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Cover: Green Sea Turtle *Chelonia mydas* watercolour by Elakshi Mahika Molur.



COMMUNICATION

Trade of skulls as novelty and aquarium objects are an additional threat to porcupines

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Abstract: The commercial exploitation of wildlife affects many species, including porcupines that are traded for meat, as pets, and for medicinal purposes. Here we report on a novel trade in Sunda Porcupine *Hystrix javanica* skulls in Bali specifically for curios and as aquarium novelty objects. Since 2018, the species is protected within Indonesia and the sale of skulls is illegal. Between December 2022 and November 2023, we visited wildlife shops in seven towns, and conducted a survey of online sellers. We recorded 44 porcupine skulls in 11 shops and 10 skulls online. Skulls sold as curios were intricately carved and were priced at USD 61, whereas skulls sold as hiding caves for aquarium fish were not carved and priced at USD 22. Porcupine skulls were sourced from Bali and Java. Especially the carved skulls are marketed primarily for international tourists and may be inadvertently taken abroad. The novel trade in skulls adds to a multitude of threats faced by porcupines, and there is a need for improved regulations and enforcement against illegal trade. Appropriate mitigation measures need to be developed to protect porcupines from unsustainable and illegal exploitation and will require the full operation of the commercial sector, local and national governments, the tourism industry and the Indonesian public.

Keywords: Bali, CITES, conservation, Indonesia, natural resource management, wildlife trade.

Indonesian: Perdagangan tengkorak (hewan) sebagai hiasan akuarium merupakan ancaman tambahan bagi landak: Eksploitasi komersial satwa liar memengaruhi banyak spesies, termasuk landak yang diperdagangkan untuk memperoleh dagingnya, sebagai hewan peliharaan, dan untuk tujuan medis. Berikut laporan tentang perdagangan baru tengkorak landak Sunda (*Hystrix javanica*) di Bali, khususnya untuk barang-barang seni dan sebagai hiasan akuarium. Sejak tahun 2018, spesies ini dilindungi di Indonesia, dan penjualan tengkoraknya ilegal. Antara Desember 2022 dan November 2023, kami mengunjungi toko-toko satwa liar di tujuh kota dan melakukan survei terhadap penjual online. Kami menemukan 44 tengkorak landak di 11 toko fisik dan 10 lainnya di toko online. Tengkorak yang dijual sebagai barang seni diukur dengan sangat terperinci dan dijual seharga US\$61 (sekitar Rp 900,000), sementara tengkorak yang dijual dalam bentuk gua persembunyian untuk ikan akuarium tidak diukur dan dijual seharga US\$22 (sekitar Rp 300,000). Tengkorak landak diperoleh dari Bali dan Jawa. Tengkorak yang diukur khususnya dipasarkan untuk wisatawan asing dan mungkin tidak sengaja terbawa ke luar negeri. Perdagangan tengkorak landak ini menambah ancaman bagi landak, sehingga diperlukan peningkatan peraturan serta penegakan hukum terhadap perdagangan ilegal. Langkah mitigasi yang sesuai perlu dikembangkan untuk melindungi landak dari eksploitasi yang tidak berkelanjutan dan ilegal, dan memerlukan partisipasi penuh dari sektor komersial, pemerintah lokal dan nasional, industri pariwisata, dan masyarakat Indonesia.

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INTRODUCTION

The commercial exploitation of wildlife, and the lack of evidence that this can be considered sustainable, is increasingly recognized as a major impediment to the conservation of wildlife (Hughes et al. 2023). This includes southeastern Asia (Nijman 2010). In recent years a series of initiatives have been taken to explore the trade in some lesser-known and somewhat overlooked species within this region that (potentially) are negatively impacted by the global wildlife trade. One of these groups are the porcupines, seven species of which occur in Asia (Van Weers 2005), and for which now a body of evidence reveals that hunting and trade are resulting in population declines (Brooks et al. 2010; Rao et al. 2011; Loke et al. 2020). Thus far, all research that has been conducted on the hunting and the trade in porcupines in Asia, focused on them being used for meat, for pets, or for medicinal purposes and in particular bezoar stones and quills (e.g., Brookes et al. 2010; Nijman & Nekaris 2014; Heinrich et al. 2020; Gomez 2021; Mardiasuti et al. 2021; Hasan & Csányi 2022). Here we focus on a novel trade in the Sunda Porcupine *Hystrix javanica* skulls in Bali (the only species of porcupine that lives in Bali and adjacent islands) specifically for curios (targeting domestic and international tourists) and as aquarium novelty objects.

Prior to 2018 the only species of porcupine that received legal protection in Indonesia was the Malayan Porcupine *H. brachyura* found on Sumatra and Borneo. In the new 2018 list (legally covered as UU Nomor P.20/MENLHK/SETJEN/KUM.1/6/2018) this was replaced by the Sunda Porcupine (Nuswantoro 2023). One cannot catch, transport, keep, sell, or buy a protected species nor any of its parts. It is irrelevant if the specimen itself was collected before or after it became listed as it is not just the catching or killing of a protected species that is illegal under Indonesian law, so is the act of selling and buying. Violations are punishable by up to five years imprisonment and/or a fine of USD 6,631 (using July 2023 exchange rates). In the years before 2018, there was no harvest quota for Sunda Porcupines and hence any commercial trade in the species would not have been allowed at the time either.

Inspired by the work of Gomez (2021) our aim was to: (a) assess the trade in Sunda Porcupines in Bali, specifically the trade in porcupine skulls, both in physical shops as online; (b) to establish the main purposes of this trade; (c) its legality and its monetary value; and (d) way to mitigate the negative effects of this trade on wild populations of Sunda Porcupines.

METHODS

From 25 December 2022 to 6 January 2023 (VN) and from 31 May to 19 June 2023 (JC and VN) we surveyed the towns of Sanur, Ubud, Legian, Jimbaran, Tampaksiring and parts of Beringkit, and Denpasar (Figure 1). Sanur, Jimbaran and Legian are known for its beaches and coastal tourism, Ubud is famous for its monkey forest and arts, and Tampaksiring is a centre for traditional Balinese culture and handicrafts. Beringkit and Denpasar are largely urbanized. All are within an hour car drive from each other. In general, the shops selling wildlife are situated along the main streets and prominently display their wares; it is no challenge locating them (Chavez et al. 2023). For shops that were visited during both periods we compared the items for sale and report only a minimum number, avoiding double counting (Chavez et al. 2024). In June, July, and November 2023 we searched the internet for porcupine skulls offered for sale by traders that were based in Bali (keywords for searching: landak, tengkorak, jual, porcupine skull, sale).

RESULTS AND DISCUSSION

With their large yellow-orange upper and lower incisors prominently on display, the porcupine skulls really do stand out amongst the other animal skulls that curio traders have on offer (Image 1). We recorded 44 porcupine skulls in 11 shops in southern Bali, i.e., five in two shops in Sanur, 21 in five shops in Tampaksiring, and 18 in four shops in Ubud. None were recorded in Legian, Beringkit, Denpasar or Jimbaran. Thirty-three of the skulls were carved and most of these were stained yellow, grey or brown to make them appear older (this is common practice in the Bali animal curio trade: Chavez et al. 2024). We obtained two independent quotes for carved porcupine skulls of USD 66 and USD 56 (vendors indicated that the price would go down after bartering something we did not do). In the online search we recorded 10 porcupine skulls for sale by five traders based in Denpasar and Gianyar; three of them specified that one of the purposes is as a decoration in an aquarium or more specifically as a hiding cave for aquarium fish. None of them were carved or stained. Prices ranged from USD 6 (two adverts) to USD 20 and USD 38 (weighted mean USD 22).

Three traders informed us that the porcupine skulls were sourced from Java (twice) and Bali (once), and all skulls were consistent with them being of Sunda Porcupine. As this is indeed most parsimonious, we

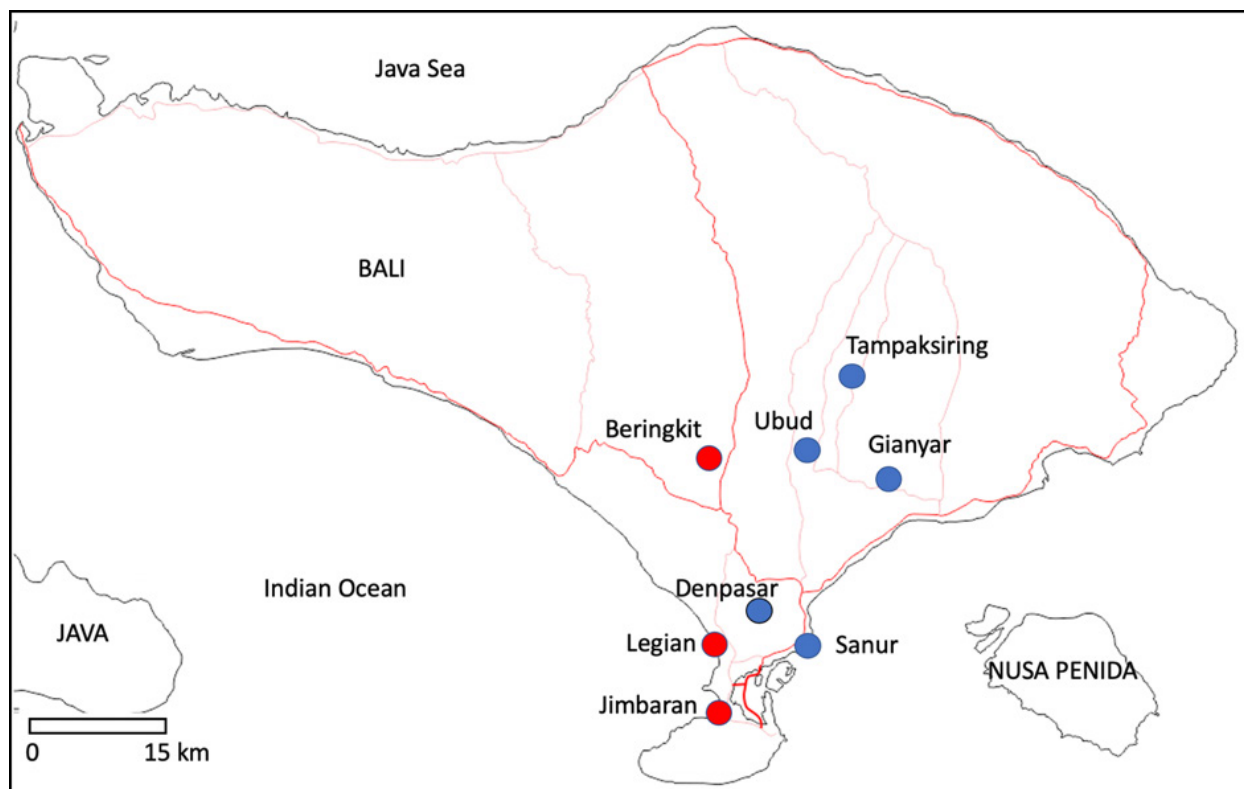


Figure 1. Map of Bali, Indonesia, with Ubud, Tampaksiring, Denpasar, Gianyar, and Sanur as locations where we did observe the trade of porcupines and Legian, Jimbaran, and Beringkit where we did not observe it.

expect most, if not all, of the skulls we did observe in Bali to belong to this species (sourcing porcupines from Sumatra or Borneo involves lengthy overland journeys and one or more sea crossings). This then confirms all the trade we observed was illegal under Indonesian law.

Our records of over 50 legally protected Sunda Porcupines in commerce recorded during a relatively short and no way near intense trade survey underscores the importance of putting more emphasis on monitoring threats to the so-called less important species. The purpose of this trade—to offer domestic and/or international tourists a unique souvenir to remind them of their time in Bali or to provide Indonesian aquarium enthusiasts with something different to their pet fish—is in no way a justification to allow this illegal trade to continue. We expect that some of the porcupines were found openly for sale in the Balinese tourist shops are intended for international tourists despite Indonesian law precluding their sale. We expect that many of these tourists will be unpleasantly surprised if their new purchases are confiscated either at Bali International Airport upon departure or when arriving at their final destination (in many countries the import of skulls or other body parts of wild rodents would require health

certificates or veterinary inspections and clearance to reduce the risk of the introduction of zoonotic diseases).

As argued by Gomez (2021), porcupines in Asia face a multitude of threats, habitat loss, retaliatory killings, targeted hunting for commercial trade (see also Brooks et al. 2010; Heinrich et al. 2020; Hasan & Csányi 2022), and while it is crucial that all species of porcupine are to be listed as protected species under Indonesian wildlife laws to improve regulation and enforcement against illegal trade, it is also imperative that these laws and regulations are properly and fairly enforced. We were unable to pinpoint where exactly the Sunda Porcupines we observed in trade were sourced, with traders pointing both to Bali and the neighbouring island of Java. Sunda Porcupines live in forested areas as well as in more human-dominated landscapes, including agroforests (Mustikasari et al. 2019), and gaining insight in how, where, and when these animals are trapped would greatly increase our understanding of the risk that the trade in body parts poses to the species.

Creating awareness among decision makers, traders and tourists of the lack of sustainability in large parts of legal wildlife trade, let alone the illegal wildlife trade, is urgently needed. For the Sunda Porcupine, unsustainable

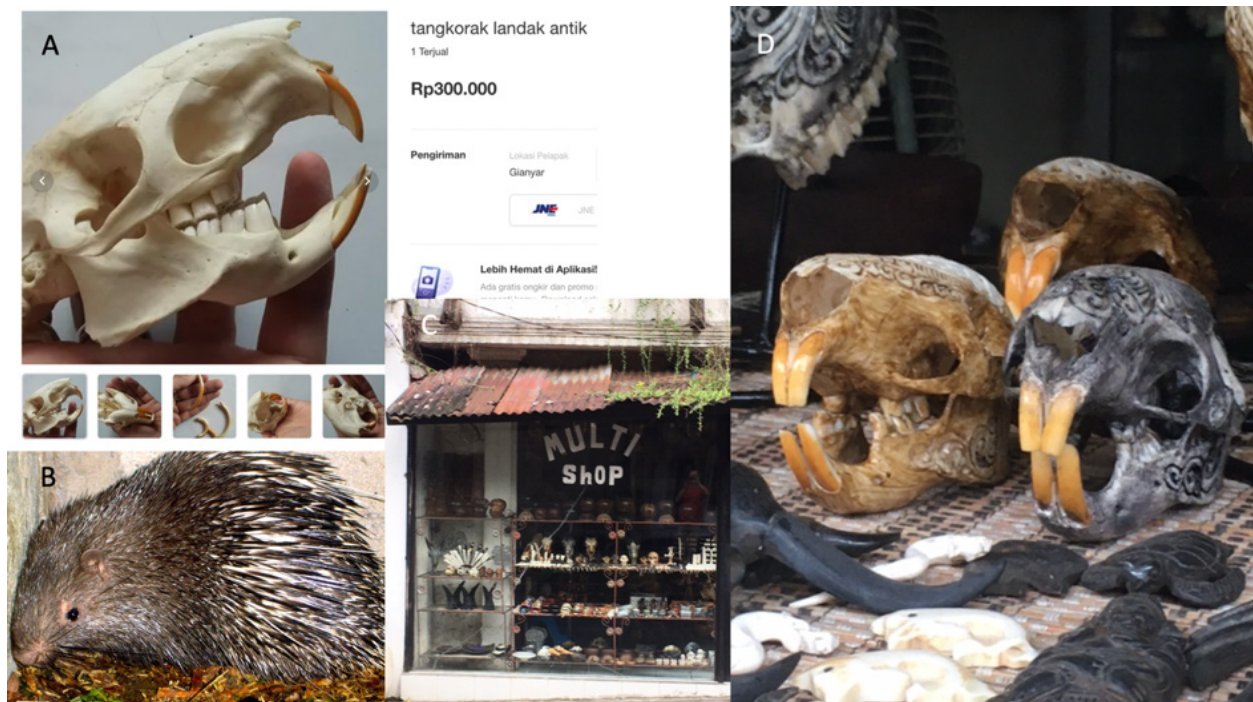


Image 1. Sunda Porcupine *Hystrix javanica* in Bali: A—a skull offered for sale on the e-commerce platform Bupalapak and while the caption suggests it is an antique, its appearance suggests otherwise; the trader is based in Gianyar (Right) | B—a juvenile Sunda Porcupine | C—a shop in selling porcupine skulls in Ubud | D—three skulls offered for sale in a shop in Ubud, all stained and intricately carved. Photos A, C and D, by Jessica Chavez and Vincent Nijman; Photo B, Linda van 't Hoff, CC-BY-NC 2.0 license

and illegal trade depletes wild populations and by doing so, undermines Indonesia's commitment to reaching biodiversity conservation goals. The online platforms that allow Sunda Porcupine skulls to be offered for sale need to enact their own terms and conditions as most preclude the sale of protected species. A more thorough examination of the commercial trade of porcupines is warranted so that appropriate mitigation measures can be developed to protect porcupines from unsustainable and illegal exploitation. If the trade indeed has a significant international component, as our research suggests it does, the Indonesian authorities may consider putting forward a Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) appendix III proposal as this would allow Indonesia to better regulate the international trade of this nationally protected species. The last two steps (mitigation measures and CITES listing) will require the full operation of both the commercial sector, local and national governments, the tourism industry and the Indonesian public.

CONCLUSION

We found the skulls of Sunda Porcupine, a legally protected species under Indonesian law, openly for sale in shops throughout Bali and by Balinese based sellers on online platforms. The impact of this trade on wild populations is unclear. Porcupine skulls are easily identifiable, and it is imperative that decisive action is taken to curb this illegal trade; for this the various stakeholders (government agencies, tourism bodies and the commercial sector) need to collaborate.

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Author contributions: JC and VN collected the data, performed the analysis and drafted the initial manuscript. K liaised with government bodies, oversaw administration, provided local context, and played a critical role in reviewing and providing constructive feedback on the initial draft. All authors contributed to the revision.



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