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## Biodiversity of indigenous ornamental fish in Wakl river system of Southern Rajasthan

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### Abstract

This study was conducted to generate the baseline data on the availability of ornamental fish in Wakal River system of Udaipur (Rajasthan). A total of 15 species belonging to 5 orders, 9 families and 15 genera were identified and documented. The family-wise interpretation revealed that Cyprinidae is the largest family and accommodating 6 genera, Mastacembelidae two genera and other 7 families like Balitoridae, Siluridae, Belontiidae, Gobiidae, Ambassidae and Belontiidae and Cobitidae represented single member from each. While assessing the potential utilization of the collected fishes, it was realized that 7 species like *Pethia conchoniis*, *Devario malabaricus*, *Rasbora daniconius*, *Trichogaster lalius*, *Schistura savona*, *Acanthocobitis botia*, *Parambassis lala*, were of high ornamental value (i.e. 46.66%), 5 species like *Mastacembelus armatus*, *Macrognathus pancalus*, *Barilius bendelisis*, *Salmophasia bacaila*, *Glossogobius giuris*, were potential ornamental fishes (i.e. 33.33%) and rest 3 species (20%) such as *Garra gotyla*, *Xenentodon cancila*, *Ompok bimaculatus* are primarily used as food fish and can also be explored as ornamental fishes. Of the above listed fish fauna *O. pabda* and *P. lala* were under 'Near threatened' (NT) category. All the 15 identified species listed above are considered as important aquarium fishes in other parts of India.

**Keywords:** Diversity, biodiversity hotspots, ornamental fish, potential ornamental fishes, Wakl River, threatened species

### 1. Introduction

The fish resources of India are one of the richest in the world, due to the availability of vast aquatic resources. The number of fish species in different water ecosystems is a part of a biological diversity of the Earth. In Asia 30,700 fish species are reported, whereas in India total 2500 including 801 freshwater fish species have been recorded [1]. The ornamental fisheries sector plays a vital role in the international and national fish trade, having high export value and contributes significantly to rural development in many developing countries. [2, 3] Since 1985, the export value of these fishes in international trade has increased at an average annual growth rate of approximately 14%. Out of the total global trade of Rs. 2000 crores of ornamental fishes, India's share is only Rs 15 crores (0.32%), which is almost negligible [4]. The ornamental fish trade in India is dominated by freshwater ornamental fishes (90%). Further, 95% of our ornamental fish export is based on the wild collection. Kumar *et al.* [5] recorded 51 ornamental fish species from the Mahanadi river system. Goswami *et al.* [6] recorded 291 ornamental fishes in North East India.

The Western Ghats is considered as one among the 34 'biodiversity hotspots' of the world [7] with a plethora of diverse fish species having remarkable endemism [8] and one of the eight "hottest hotspots" of biological diversity in the world. The Western Ghats portrays the rich endemic fish fauna of 189 species, belonging to 69 genera, 23 families and 7 orders [9]. About 110 species of fishes reported from the Western Ghats have ornamental value. [10] Among the 300 species of freshwater fishes in the Western Ghats, 155 are considered ornamental fishes of which 117 are endemic to the Western Ghats [7]. The fish fauna of the Western Ghats includes a variety of Barbs, Rasboras, Killifishes, Glass Fishes, Catfishes, Hill Trouts, and Danios, which are ideal candidates for the ornamental fish industry. However, these resources have not been managed properly either for its conservation or for sustainable exploitation. Unlawful exploitation of native ornamental fishes especially *Sahyadria denisonii* from Southern-Western Ghats, due to its high market demand, and subsequent reduction in its population is an example of exploitation of unmanaged resources [11, 12]. Therefore, the development of scientific management strategies for the sustainable conservation of natural resources is must.

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Further, the knowledge of existing fish fauna of a particular region is a prerequisite for sustainable exploitation. Although a large number of workers have studied ichthyo-fauna of lotic and lentic waters, however much is not known about the status of fish diversity especially the native ornamental fishes of Wakal river system of Udaipur (Rajasthan). Therefore, considering the ecological conditions the present study has been designed and conducted to investigate the native fish fauna of Wakal river system with special reference to

ornamental fish.

## 2. Materials & Methods

**2.1 Study Area:** Wakal River originates near Sran village in northwest of Udaipur district, Rajasthan. The river flows in south direction up to Manpur village in Udaipur district, where it turns northeast and after a distance of about 90 km leaves Rajasthan near the Gaupipli village and joins Sabarmati River near Eitarwar village in Gujarat (Plate.1).

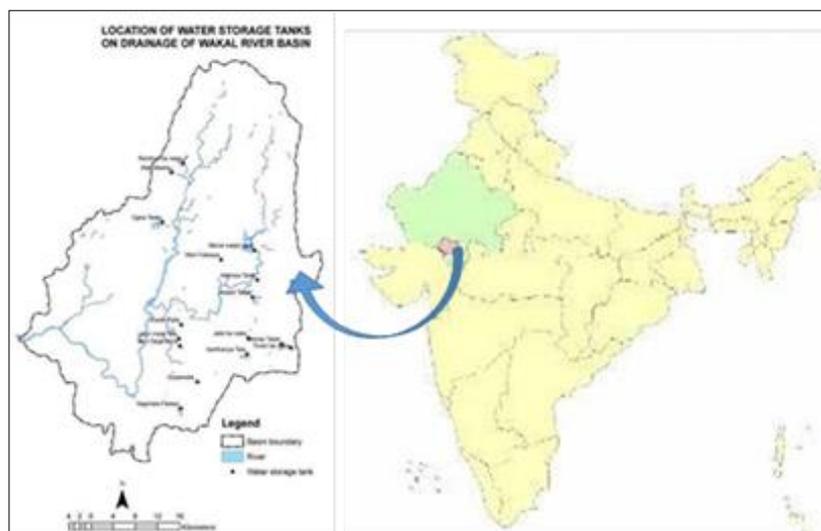


Plate 1: Map showing study area

**2.2 Sample Collection:** To collect the data on native ornamental fishes, the sampling cycle was divided into three seasons as (a) pre-monsoon (April-June), (b) monsoon (July-September) and (c) post-monsoon (October-December). Investigation of fishes was conducted in five selected sites of river Wakal with the help of fishermen. Fishing gears applied were mostly cast net, scooping gears, encircling net, etc. The specimens were photographed and fixed individually in formalin solution for recorded their morphological characters.

**2.3 Preservation of Fish Specimen:** The collected fish specimens were preserved in 4% formaldehyde solution at the sampling site itself. Small fish specimen (less than 10 cm in total length) were preserved directly without injection or opening the visceral cavity. But larger specimens were preserved with an injection of preservative into the visceral cavity slitting of the abdomen for about 25% of body length. Store in plastic or glass air tight bottle in cool place.

**2.4 Identification of Fish Specimen:** Identification of fish specimen was based on diagnostic characters such as body form, colour, size, shape and position of fins and meristic features. Identification was performed on the basis of both fresh and preserved specimen. Fresh materials were mainly used for colour and preserved specimen for morphometric and meristic characteristics. Samples were brought to the laboratory and then identified based on the taxonomical key [1, 13, 14, 15, 16].

## 3. Results

Exploratory surveys were conducted on Wakal river of Udaipur district and total fifteen (15) indigenous ornamental fish species were recorded (Plate 2). A total of 15 species belonging to 5 orders, 9 families and 15 genera were recorded

from 5 sampling stations. The list of fish was collected together with their local names, commercial values and categorized into highly ornamental (ho), potential ornamental (po) or food fish (fo) species and relative abundance (Table 1). Among the orders, Cypriniformes exhibited the largest representation with 3 families, 6 genera and 6 species followed by Perciformes with 3 families, 3 genera and 3 species. Synbranchiformes with 2 species belongs to the same family. Siluriformes and Belontiiformes each with 1 family and 1 species. The family-wise interpretation revealed Cyprinidae as the largest family accommodating 6 genera (i.e. *Pethia*, *Barilius*, *Salmophasia*, *Devario*, *Rasbora*, and *Garra*). For family Mastacembelidae two genera were recorded. Further other 7 families like Balitoridae, Siluridae, Belontiidae, Gobiidae, Ambassidae and Belontiidae and Cobitidae represented single member from each. While assessing the potential utilization of the collected fishes, it was realized that among 15 species, 7 species like *Pethia conchoniensis*, *Devario malabaricus*, *Rasbora daniconius*, *Trichogaster lalius*, *Schistura savona*, *Acanthocobitis botia*, *Parambassis lala*, are of high ornamental value (i.e. 46.66% were identified as 'ho'). 5 species like *Mastacembelus armatus*, *Macrognathus pancalus*, *Barilius bendelisis*, *Salmophasia bacaila*, *Glossogobius giuris*, are potential ornamental fishes and can be exploited for commercial purpose (i.e. 33.33% were identified as 'po'). Rest 3 Species (20%) such as *Garra gotyla*, *Xenentodon cancila*, *Ompok bimaculatus* are primarily used as food fish which can also additionally be explored for their ornamental qualities. The data presented in the (Table 1) shows that 6 species such as *Pethia conchoniensis*, *Barilius bendelisis*, *Salmophasia bacaila*, *Devario malabaricus*, *Garra gotyla* and *Parambassis lala* were abundant in the system and were collected from all locations throughout the year. Whereas, 3 species (*Rasbora daniconius*, *Xenentodon cancila*,

and *Ompok bimaculatus*) were found commonly in all the locations, but the number of specimens collected with respect to each species was relatively less. Rest six species like *Schistura savona*, *Acanthocobitis botia*, *Glossogobius giuris*, *Trichogaster lalius*, *Mastacembelus armatus* and *Macrognathus pancalus*, were found rare in this area, which could not be collected from more than one location and also the number of specimens collected was very less.

The data on conservation status for all the species collected from Wakal river system was generated from “The IUCN Red List of Threatened Species” database. These data revealed

that only two species (*Ompok pabda* and *Parambassis lala*) were under ‘Near threatened’ (NT) category. The remaining thirteen species were accounted under ‘Least Concern’ category (Table 2 and Fig. 3). The least concern status of 13 species indicated a better environment and less exploitation for these species. Irrespective of all the results achieved, it can undoubtedly be surmised that the species under threat need adequate attention towards conservation of the individual species as well as their natural habitat with a holistic approach.

**Table 1:** Ornamental fish diversity along with their relative abundance, category of use in Wakal River

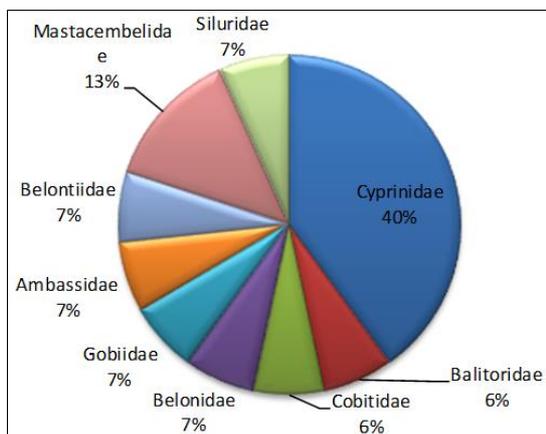
S. No.	Local Name	Scientific name	Order	Family	No./Collection	Relative abundance	Category of use*
1	Rosy barb	<i>Pethia conchonius</i>	Cypriniformes	Cyprinidae	50	+++	Ho
2	Hamilton’s barila	<i>Barilius bendelisis</i>	Cypriniformes	Cyprinidae	32	+++	Po
3	Large razorbelly minnow	<i>Salmophasia bacaila</i>	Cypriniformes	Cyprinidae	35	+++	Po
4	Sind Dario	<i>Devario malabaricus</i>	Cypriniformes	Cyprinidae	43	+++	Ho
5	Slender rasbora	<i>Rasbora daniconius</i>	Cypriniformes	Cyprinidae	27	++	Ho
6	Sucker head	<i>Garra gotyla</i>	Cypriniformes	Cyprinidae	33	+++	Fo
7	Half banded loach	<i>Schistura Savona</i>	Cypriniformes	Balitoridae	04	+	Ho
8	Mottled loach	<i>Acanthocobitis botia</i>	Cypriniformes	Cobitidae	05	+	Ho
9	Freshwater garfish	<i>Xenentodon cancila</i>	Beloniformes	Belonidae	22	++	Fo
10	Tank goby	<i>Glossogobius giuris</i>	Perciformes	Gobiidae	11	+	Po
11	Highfinglassy perchlet	<i>Paraambassis lala</i>	Perciformes	Ambassidae	44	+++	Ho
12	Dwarf gaurami	<i>Trichogaster lalius</i>	Perciformes	Belontiidae	15	+	Ho
13	Zig zag eel	<i>Mastacembelus armatus</i>	Synbranchiformes	Mastacembelidae	07	+	Po
14	Barred spiny eel	<i>Macrognathus pancalus</i>	Synbranchiformes	Mastacembelidae	09	+	Po
15	Butter catfish	<i>Ompok bimaculatus</i>	Siluriformes	Siluridae	21	++	Fo

Fo- Food ornamental, Po- Potential ornamental, Ho- Highly ornamental

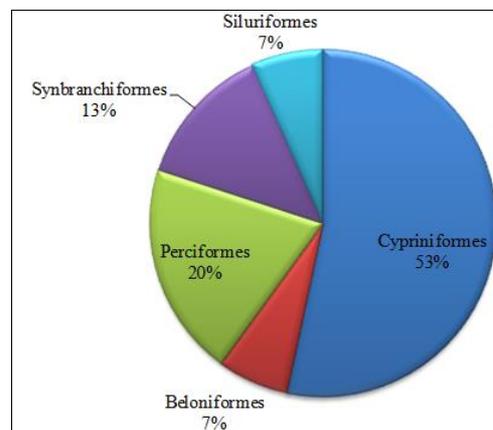
**Table 2:** Family wise representation of ornamental fish species diversity and conservation status of Wakal River

Order	Family	Species	IUCN *
Cypriniformes	Cyprinidae	<i>Pethia conchonius</i>	LC
		<i>Barilius bendelisis</i>	LC
		<i>Salmophasia bacaila</i>	LC
		<i>Devario malabaricus</i>	LC
		<i>Rasbora daniconius</i>	LC
		<i>Garra gotyla</i>	LC
Balitoridae	Balitoridae	<i>Schistura Savona</i>	LC
		<i>Acanthocobitis botia</i>	LC
Beloniformes	Belonidae	<i>Xenentodon cancila</i>	LC
		<i>Glossogobius giuris</i>	LC
Perciformes	Gobiidae	<i>Paraambassis lala</i>	NT
		<i>Trichogaster lalius</i>	LC
		<i>Mastacembelus armatus</i>	LC
Synbranchiformes	Mastacembelidae	<i>Macrognathus pancalus</i>	LC
		<i>Ompok bimaculatus</i>	NT
Siluriformes	Siluridae		

LC- Least concerned, NT- Near threatened



**Fig 1:** Family wise representation of ornamental fish



**Fig 2:** Order wise representation of ornamental fish

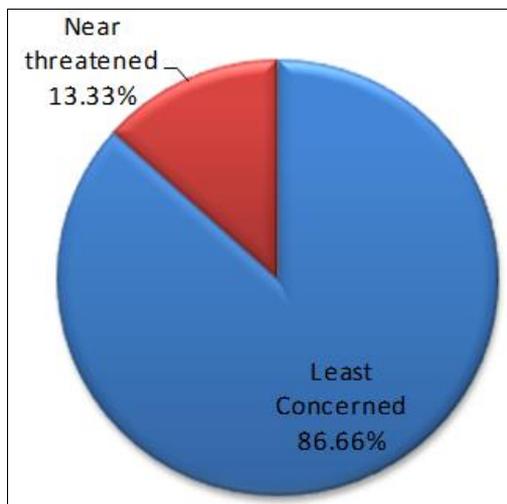


Fig 3: Overall conservation status of ornamental fish

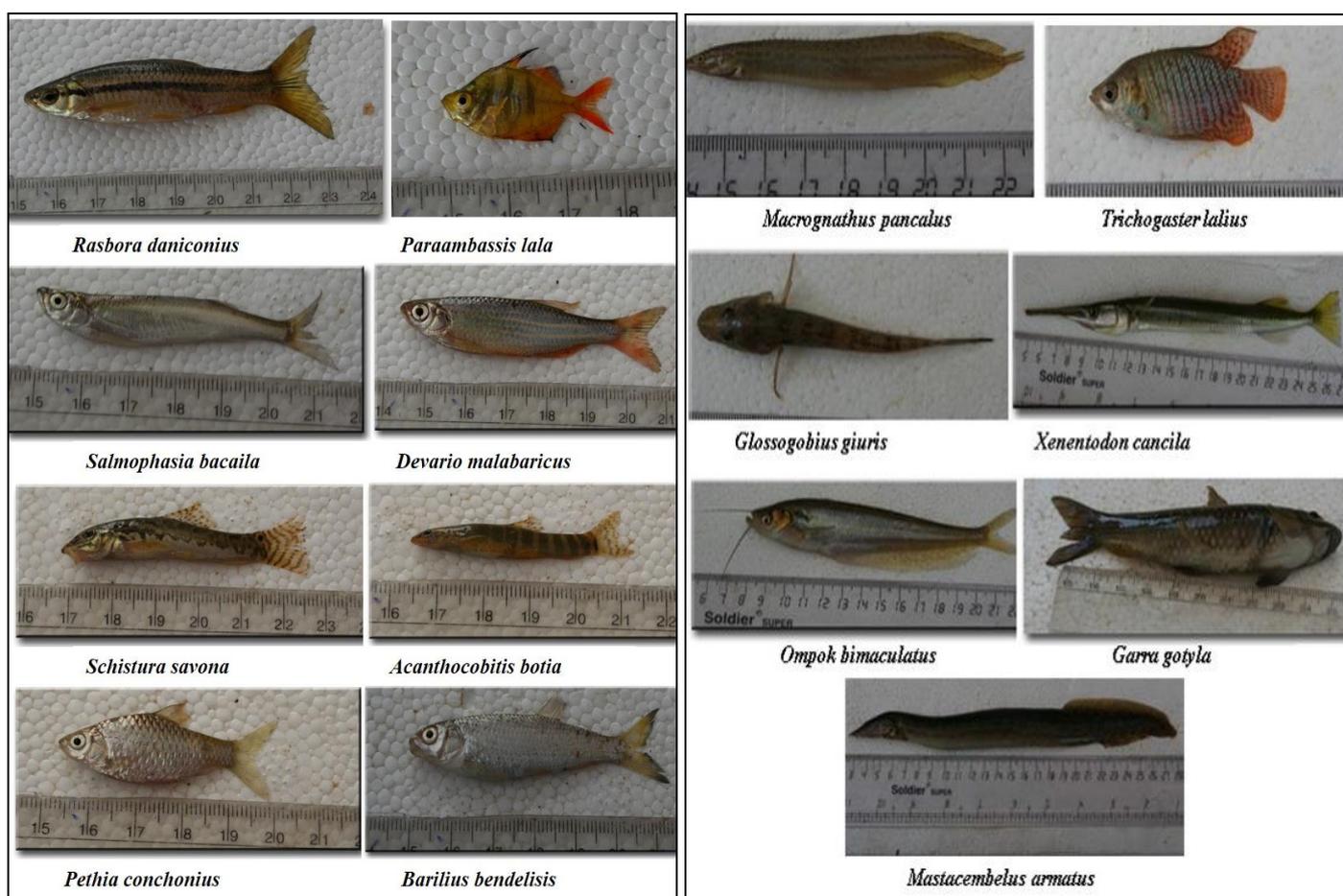


Plate 2: Photographs of fisher reported in the present study

#### 4. Discussion

In the present study total 15 fish species were identified from five sampling sites of Wakal river of Udaipur district Rajasthan (India). These fifteen species belonging to 15 genera, 9 families and 5 orders (Table 2). The largest representation was recorded for Cypriniformes order with 3 families, 6 genera and 6 species. The percent share of different families and order (Fig.1 & 2) was noticed in the following decreasing order:

**Family:** Cyprinidae(40%)<Mastacembelidae (13%)<Siluridae (7%)<Belontiidae (7%)< Ambassidae (7%)<Gobiidae (7%)<Cobitidae (6%)<Balitoridae (6%)

#### Order

Cypriniformes(53%)<Perciformes(20%)<Synbranchiformes(13%)<Siluriformes (7%)<Beloniformes(7%).

According to the IUCN status (Table 2), two fish (*Ompok bimaculatus* & *Paraambassis lala*) are Near Threatened (NT) and remaining thirteen are List Concern (LC). Further, the relative abundance of six species (*i.e. Paraambassis lala, Salmophasia bacaila, Devario malabaricus, Garra gotyla, Barilius bendelisis, Pethia conchonius*) was observed comparatively high (>30 numbers of each in sampling). It is worth mentioning here that, *Paraambassis lala* recorded as Near Threatened species, but its population in Wakal river was adequately very high (>40 Nos in sampling).

The exploration and investigation of the fish fauna of Rajasthan were initiated in the 1950's [17, 18]. Datta and Mazumdar [19] have conducted an extensive survey of Rajasthan waters and reported 75 fish species belonging to 16 families, 8 orders and 36 genera. During 1986-1990, Johal, *et al.* [20] have reported 95 species belonging to 52 genera and 7 orders from different water resources of Rajasthan. However, none of the research has surveyed and reported fish fauna of Wakal river of Udaipur. Since, the present study is very first attempt to enlist the fish fauna of Wakal, therefore the changes in ichthyofaunal composition could not be analyzed. As stated earlier, total of 15 fish species were identified from

Wakal River. Out of 15, nine species (Table 3) were also reported by Datta and Mazumdar [19]. Johal, *et al.* [20] have also recorded 10 out of fifteen (Table 3).

From the comparative list of fishes (Table 3) reported in the present study and earlier by Datta and Mazumdar [19] and Johal, *et al.* [20] it is obvious that the five species (i.e. *Parambassis lala*, *Devario malabaricus*, *Trichogaster lalius*, *Acanthocobitis botia* and *Schistura savona* are reported first time in Rajasthan. Further, it is worth mentioning here that these five species have been considered as important aquarium fishes in other parts of India [7].

**Table 3:** List of fish species reported from aquatic resources of Rajasthan.

Fishes Reported in present study	Fishes Reported by Datta and Mazumdar (1970)	Fish Reported by Johal, <i>et al.</i> (1993)
<i>Parambassis lala</i>	*	*
<i>Salmophasia bacaila</i>	*	<i>Salmophasia bacaila</i>
<i>Devario malabaricus</i>	*	*
<i>Garra gotyla</i>	<i>Garra gotyla</i>	<i>Garra gotyla</i>
<i>Barilius bendelisis</i>	<i>Barilius bendelisis</i>	<i>Barilius bendelisis</i>
<i>Pethia conchoni</i>	<i>Pethia conchoni</i>	<i>Pethia conchoni</i>
<i>Rasbora daniconius</i>	<i>Rasbora daniconius</i>	<i>Rasbora daniconius</i>
<i>Glossogobius giuris</i>	<i>Glossogobius giuris</i>	<i>Glossogobius giuris</i>
<i>Xenentodon cancila</i>	<i>Xenentodon cancila</i>	<i>Xenentodon cancila</i>
<i>Macrornathus pancalus</i>	<i>Macrornathus pancalus</i>	<i>Macrornathus pancalus</i>
<i>Trichogaster lalius</i>	*	*
<i>Acanthocobitis botia</i>	*	*
<i>Schistura savona</i>	*	*
<i>Mastacembelus armatus</i>	<i>Mastacembelus armatus</i>	<i>Mastacembelus armatus</i>
<i>Ompok bimaculatus</i>	<i>Ompok bimaculatus</i>	<i>Ompok bimaculatus</i>

## 5. Conclusion

The primary goal of the present study was to explore the hitherto unexplored habitat of the indigenous ornamental freshwater fish fauna of Wakal river system of southern Rajasthan. The results of this study showed that the Wakal river system has 15 small sized fish which can be used as ornamental fish. Further, five species such as *Parambassis lala*, *Devario malabaricus*, *Trichogaster lalius*, *Acanthocobitis botia* and *Schistura savona* have been first time from Rajasthan waters.

## 6. Acknowledgement

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