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Fish Biodiversity Assessment of Tawarja Reservoir, Latur (Maharashtra): A Case Study

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present study deals with the ichthyofaunal diversity of Tawarja reservoir, Latur, Maharashtra. Tawarja reservoir is a perennial water body used for human and livestock consumption in nearby areas. This reservoir's primary purpose is irrigation, and it is also used for culture-based capture fisheries by the fisherman community of Latur taluka. Tawarja reservoir is allocated to *Mahadev Koli Samaj Matsyavawsay Cooperative Society Ltd.*, Kava of Latur taluka. The present study observed that the ichthyofauna belongs to 05 orders, 09 families, 19 genera and 31 species. Cyprinidae family was reported dominant with 17 species (54.83%) followed by Bagridae & Siluridae 3 species with 9.67 % contribution, Channidae with 02 species (6.45%), and the families of Notopteridae, Botiidae, Clariidae, Heteropneustidae, Pangasidae and Mastacembelidae contributing 01 species (3.22%) of each. Regarding their conservation status, 25 species were of least concern, 2 were vulnerable, 3 were near threatened, and 1 was in an endangered stage. (IUCN-2023).

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1. INTRODUCTION

Water is essential for survival. A crucial human necessity, water is also one of the most important, ever-changing, and irreplaceable resources. It generates hydroelectric power and has several additional uses, including irrigation, water supply, industry, drinking, aquaculture, and other aquatic creatures' cultivation. According to the CIA (2008), water covers 71% of the Earth's surface. However, 96.5% of that water is salty, meaning it cannot be directly utilized for human consumption, irrigation, or household or industrial activities. The amount of freshwater found in bodies of water such as rivers, lakes, ponds, reservoirs, etc., is close to one percent. Estimates show that effluents from farms, businesses, and homes contaminate almost 70% of the water supply in our nation. India has a vast reservoir resource, with over 3.0 million hectares of water spread area.

Biodiversity refers to the diversity and variability of life on Earth. It covers variations in genes, species, and ecosystems. It is usually assessed among living forms regarding richness, evenness, and variety [1]. Fish food is considered as good source of protein. Fish culture and capture serves as livelihood for millions of people worldwide. Fish diversity is now recognized globally, with 25,000 species, 10,000 of which are found in freshwater ecosystems and around 11.7% in biodiversity of conservation values (www.fishbase.se). Fish account for more than half of all vertebrates, and India accounts for around 7.7% of world fish diversity. India, a biologically rich nation, is home to 7.6% of all mammalian, 12.6% of all avian, 6.2% of all reptile, 4.4% of all amphibian, 11.7% of all piscine, and 6.0% of all flowering plant species [2]. Fish account for somewhat more than half of the total vertebrates, with 34300 species. According to Froese and Pauly [3], India accounts for around 7.7% of world fish diversity, with 1,673 marine species and 994 freshwater. Coad and Murray [4] estimated that there are about 32,000 genuine fish species on the planet, divided into 85 orders and 536 families, with freshwater fish accounting for 43% of the total. Although just a tiny portion of the Earth's surface freshwater is occupied by fish, it supports a significant number of species.

Biodiversity is crucial for the stability of ecosystems, conservation of overall quality environments, and comprehending the inherent value of all species on the planet [5]. To maintain fish biodiversity, it is necessary to conduct sustainable fishing, protect and restore ecosystems, and limit pollution. Sustainable fishing techniques, such as catch quotas and gear limitations, may assist to avoid overfishing and keep fish populations healthy. Fish may flourish in environments that have been protected and restored, such as wetland conservation and coral reef restoration. Pollution reduction via improved waste management methods, as well as the use of bio-degradable insecticides, may all assist in conserving fish biodiversity.

The integration of standardized research surveys with historical fisheries data, such as written archives or archaeological studies [6,7], enables the establishment of reference points for detecting future alterations in species richness and size composition. This approach facilitates the identification of the factors responsible for these changes. Numerous alterations in the species and size composition of fish populations resulting from fisheries activities have been extensively reported in the literature [8]. It has become increasingly evident that these alterations have an impact on the composition and operation of freshwater ecological systems, including the biomass of organisms at lower trophic levels. As a result, fisheries managers and policy makers have embraced more cautious and accountable strategies, as well as the implementation of an ecologically-oriented approach to fisheries management [9].

Various researchers from india has attempted to study the biodiversity of fishes in India. Shinde et al. [10] investigated the fish biodiversity, variety, and quantity of freshwater fishes in the Pravara River, Pravara Sangam District, Ahmednagar (M.S) India. Bhat et al. [11] investigated the diversity and composition of freshwater fishes in river systems in Central Western Ghats, India. Singh and Johal [12] conducted research on the current situation of fish species diversity in the Ganga River in Allahabad, Uttar Pradesh, India. Noss [13] identified composition, structure, and function as the primary features of biodiversity and reinforced them hierarchically into nested forms by integrating additional organizational levels: regional landscape, community-ecosystem, population species, and genetics.

The current research was conducted to investigate the ichthyofaunal diversity of Tawarja dam in Latur district. The findings of this research have the potential to positively impact the local community by providing useful knowledge on the variety of fish species in the Tawarja reservoir. Also the baseline data on fish diversity would help policy makers to take precautionary measures to conserve the endangered fish species and further, to conserve the local biodiversity.

2. MATERIALS AND METHODS

Latur district is located in the south-eastern region of Maharashtra. Latur town is situated between 18.05º and 18.7º North latitude and

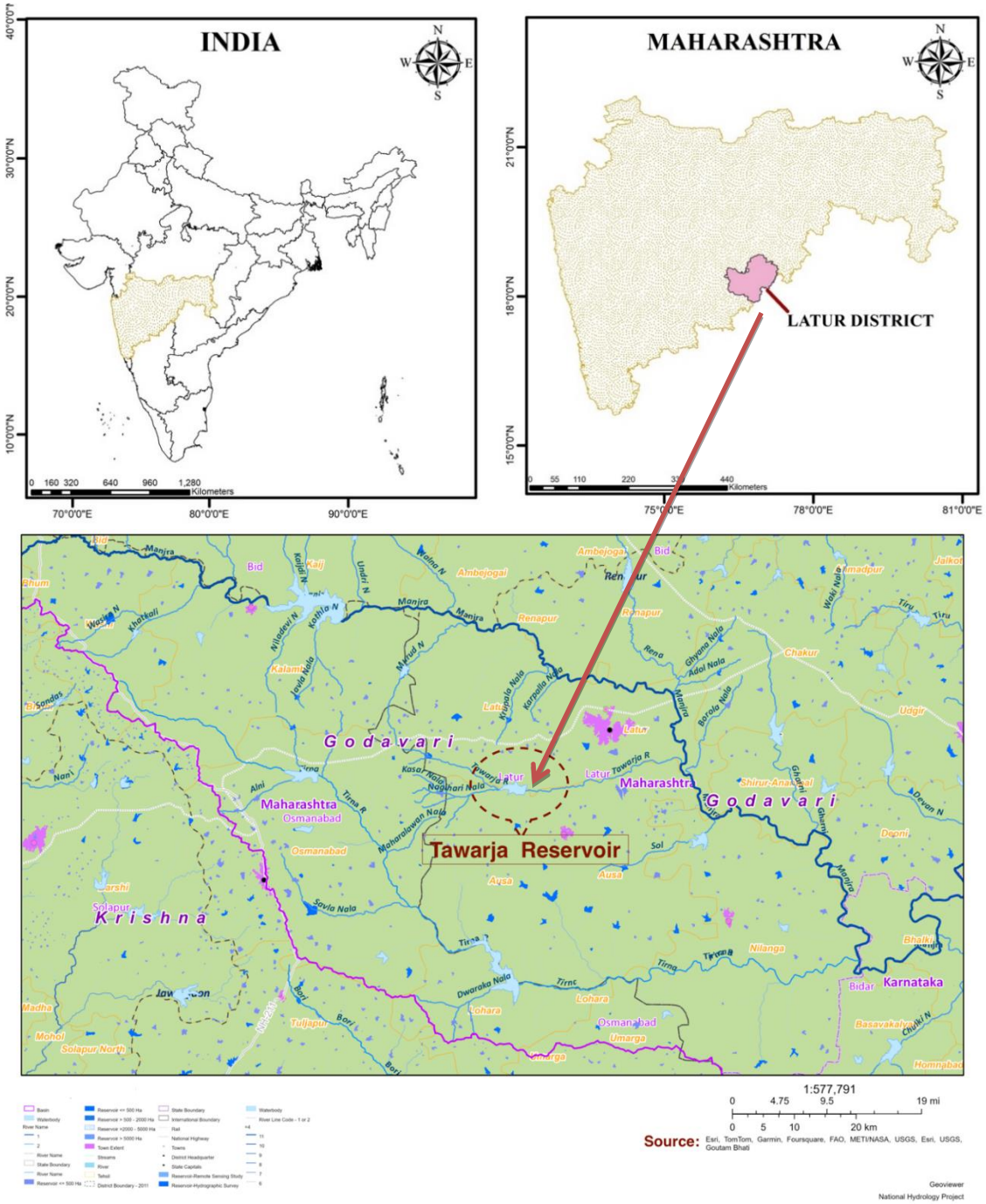

Fig. 1. Tawarja reservoir location map

73.25º and 77.25º East longitude. It is located 636 meters above sea level. The whole district of Latur is located on the Balaghat Plateau. Tawarja reservoir is situated near Kava, which is km from Latur city. The Tawarja Dam is an earthfill dam built on the Tawarja River, which starts at Murud in Latur taluka and meets the Manjara River at Shivani on the Latur-Ausa border. The dam is 14.3 m tall and 2222 m long, with a water spread area of 741 Km^2. (478.9 ha.). The volume content is 361 km^3, and the gross storage capacity is 20,520.00 km^3. This dam is also known as a tourist destination for the Nereby people.

2.1 Study Area

Members of the Mahadev Koli Samaj Matsyavawsay Cooperative Society Ltd. Kava, a recognized fishing cooperative in Latur taluka, assisted in the fish collection effort from Tawarja reservoir (Fig. 1). The traditional fishing gear used to catch the fish included hand nets, gill nets, cast nets, and bhor jal. Photographs were captured at the reservoir's fish landing location. We also shopped at the local fish market for these fish. Over the course of a year, from June 2022 to May 2023, researchers systematically examined several aspects of fish collecting and catch. The fish were transferred to the lab and placed in a 10% formalin solution for preservation. The specimens were preserved in glass jars and housed with small fish immediately in the 10% formalin. After degumming, big fish were stored in huge HDPE tubs. According to established taxonomic keys for fishes, physical features such as colour, form, scale pattern, mouth pattern, and fins were used for identification (Day, 1889), [14,15].

2.2 Climate and Rainfall

In the Latur area, the monsoon rain starts in mid-June and ends in October. Winter lasts from November to February, and summer begins in March and ends mid-June. When it rains, the air stays damp. In the winter, it stays dry and cold; in the summer, it stays dry and hot. It rains an average of 801.04 mm a year. It rains during the south-west monsoon.

3. RESULTS AND DISCUSSION

There were 31 different species of fish identified in this research, spread throughout 5 orders (Fig. 2) and 9 families (Fig. 3). Data analysis revealed that out of all the fish orders, 17 belonged to the Cypriniformes, 9 to the Siluriformes, and 2 to the Anabantiformes. The Twawarja reservoir water body was sampled for its richness of fish and shellfish, and one species from the orders Osteoglossiformes and Synbranchiformes was found there. The conservation status of the species was as follows: 25 were of least concern, 2 were vulnerable, 3 were near threatened, and 1 was in danger. (1923, IUCN). Table 1 displays the 31 fish species that were recorded together with their conservation status over the one year of the inquiry.

Kurup (1994), Easa and Shaji [16], Biju et al. (2008), Radhakrishnan and Kurup [17], and Ali et al. [18] are among the past research that have examined the freshwater fish fauna of Kerala. Zacharias et al. [19] and Kurup [20,18] are only two of the numerous researchers that have documented challenges to freshwater fish biodiversity.

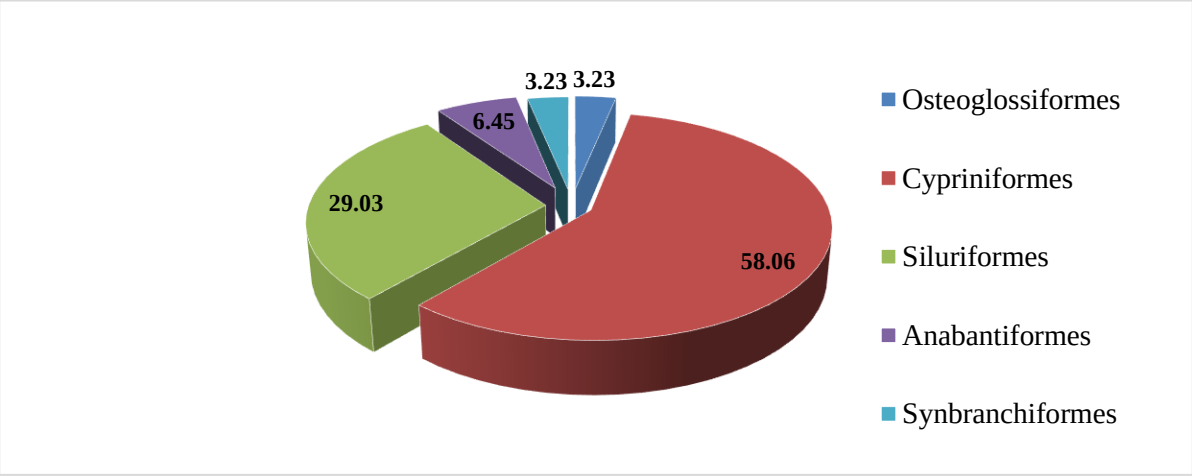

Fig. 2. Percentage contribution of 31 species in five orders

Table 1. Fish species observed in the Tawarja reservoir, Latur

S.N.	Order	Family	Genus	Species	Conservation Status	Economic value	Status
			Class: Actinoptregii				
1	1. Osteoglossiformes	1. Notopteridae	*Notopterus*	*notopterus (*Pallas, 1769*)*	LC	PF, MD	+
2	2. Cypriniformes	Cyprinidae	*Catla*	*catla (*Hamilton, 1822)	LC	FD	+++
3	Cypriniformes	Cyprinidae	*Labeo*	*rohita (*Hamilton, 1822*)*	LC	FD	+++
4	Cypriniformes	Cyprinidae	*Labeo*	*bogggut (*Sykes, 1839)	LC	FD	++
5	Cypriniformes	Cyprinidae	*Labeo*	*fambriatus (*Bloch, 1795*)*	LC	FD	++
6	Cypriniformes	Cyprinidae	*Labeo*	*calbasu (*Hamilton, 1822*)*	LC	FD	++
7	Cypriniformes	Cyprinidae	*Labeo*	*gonius (*Hamilton, 1822*)*	LC	FD	++
8	Cypriniformes	Cyprinidae	*Cirrhinus*	*mrigala (*Hamilton, 1822*)*	LC	FD	+++
9	Cypriniformes	Cyprinidae	*Cirrhinus*	*reba (*Hamilton, 1822)	LC	FD	++
10	Cypriniformes	Cyprinidae	*Cirrhinus*	*cirrosus (*Bloch, 1795)	VU	FD	+
11	Cypriniformes	Cyprinidae	*Osteobrama*	*cotio (Hamilton, 1822)*	LC		+
12	Cypriniformes	Cyprinidae	*Ctenopharyngodon*	*idella (Valenciennes, 1844)*	LC	FD	+
13	Cypriniformes	Cyprinidae	*Rasbora*	*daniconius (*Hamilton, 1822*)*	LC	LV	+
14	Cypriniformes	Cyprinidae	*Garra*	*mullya (*Sykes, 1839)	LC	FD	+++
15	Cypriniformes	Cyprinidae	*Osteobrama*	*vigoris (*Sykes, 1839)	LC	FD	+
16	Cypriniformes	Cyprinidae	*Puntius*	*sophore (*Hamilton, 1822*)*	LC	BT,LV,WF,FD	+
17	Cypriniformes	Cyprinidae	*Puntius*	*ticto*	LC	FD	+
18	Cypriniformes	Cyprinidae	*Puntius*	*vittatus* (Day, 1986)	LC	FD	+
19	Cypriniformes	2. Botiidae	*Botia*	*striata (*Narayan Rao, 1920*)*	EN	FD	+
20	3. Siluriformes	3. Bagridae	*Mystus*	*seengtee (*Sykes, 1839)	LC	*FD*	+
21	Siluriformes	Bagridae	*Mystus*	*covasius (*Hamilton, 1822*)*	LC	FD	+
22	Siluriformes	Bagridae	*Mystus*	*vittatus (*Bloch, 1794)	NT	FD	-
23	Siluriformes	4. Clariidae	*Clarias*	*batrachus (*Linneaeus, 1758*)*	LC	FD	+
24	Siluriformes	5. Heteropneustidae	*Heteropneustes*	*fossilis* (Bloch, 1794)	LC	FD	+
25	Siluriformes	6. Pangasiidae	*Pangasius*	*pangasius (*Hamilton, 1822*)*	LC	FD	++
26	Siluriformes	7. Siluridae	*Ompok*	*bimaculatus* (Bloch, 1794)	NT	FD	+
27	Siluriformes	Siluridae	*Ompok*	*pabda (*Bloch, 1794)	NT	FD	+
28	Siluriforms	Siluridae	*Wallago*	*attu (Bloch and Schneider)*	VU	FD	+
29	4. Anabantiformes	8. Channidae	*Channa*	*marulius* (Hamilton, 1822*)*	LC	FD	++
30	Anabantiformes	Channidae	Channa	punctate (Bloch, 1793)	LC	FD	++
31	5. Synbranchiformes	9. Mastacembelidae	*Mastacembelus*	armatus (Lacepede, 1800)	LC	FD	+

+++ Most abundant, ++ Abundant, + Less abundant, - Rare.

1) LV-Larvivous fish. 2) BT-Bait. 3) PF-Predatory Food Fish. 4) WF-Weed Fish. 5) MD-Medicinal Value. 6) FR-Forage Fish. 7) FD- Food Fish.

Taxonomic status as per Eschemeyer et al. 2018, T = Transplanted; I = Invasive, IUCN (2018). EN = Endangered, NT = Near Threatened, VU = Vulnerable, LC = Least Concern, NE = Not Evaluated, DD = Data Deficient. Statuses for introduced/transplanted species are not provided.

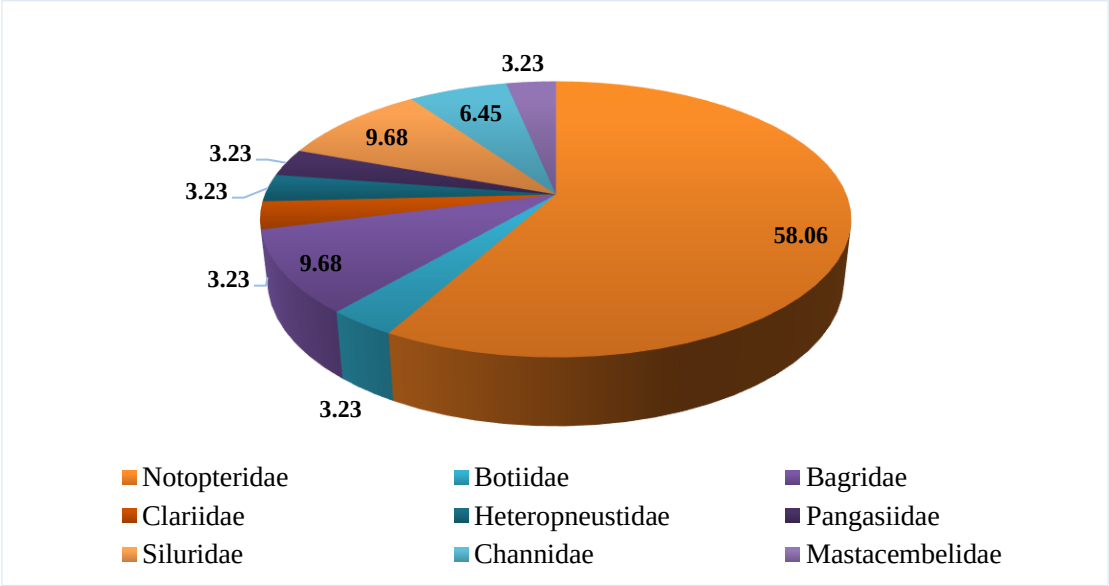

Fig. 3. Percentage contribution of 31 species in nine families

The findings corroborate previous research on the fish richness in this area. Eleven different species of fish from five different orders have been discovered in the Sirur Dam in the Nanded District. In the Palas-Nilegaon reservoir in the Osmanabad district, about 28 different species of fish were found. These included 9 species of carps, 5 species of catfish, 2 species of featherbacks, 5 species of live fish, and 7 species of other fish. Twenty species were documented from the Ghogaon reservoir in Satara district. These species belonged to thirteen genera and seven families, spanning four orders. Fish life at Hyderabad's Himayasgar Lake was studied, and 32 species from 11 families and 6 orders were identified.

Also, between May 2007 and April 2009, Jadhav et al. [21] documented 58 fish species from 16 families and 38 taxa in their two-year study of freshwater fish fauna. Thirty species from fifteen genera belonged to the Cyprinidae, making it the most numerous family. Out of the 58 species of fish found in the Koyna River, 22 are native to the western Ghats and 11 are exclusive to the Krishna River system. In the research region, 8 species were plentiful, 21 were common, 19 were moderate, and 10 were uncommon. According to Ubharhande and Sonawane [22], the ichthyofauna in Pantakli dam from Buldhana district, (M.S.) India, belongs to seven orders, ten families, nineteen genera, and twenty-one species [23-25]. The Cyprinidae family has the most representation, with ten species (47.63%), followed by the Channidae and Mastacembelidae families, each with two species (9.52%). Balitoridae, Bagridae, Clariidae, Belonidae, Notopteridae, Cichlidae, and Poecilidae each make up one species (4.76%) [26,27].

4. SUMMARY

The examination found thirty-one (31) fish species belonging to five orders and nine families. The data analysis revealed that the order Cypriniformes has the most fish species (17), followed by Siluriformes (9) and Anabantiformes (02). The order Osteoglossiformes and Synbranchiformes have one species documented from the Tawarja reservoir, which is being studied for Ichthyofaunal diversity. In terms of conservation status, 25 species were classified as least concern, two as vulnerable, three as near threatened, and one as endangered. (IUCN-2023).

5. CONCLUSIONS

With the changing conditions of progressive habitat destruction, the conservation of fish diversity becomes the top concern. Some fish species are either not present at all or are very few, which points to a worrying decrease in fish diversity in the studied region. Exotic species have mostly supplanted the native flora and fauna. This means that a wide range of approaches is required to ensure the survival of these fish species. Thus, it is critical to comprehend the conservation priorities via fish

killing, protecting juveniles, eggs, fry, fingerlings, and the construction of fish sanctuaries from poaching, sale, and the closure period.Tawarja Reservoir's administration and planners want to use the study's results to create more environmentally friendly fishing and conservation initiatives.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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