandy or muddy shores (Melisch et al. 1996), and while not tied to such habitats throughout its range, occurring as far from the sea as Nepal (Pocock 1939), the locations in Delsman (1932) are consistent with similar habitat use in Sumatra.

Secondly, most camera-trapping in Sumatra has targeted tigers, and chances of camera-trapping fishing cat in this way, with its sampling focus on game trails, ridges and springs within closed forest, are low. Camera-trapping in Sumatran lowland swamp forest has been undertaken to a significant extent only in Way Kampas NP. Since late 2008 a programme in Berbak NP includes many sites near rivers, but so far no fishing cats have been photographed. There seems to have been no camera-trapping where Delsman (1932) reported the species.

Thirdly, variation in fishing cat habitat use across its range is too poorly understood to know what specific microhabitat placement of camera-traps, if any, would boost chances of detection in Sumatra. Without good understanding of any species's local behaviour and ecology, interpreting its prevalence, including absence, on camera-trap pictures is difficult. Sumatra is not alone in chequered percep-



Fig. 3. Captive fishing cat, Surabaya, Java, 14 August 2005 (Photo M. Auliya).

tions of fishing cat occurrence. This cat was generally treated as absent from peninsular (=West) Malaysia, an area relatively well surveyed historically, but one, reportedly a wild-trapped animal from Negeri Sembilan, lived in a zoo there over 1967–1977 (Van Bree & Mohd. Khan 1992), and specimens labelled as from Malaysia come from Kuala Lumpur (1971 and 1977; both in SMF, and plausibly traded with the zoo; no further details on origin are available), and Malacca (1878, SMNS; and c.1820s [date inferred from the collector's identity: Diard], RMNH). This last is presumably the Malacca specimen(s) examined by Swinhoe (1862). Malacca provided many trade specimens at this era, and the origin of the modern zoo animal cannot be known with certainty. There remain no incontestable records of a wild-living fishing cat in peninsular Malaysia: an incomplete camera-trap image from Taman Negara NP in 1999 was thought perhaps of a fishing cat (Kawanishi & Sunquist 2003), but JGS believes it to be a leopard cat. Kawanishi & Sunquist (2003) also observed tracks in that park which they thought likely to belong to fishing cat.

There are also indications, assumed to be trade specimens or misidentifications, of fishing cat from Borneo (see above), Singapore and Bali (Van Bree & Mohd. Khan 1992). Fishing cat was listed from Taiwan by Swinhoe (1862), in error; as Nowell & Jackson (1996) pointed out, this mistake was still being repeated over a century later (e.g. Wozencraft 1993), and the island is still mapped for the

species in Pan Qinghua et al. (2007). Confirmation that fishing cat may be detected only late even in relatively well-collected regions does, however, come from Myanmar: the first country record (discounting non-specific 19th century statements of occurrence) was not until 1935 (Carter 1943; AMNH 113496), despite the Bombay Natural History Society's collection programme in operation, and extensive in lowland regions superficially suitable for the species, for the preceding twenty years (Fry 1929 and references therein).

Concluding discussion and recommendations

The occurrence of fishing cat in Sumatra should be considered hypothetical pending an objectively verifiable record: a specimen, photograph or, less preferably, a field sighting by a cautious and capable observer experienced with identification of leopard cat, and published with full supporting field notes for the basis of the identification. Sign-based records can help inform hypothetical distribution, but, unless there is genetic confirmation (see e.g. Lucherini et al. 2008), the richness of Sumatra's carnivore community prevents their being taken as proof. In the rather few attempts to assess the reliability of carnivore sign records, observers are generally overconfident, even in carnivore communities much simpler than Sumatra's (e.g. Davison et al. 2002), reflecting problems of accurate sign identification to species more broadly across mammals (e.g. McKelvey et al. 2006; Bowkett et al. 2009).

Although it might seem implausible that any morphologically distinctive mammal could mistakenly enter 'common knowledge' of occurrence on a large island, this does happen. Once a species is listed for a significant geopolitical unit, even if that is soon discredited, secondary citation of the original error almost invariably occurs: Malay Weasel *Mustela nudipes* is still listed for Java (e.g. Wozencraft 2005) 175 years after the original error was highlighted (Duckworth et al. 2006). Furthermore, when an observer 'knows' a species inhabits a given area, the bar may be (consciously or subconsciously) lowered for subsequent identifications, and so further 'records' result, a cycle, in extreme cases, perverting conservation resource deployment (Pratt 2000, McKelvey et al. 2008). That fishing cat is not proven to inhabit Sumatra therefore requires wide dissemination, and any overlooked or future claim warrants detailed documentation.

The Endangered status of fishing cat on the 2008 IUCN Red List of Threatened Species (Sanderson et al. 2008) urges specific surveys seeking it in Sumatra. Any suitable habitat remaining around Delsman's (1932) sites is of obvious survey priority. A. Compost (in litt. 2009) points out that the habitat in some parts of Way Kambas, Berbak and Bukit Barisan Selatan NPs resembles that where he has seen fishing cats in Java: Ujung Kulon and Pulau Dua Bird Sanctuary, Banten bay, West Java; in the latter, he photographed and filmed them regularly from 1988 to 1992 (see www.mawaspictures.com). Other search areas, suggested by H. Rijksen (in litt. 2009) on habitat grounds, are the Rawa Singkil area, Kluet, and the Meulaboh (Bahbahrot) swamps, along the west coast of Aceh. Even if no fishing cat records result, the undertaking will help clarify current status of flat-headed cat, now also Red-Listed as Endangered (Hearn et al. 2008). Equally urgent is an assessment of fishing cat's current status in Java and, arguably, in peninsular Malaysia. Java holds the only confirmed Sundaic population, which was considered to be highly threatened by the last review (Melisch et al. 1996). A. Compost (in litt. 2009) revisited Pulau Dua three years ago and heard that the fishing cats there, which had been quite confiding, had been poisoned by the owners of the fish ponds adjacent to the island.

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