Market surveys and social media provide confirmation of the endangered giant freshwater whipray *Urogymnus polylepis* in Myanmar

Michael I. Grant1 | Anthony W. J. Bicknell2 | Thaung Htut3 | Antt Maung3 | Thu Maung3 | Khin Myo Myo3 | Thu Rein3 | Min Khan San3 | William T. White4,5 | Kyaw Zay Ya3 | Meira Mizrahi1,3

1CENTRE for Sustainable Tropical Fisheries and Aquaculture, College of Science and Engineering, James Cook University, Townsville, Queensland, Australia
2University of Exeter, College of Life and Environmental Sciences, Exeter, UK
3Wildlife Conservation Society, Myanmar Programme, Yangon, Myanmar
4CSIRO Oceans and Atmosphere, Hobart, Tasmania, Australia
5Australian National Fish Collection, CSIRO National Research Collections Australia, Hobart, Tasmania, Australia

Correspondence
Michael I. Grant and Meira Mizrahi, Centre for Sustainable Tropical Fisheries and Aquaculture, College of Science and Engineering, James Cook University, 1 James Cook Drive, Townsville, QLD 4811, Australia. Email: michael.grant4@jcu.edu.au; mmizrahi@wcs.org

Funding information
This work was supported in part by the MacArthur Fund, grant title “Securing the Future of Sharks and Rays in Myanmar,” and the Darwin Initiative, grant title “Securing Marine Fisheries, Livelihoods and Biodiversity in Myanmar through Co-management.”

Abstract
The giant freshwater whipray *Urogymnus polylepis* is a threatened species that is vulnerable to riverine and coastal marine pressures. Despite its threatened status, the range of *U. polylepis* is still being determined. In this study, photographic evidence of *U. polylepis* in Myanmar was provided through market surveys (2017–2018) and social media (Sharks and Rays of Rakhine Facebook page, 2021). *Urogymnus polylepis* is exposed to fisheries and habitat degradation pressures in Myanmar; therefore, conservation management is likely needed to ensure populations persist into the future.

KEYWORDS
biodiversity, Chin State, Facebook, non-marine elasmobranchs, Rakhine, threatened species

There is global concern about the deterioration of riverine environments. In the tropics, riverine environments have degraded through a range of human-induced activities, such as the construction of water retention structures (Grill et al., 2019); general land repurposing for agriculture; and residential, commercial and industrial development within catchments (Vörösmarty et al., 2010). These activities have collectively altered, fragmented and reduced the quality of available riverine habitat. Intensive inland fisheries (e.g., Ainsworth et al., 2021; Funge-Smith, 2018) and species introductions have additionally compounded these pressures, resulting in a freshwater crisis (Su et al., 2021; Tickner et al., 2020), with large fish species being particularly affected (He et al., 2019).

Among freshwater fishes, there is very little information on the conservation status of non-marine elasmobranchs (Grant et al., 2019). Elasmobranchs that use freshwater environments are either freshwater obligates (45 described species, Grant et al., 2019; Loboda et al., 2021) or euryhaline generalists (10 species), which use a range of freshwater, estuarine and marine habitats throughout their life history (Grant et al., 2019). In the Indo-Pacific, most non-marine elasmobranchs are threatened with extinction on the IUCN Red List of Threatened Species (hereafter IUCN Red List, IUCN. 2021). These species are, however, poorly studied, and fundamental information is still required on aspects of their biology and distribution.
The giant freshwater whipray *Urogymnus polylepis* is one of the largest ray species, attaining sizes of at least 223 cm disc width (Grant et al., 2021b). It is an euryhaline species with fragmented populations across Indonesia (Java, Kalimantan and Sumatra), Malaysia (Peninsular and Borneo), Brunei, the Mekong River basin (including Laos, Thailand, Vietnam and Cambodia), Thailand, Bangladesh and India (Grant et al., 2021b). Within this range, *U. polylepis* is exposed to intense small-scale (subsistence and artisanal) fisheries (e.g., Funge-Smith, 2018; Haque et al., 2021), as well as targeted recreational fisheries and harvest for ornamental aquaculture (e.g., Compagno & Cook, 2005).

Despite the charismatically large size of *U. polylepis*, its global range is still being determined. It is only recently that this species has been observed broadly throughout the island of Borneo (Windusari et al., 2019), Indonesia (Iqbal et al., 2020) and Peninsular Malaysia (Iqbal et al., 2019), and contemporary observations in India (Ishihara et al., 1998; Sen et al., 2020) and Bangladesh (Haque et al., 2021) have been limited following the historic description of the junior synonym *Trygon fluviatilis* (Annandale, 1910) from the lower Ganges River. Although conspecific subpopulations across this range are presently considered to be *U. polylepis*, the possibility of some subpopulations being separate species remains. For example, large divergences in sequences of the cytochrome *b* gene have been found between populations in India and Thailand (Sezaki et al., 1999).

A persistent ambiguity within the range of *U. polylepis* has been whether it occurs in Myanmar (formerly Burma). Vidthayanon et al. (2013) had mentioned possible reports of this species from Myanmar, whereas Grant et al. (2021b) recently considered *U. polylepis* as “possibly extant” in the lower Ayeyarwady basin based on Vidthayanon et al. (2013) and because the Ayeyarwady basin presents an ideal expanse of riverine habitat situated between populations in the Sundarbans-Ganges River and Southeast Asia. Furthermore, a potential range of *U. polylepis* also lies in rivers of northern Rakhine, which has been subject to ongoing civil insurgency since the 1950s. Nonetheless, the presence of *U. polylepis* in Myanmar has not yet been verified. This is partly because field studies in Myanmar are logistically challenging to conduct and further complicated by regular political unrest in recent decades.

The aim of this paper is to provide photographic evidence of *U. polylepis* in Rakhine and Chin State, Myanmar, that resulted from
landing site surveys and social media data collection. Landing site surveys were conducted over three seasons (rainy, cool and dry) between 2017 and 2018. These surveys aimed to obtain baseline biological information on shark and ray species in Rakhine State (i.e., presence, diversity, spatial distribution, sex and size and gear susceptibility). The authors followed the survey protocol outlined in the Wildlife Conservation Society (WCS) Field Manual for Shark and Ray Fisher, Trader & Market Based Surveys in Rakhine, Myanmar (Bicknel, 2017). All surveys were conducted in Myanmar language by native Myanmar speakers. At each landing site, the authors identified boats that had shark or ray landings and obtained verbal consent from the fishers to conduct the survey. Before recording any landings data, the authors obtained information related to boat details, gear type, target species and fishing activity. For each ray specimen, they recorded the species, disc length, disc width, weight and sex. They also took a photograph of each specimen to verify species identifications. From these market surveys, two records of U. polylepis were made from Sittwe Market in July and December 2017 (Figure 1; Table 1).

A post was additionally made on the Sharks and Rays of Rakhine Facebook group (64 members) on 9 June 2021, where users were invited to share any photographs of large stingrays caught locally within riverine environments. An additional five records were received from Facebook users, and consent for use of their images in publication was received. These records were dated between 2016 and 2021 from fishing communities along the Mayu and Kalatan Rivers in Rakhine and Chin States (Figure 1).

In sum, photographs of six specimens and one video of a large female with two pups were obtained from five locations (Figure 1; Table 1). Although the quality of photographic evidence varied, each of the specimens pictured (Figure 2) were clearly very large, uniformly brown stingrays. The broadly oval-to-subcircular disc, broad snout with an enlarged narrow apical lobe and minute eyes are distinctive of U. polylepis (see Last et al., 2016). Five of these specimens were reportedly caught in riverine environments, but no catch location was available for the Sittwe Market observations. One pregnant female was observed in an upstream freshwater environment at Kinwa, Paletwa, in the Kalatan River. This female pupped two well-developed neonates upon capture (Figure 2I,m), supporting suggestions that parturition and nursery areas occur in freshwater environments for this species (Grant et al., 2019).

The two neonates observed provide new information on the morphology of U. polylepis. The dorsal disc of both neonates had a narrow white margin and two or three enlarged denticles on the scapular region (Figure 2I.m). Both these features have not previously been noted for U. polylepis and are absent in larger specimens (e.g., Last et al., 2016), including those observed in the current study. This indicates that these features are possibly unique to neonates. Collectively, these morphological features indicate the potential for misidentification with the white-edge whipray Fluvitrygon signifer, an obligate freshwater species with an overlapping distribution in rivers of Southeast Asia (Grant et al., 2019). F. signifer also has a ventral white margin on its disc and a pearl spine on the scapular region as juveniles (Compagno & Roberts, 1982; Last et al., 2016). The tail provides a distinguishing characteristic between neonate U. polylepis and F. signifer: U. polylepis has a dark-coloured tail, covered entirely in denticles, whereas F. signifer has a characteristically light-coloured tail that is sparsely covered in denticles beyond the caudal stings (Last et al., 2016).

**Table 1** Available information for records of *Urogymnus polylepis* in Rakhine and Chin States, Myanmar

| Observation method | Date of capture | River system | State/region | Town/location | Coordinates | Gear type | Comments |
|--------------------|----------------|--------------|--------------|---------------|-------------|-----------|----------|
| Facebook           | May 2016       | Kaladan River| Rakhine      | Kyauktaw      | 20°35’44.980”N 93°27.990”E | Longline  | E-F      |
| Facebook           | 25 September 2016 | Mayu River | Rakhine | Buthidaung | 20°30’38.150”N 92°43’42.560”E | Longline | H        |
| Facebook           | May 2017       | Mayu River   | Rakhine      | Buthidaung    | 20°30’38.150”N 92°43’42.560”E | Longline  | G        |
| Market surveys     | July 2017      | Kaladan River| Rakhine      | Sittwe        | 20°8’29.040”N 92°53’0.180”E | Longline  | I        |
| Market surveys     | 21 December 2017 | Kaladan River | Rakhine | Sittwe | 20°8’29.040”N 92°53’0.180”E | Tidal net/fence net | J-K      |
| Facebook           | April 2018     | Kaladan River| Rakhine      | Pauktaw       | 20°10’41.963”N 93°4’17.260”E | Longline  | A-D      |
| Facebook           | June 2021      | Kaladan River| Chin     | Kinwa, Paletwa | 21°16’58.314”N 92°52’22.703”E | Longline  | L-M      |

Note. DL, disc length; DW, disc width; MMK, Myanmar Kyat.
The observations of *U. polylepis* in the present study provide an important update on the range of this endangered species; nonetheless, there is concern about the status of local populations. Myanmar supports one of the world’s largest per-capita (24.46 kg per year) inland fisheries (Funge-Smith, 2018), accounting for one-third of Myanmar’s total fisheries production (Baran et al., 2018). A diverse range of gear types are documented in Myanmar’s inland fishery that includes various gillnet, hook, trap and electrofishing techniques (Baran et al., 2018; Soe et al., 2020). Whereas several studies have focused on inland fisheries catch in Myanmar (e.g., Baran et al., 2018; Lwin, 2017; Soe et al., 2020), reports of rays are, to the best of authors’ knowledge, either absent or unpublished. Marine rays are targeted heavily in coastal Rakhine, often dried for local consumption (WCS Myanmar, unpubl. data); therefore, it is possible that the same could be true for rays captured in inland fisheries. It is unclear whether the dearth in ray catch data in inland fisheries is due to large historic depletions before detailed catch landing surveys were conducted, if local gear is ineffective in capturing rays, or simply due to

FIGURE 2 Photographs of *Urogymnus polylepis* in Rakhine and Chin States, Myanmar. (a–d) Pauktaw, (e, f) Kyautaw, (g, h) Buthidaung. (i–k) Sittwe Market and (l, m) Kinwa Paletwa (Table 1)
the focus of these studies towards other taxa. A further reason may be due to the subsistence nature (i.e., fishing directly for household consumption) of inland fisheries in Myanmar, limiting the amount of catch that is sold in markets and thus more easily observable. Apart from fishing, riverine environments in Myanmar have been significantly degraded by land repurposing activities and potentially from mining pollutants (Grant et al., 2021a). In particular, deforestation of mangroves in the lower delta estuarine areas of the Ayeyarwady River and Rakhine State has increased dramatically in recent decades (Estoque et al., 2018).

Only four other non-marine elasmobranch species are known from Myanmar. The Chindwin cowtail ray *Makararaja chindwinesis* is known from only two recorded specimens in the Chindwin River tributary of the Ayeyarwady basin (Grant et al., 2021a); the Ganges River shark *Glyphis gangeticus* has not been observed in Myanmar since the description of the junior synonym *Glyphis (Pristodon) siamensis* in the late 19th century (Li et al., 2015); the largеtooth sawfish *Pristis pristis* has limited available records in Myanmar, and its presence is considered “uncertain” (Dulvy et al., 2016), whereas only the bull shark *Carcharhinus leucas* is still regularly observed in marine catch landsings (e.g., Howard et al., 2015). Considering the conservation status of these other non-marine elasmobranch species in Myanmar, the present range extension of *U. polylepis* is unlikely to provide a globally significant refuge for this species, as populations are exposed to a combination of fisheries and habitat degradation pressures.

*U. polylepis* likely requires a concerted conservation effort in Myanmar to ensure populations persist into the future. Furthermore, the presence of *U. polylepis* in the Ayeyarwady basin still requires verification. With the present political unrest in Myanmar, the use of social media in the present study has provided an effective tool to document the distribution of a distinctive and poorly known threatened species and may have further applications for conservation of elasmobranchs in Myanmar (Di Minin et al., 2015). Use of social media platforms to generate citizen science and track public perception of protected species (e.g., Kroetz et al., 2021) and collect data for cryptic and poorly known species (e.g., McDavitt & Kyne, 2020), or from regions that are logistically difficult to conduct surveys in (Iqbal et al., 2017, Iqbal et al., 2018), has been successfully applied to threatened elasmobranchs. It is likely that social media can provide further information on Myanmar’s data-poor elasmobranch species into the future (e.g., *M. chindwinesis*) and continue to have broad applications to conservation of elasmobranchs globally.

**ACKNOWLEDGEMENTS**

The authors are thankful for the helpful insights from the individuals who participated, shared and responded to our call for information on social media in Myanmar and generously gave their time to contribute to this research. The authors thank the MacArthur Fund and the Darwin Initiative for supporting this work.

**AUTHOR CONTRIBUTIONS**

M.I.G. and M.M. were involved in conception of this study; A.B., T.H., A.M., K.M.M., T.R., M.K.S. and M.M. helped in data generation; M.I.G., T.H., A.M., T.M., K.M.M., T.R., M.K.S., W.T.W., K.Z.Y. and M.M. assisted with data analysis; M.I.G and M.M. were involved in manuscript preparation; all other authors contributed to editing the manuscript.

**ORCID**

Michael I. Grant https://orcid.org/0000-0002-6127-8968
Anthony W. J. Bicknell https://orcid.org/0000-0002-2817-2010
Meira Mizrahi https://orcid.org/0000-0002-7870-1232

**REFERENCES**

Ainsworth, R., Cowx, I. G., and Funge-Smith, S. J. (2021). A review of major river basins and large lakes relevant to inland fisheries. FAO Fisheries and Aquaculture Circular No. 1170. FAO, Rome. https://doi.org/10.1007/s11160-019-3060-9

Baran, E., Ko, W. K., Wah, Z. Z., Nwe, K. M., Ghaatre, G., and Soe, K. M. (2018). Fisheries in the Ayeyarwady Basin. Ayeyarwady State of the Basin Assessment (SOBA) Report 4.1. National Water Resources Committee (NWRC), Myanmar. Available at: https://digitalarchive.worldfishcenter.org/bitstream/handle/20.500.12348/696/4252.pdf?sequence=1

Bicknel, A. (2017). Field Manual for Shark and Ray Fisher. Trader & Market Based Surveys in Rakhine, Myanmar. Prepared for Wildlife Conservation Society (WCS) Myanmar, pp. 1–36.

Compagno, L., & Cook, S. F. (2005). Giant freshwater stingray or whipray *Himantura chaophyrae* Monkolprasit & Roberts, 1990. In S. L. Fowler, R. D. Cavanagh, M. Camhi, G. H. Burgess, G. M. Cailliet, S. V. Fordham, et al. (Eds.), Sharks, rays and chimaeras: The status of the Chondrichthyan fishes (pp. 348–349). Gland and Cambridge: IUCN/SSC Shark Specialist Group, IUCN. https://portals.iucn.org/library/files/documents/2005-029.pdf

Compagno, L. J. V., & Roberts, T. R. (1982). Freshwater stingrays (Dasyatidae) of Southeast Asia and New Guinea, with description of a new species of *Himantura* and reports of unidentified species. Environmental Biology of Fishes, 7, 321–339. https://doi.org/10.1007/BF00005567.

Di Minin, E., Tenkanen, H., & Toivonen, T. (2015). Prospects and challenges for social media data in conservation science. Frontiers in Environmental Science, 3. https://doi.org/10.3389/fenvs.2015.00063

Dulvy, N. K., Davidson, L. N. K., Kyne, P. M., Simpfendorfer, C. A., Harrison, L. R., Carlson, J. K., & Fordham, S. V. (2016). Ghosts of the coast: Global extinction risk and conservation of sawfishes. Aquatic Conservation: Marine and Freshwater Ecosystems, 26, 134–153. https://doi.org/10.1002/aqc.2525.

Estoque, R. C., Myint, S. W., Wang, C., Ishtiaque, A., Aung, T. T., Emerton, L., ... Wang, Z. (2018). Assessing environmental impacts and change in Myanmar’s mangrove ecosystem service value due to deforestation (2000–2014). Global Change Biology, 24, 5391–5410. https://doi.org/10.1111/gcb.14409.

Funge-Smith, S. J. (2018). Review of the state of world fishery resources: inland fisheries FAO Fisheries and Aquaculture Circular No. C942 Rev.3. Rome. 397 pp. Available at: https://www.fao.org/publications/card/en/c/CA0388EN/

Grant, M. I., Kyne, P. M., Simpfendorfer, C. A., White, W. T., & Chin, A. (2019). Categorising use patterns of non-marine environments by elasmobranchs and a review of their extinction risk. Reviews in Fish Biology and Fisheries, 29, 689–710. https://doi.org/10.1007/s11160-019-09576-w.

Grant, M. I., Rigby, C., Mizrahi, M., and Sayer, C. (2021a). *Makararaja chindwinesis*. The IUCN Red List of Threatened Species 2021: e. T161698A124530183. Available at: https://doi.org/10.2305/IUCN.UK.2021-2.RLTS.T161698A124530183.en.
Grant, M. I., Rigby, C. L., Bin Ali, A., Fahmi, Haque, A. B., Hasan, V., and Sayer, C. (2021). *Urogymnus polylepis*. The IUCN Red List of Threatened Species 2021. e.T195320A104294071. Available at: https://doi.org/10.2305/IUCN.UK.2021-2.RLTS.T195320A104294071.en.

Grill, G., Lehner, B., Thieme, M., Geenen, B., Tickner, D., Antonelli, F., and Zulkifli, H. (2019). Mapping the world’s free-flowing rivers. *Nature*, 569, 215–221. https://doi.org/10.1038/s41586-019-1111-9.

Haque, A. B., Cavanagh, R. D., and Seddon, N. (2021). Evaluating artisanal fishing of globally threatened sharks and rays in the bay of Bengal, Bangladesh. *PLoS One*, 16, e0256146. https://doi.org/10.1371/journal.pone.0256146.

He, F., Zulkifli, H., Bremerich, V., David, J. N. W., Hogan, Z., Kalinkat, G., and Jähning, S. C. (2019). The global decline of freshwater megafauna. *Global Change Biology*, 25, 3883–3892. https://doi.org/10.1111/gcb.14753.

Howard, R., Ahmad, A. and U Saw Han Shein. (2015). Tracking public interest and perceptions about smalltooth sawfish, *Pristis pectinata* (Bleeker, 1852) in Indonesia. *Australian Centre for International Agricultural Research, Canberra, and WorldFish, Yangon*. Available at: https://www.worldfishcenter.org/publication/myanmar-inland-fisheries-and-aquaculture-decade-review.

Iqbal, M., Setiawan, D., and Ajiman, A. (2017). Presence of *Fluvitrygon oxyrhynchus* in Sumatra, Indonesia (Chondrichthyes: Dasyatidae). *Ichthyological Exploration of Freshwaters*, 28, 83–85.

Iqbal, M., Urogymnus polylepis (Bleeker, 1852) in Indonesia. *Ichthyological Exploration of Freshwaters*, 29, 371–374. https://doi.org/10.23788/IIF-1112.

Iqbal, M., Zulkifli, H., and Yustian, I. (2018). The valid species and distribution of stingrays (Myliobatiformes: Dasyatidae) in south Sumatran waters, Indonesia. *BIOVALENTIA: Biological Research Journal*, 4, 12–20. https://doi.org/10.24233/BIOV.4.1.2018.98.

Ishihara, H., Tanaka, T., Tanaka, S., and Srivastava, M. P. (1998). Investigation of the freshwater elasmobranchs in the river Ganges. In *Adaptability and conservation of freshwater elasmobranchs. Report of research project, Grant-in-aid for international scientific research (field research)* in the *financial year of 1996 and 1997* (pp. 41–55). Tokyo, Japan: School of Marine Science and Technology, Tokai University.

IUCN. (2021). The IUCN Red List of Threatened Species. Version 2021-3. Available at: https://www.iucnredlist.org.

Kroetz, A. M., Brame, A. B., Bernanke, M., McDavitt, M. T., and Wiley, T. R. (2021). Tracking public interest and perceptions about smalltooth sawfish conservation in the USA using Instagram. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 31(10), 2901–2909. https://doi.org/10.1002/aqc.3680.

Last, P., Naylor, G., Séré, B., White, W., Stehmann, M., and de Carvalho, M. (2016). *Rays of the world*. Clayton, VIC: CSIRO PUBLISHING.

Li, C., Corrigan, S., Yang, L., Straube, N., Harris, M., Hofreiter, M., and Naylor, G. J. P. (2015). DNA capture reveals transoceanic gene flow in endangered river sharks. *Proceedings of the National Academy of Sciences*, 112, 13302–13307. https://doi.org/10.1073/pnas.1508735112.

Loboda, T., Lasso, C., Rosa, R., and Carvalho, M. (2021). Two new species of freshwater stingrays of the genus *Paratrygon* (Chondrichthyes: Potamotrygonidae) from the Orinoco basin, with comments on the taxonomy of *Paratrygon aierrea*. *Neotropical Ichthyology*, 19(2), 1–80. https://doi.org/10.1590/1982-0224-2020-0083.

Lwin, T. T. (2017). Investigation of Fish Resources and Assessment of Fishing Operations in the Chindwin River. *Fisheries Research Development Network*, Department of Zoology, Monywa University, Nay Pyi Taw, U Soe Myint (01683). Available at: http://www.dof-myanmar-fic.org/multimedia/Research%20Reports/33.%20Investigation%20of%20Fish%20Resources%20in%20Chindwin%20(Monywa%20Uni,%20-%20FIRDNON004.pdf.

McDavitt, M. T., and Kyne, P. M. (2020). Social media posts reveal the geographic range of the critically endangered clown wedgefish, *Rhynchobatus cooki*. *Journal of Fish Biology*, 97, 1846–1851. https://doi.org/10.1111/jfb.14530.

Sen, S., Dash, G., Kishakudan, S., Chakraborty, R. D., and Mukerjee, I. (2020). New record of the giant freshwater whipray *Urogymnus polylepis* from west Bangal waters, east coast of India. *Ichthyological Exploration of Freshwaters*, IEF-1113. https://doi.org/10.23788/IEF-1113.

Sezaki, K., Begum, R., Wongrat, P., Mb, S., Sri Kantha, S., Kikuchi, K., and Watabe, S. (1999). Molecular phylogeny of Asian freshwater and marine stingrays based on the DNA nucleotide and deduced amino acid sequences of the cytochrome b gene. *Fisheries Science*, 65, 563–570. https://doi.org/10.2331/fishesci.65.563.

Soo, K., Baran, E., Grantham, R., Tezzo, X., and Johnstone, G. (2020). *Myanmar inland fisheries and aquaculture: a decade in review, monograph no. 209*. Australian Centre for International Agricultural Research, Canberra, and *WorldFish, Yangon*. Available at: https://www.worldfishcenter.org/publication/myanmar-inland-fisheries-and-aquaculture-decade-review.

Su, G., Logez, M., Xu, J., Tao, S., Villéger, S., and Brosse, S. (2021). Human impacts on global freshwater fish biodiversity. *Science*, 371, 835–838. https://doi.org/10.1126/science.abc3369.

Tickner, D., Opperman, J. J., Abell, R., Acreman, M., Arthington, A. H., Bunn, S. E., Young, L. (2020). Bending the curve of global freshwater biodiversity loss: An emergency recovery plan. *Bioscience*, 70, 330–342. https://doi.org/10.1093/biosci/biaa022.

Vidhyayanon, C., Baird, I., and Hogan, Z. (2013). *Himantura polylepis*. The IUCN Red List of Threatened Species 2013: e.T195320A8956611. Available at: https://doi.org/10.2305/IUCN.UK.2011-1.RLTS.T195320A8956611.en.

Vörösmarty, C. J., McIntyre, P. B., Gessner, M. O., Dudgeon, D., Prusevich, A., Green, P., and Davies, P. M. (2010). Global threats to human water security and river biodiversity. *Nature, 467*, 555–561. https://doi.org/10.1038/nature09440.

Windsuari, Y., Iqbal, M., Hanum, L., Zulkifli, H., and Yustian, I. (2019). Contemporary distribution records of the giant freshwater stingray *Urogymnus polylepis* in Borneo (Chondrichthyes: Dasyatidae). *Ichthyological Exploration of Freshwaters*, 2019, 1–6. https://doi.org/10.23788/IEF-1089.