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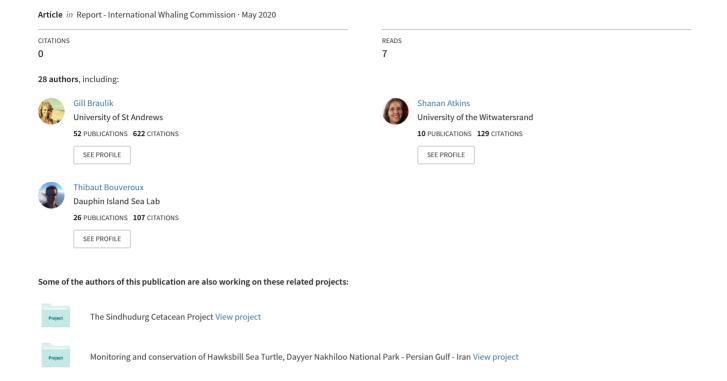
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Gill Braulik, Shanan Atkins, et al.

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Development of Flukebook automated photo-ID matching capability for the Indian Ocean humpback dolphin, *Sousa plumbea*

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Abstract

The four currently recognised species of *Sousa* are all threatened on the IUCN Red List. To date they have not been included in any of the available software platforms that have been developed for the automated matching of cetaceans from photo-ID data. Because of their unique morphology, existing algorithms are unlikely to be successful and new algorithms will be required. A collaboration between more than 35 researchers in the Western Indian Ocean began in 2020 and to date more than 1200 photos of 273 *Sousa plumbea* individuals from 7 countries (South Africa, Madagascar, Tanzania, Kenya, UAE, Iran and India) have been contributed to a training dataset; one of the largest collaborative efforts of its kind. Flukebook and finFindR are now starting the work of developing the matching algorithms and plans are underway to test the resulting algorithms and to develop a comprehensive plan for matching catalogues throughout the species range. It is hoped that resulting algorithms will also work on the three other species of *Sousa*, and that ultimately these will help to answer questions regarding movements patterns, home range etc that are important for these threatened species.

The four currently recognised species of *Sousa* are all coastally distributed and listed as threatened on the IUCN Red List. To date they have not yet been included in any of the available software platforms that have been

developed for the automated matching of cetaceans from photo-ID data (Blount *et al*. 2019; Thompson *et al*. 2019). Unlike some other dolphin species, *Sousa* spp. are often matched using photos of the marks and scars on both the leading and trailing edges of their dorsal fin, as well as on the upper tail stock. In addition, dorsal fin shape and colour variation are often also used for matching. There is considerable variation in size, shape and colouration of dorsal fins and humps among individuals and sites. Matching algorithms used for other species, such as bottlenose dolphins (*Tursiop*s spp.), that rely primarily on trailing-edge marks, are unlikely to be as effective for humpback dolphins and new algorithms are needed.

The Indian Ocean humpback dolphin, *Sousa plumbea*, occurs in shallow, nearshore waters from South Africa to India and is listed as Endangered on the IUCN Red List (Braulik *et al*. 2015, 2017). A large-scale, nation-wide effort in South Africa matched 20 photo-ID catalogues, and the ranging distances of Indian Ocean humpback dolphins, *S. plumbea*, varied from 30 km up to 500 km (Vermeulen *et al*. 2018). Likewise, along the central and eastern regions of the Emirate of Abu-Dhabi (UAE) individual movements of up to 100 km (mean = 92 ± 12 km) were recorded (Díaz López *et al.*, 2018). A humpback dolphin photo-identified in Kisite in southern Kenya was also re-sighted in Watamu around 150 km to the north (Kenya Marine Mammal Network, 2012). It is expected that there are similar along-shore movements in other parts of the species range and for other *Sousa* spp. and understanding these ranging patterns is important for developing effective conservation interventions. The visual photo-ID matching process is time consuming, and an automated matching platform adapted for *Sousa* spp. would greatly expedite the routine comparison of photo-ID catalogues, and in turn would serve to improve the availability of data on the movements of these threatened coastal animals.

In late January 2020 a discussion was initiated among more than 35 of the researchers and groups working throughout the range of *S. plumbea,* from South Africa through East Africa and the Middle East to India, to gauge interest in developing automated photo-ID matching capability within Flukebook. This process included an invitation for individuals and groups to contribute their *S. plumbea* catalogues to be used for algorithm training data. The responses were very positive and as of 1st May 2020 more than 1200 photos of 273 individuals from seven countries (South Africa, Madagascar, Tanzania, Kenya, UAE, Iran and India) had been uploaded into the training dataset (Table 1). This includes the large combined catalogue from South Africa's SouSA consortium.

Table 1 - Sousa plumbea catalogues available for automated matching algorithm development

Country	n images	n individuals	images / individual
Madagascar	88	31	2.8
Tanzania	45	12	3.8
Kenya	367	33	11.1
Iran	101	39	2.6
South Africa	569	141	4.0
UAE	35	13	2.7
India	12	4	3.0
Total	**1217**	**273**	**4.5**

There are three existing cetacean consortiums within the range of *S. plumbea* in the Indian Ocean: Indocet in the south-west Indian Ocean, the Arabian Sea Whale Network (ASWN) in the north-west Indian Ocean and the SouSA consortium in South Africa. Indocet and the ASWN are working closely with Flukebook to host and match their humpback whale catalogues (Blount *et al*. 2019). The intention is to build on this existing capacity to explore the possibility of adding *Sousa plumbea* into Flukebook under the umbrella of these consortia, thereby expanding those existing networks and further inter-linking their work. The development of an algorithm for matching *S. plumbea* should also greatly facilitate automated matching of the other three *Sousa* species, including the Critically Endangered Atlantic humpback dolphin, *Sousa teuszii* (Collins *et al*. 2017).

New algorithms will draw from those already developed, or under development, for grey whales, humpback whale dorsal fins and *Tursiops* spp. The collaborative group is now exploring options to raise the funds for developing the matching algorithms within Flukebook and finFindR.

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