

1 **ACCEPTED MANUSCRIPT**

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3 RANGE EXPANSION OF *Parachromis managuensis* (GÜNTHER, 1867) (PERCIFORMES,  
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18 **RANGE EXPANSION OF *Parachromis managuensis* (GÜNTHER, 1867) (PERCIFORMES,**  
19 **CICHLIDAE) IN JAVA, INDONESIA**

20

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**ABSTRACT**

28 The Jaguar cichlid, *Parachromis managuensis* (Günther, 1867), is native to Central America,  
29 with introductions reported from West Java and Central Java (Indonesia). On 7-8 January 2019,  
30 sixteen specimens of *P. managuensis* were collected from Karangates, the largest hydropower  
31 reservoir in East Java, Indonesia. A description of the morphological characters of specimens is  
32 provided.

33

34 **Keywords:** Cichlid, distribution, freshwater fish, Jaguar Guapote

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**INTRODUCTION**

37 *Parachromis managuensis* (Günther, 1867), is a cichlid native to Costa Rica, Nicaragua, and  
38 Honduras (Conkel 1993), but it has been introduced to several other locations: North America (Fuller  
39 et al. 1999), South America (Magalhães and Jacobi 2013), Europe (Takács et al. 2015), and Southeast  
40 Asia (Agasen et al. 2006). *Parachromis managuensis* exhibits highly predatory habits and a tolerance  
41 to new habitats (Rosana et al. 2006; Agasen et al. 2006). Because of this, *P. managuensis* has the  
42 potential to become an invasive species (Yamamoto and Annete 2000; Mandoza et al. 2015).

43 *Parachromis managuensis* is generally sold in the aquarium trade and has not been cultured  
44 openly. In Java, Indonesia, these *P. managuensis* come from natural freshwaters in the West Java  
45 (Dahrudin et al. 2016) and Central Java (Hedianto et al. 2013). Meanwhile, despite being used as a  
46 fisheries centre, there has been no previous record of exotic fish culture in Karangates Reservoir,  
47 the largest hydropower reservoir in East Java. Therefore, the presence of *P. managuensis* in  
48 Karangates Reservoir constitutes a new finding.

49

50

**MATERIALS AND METHODS**

51 **Fish Sampling and Description of Study Sites**

52 Sixteen (16) live specimens of *P. managuensis* were obtained from a local angler during  
53 fieldwork on 7-8 January 2019 at the Karangates Reservoir (8°11'16"S; 112°27'22"E) (Figure 1).  
54 Administratively, the site is located in Malang Regency, East Java Province, Indonesia. The fishing  
55 gear used by the angler was a medium hook on the bottom and worms used as bait (Stein et al. 2012).



56

57 Figure 1 Karangates reservoir, East Java, showing the location where *Parachromis managuensis*  
58 was collected

59

### 60 **Fish Identification**

61 Diagnostic morphological characters of the specimens were analysed using the traits  
62 identified by Kullander and Hartel (1997) and Bussing (1998).

63

## 64 **RESULTS AND DISCUSSION**

### 65 **Specimens Collection**

66 The sixteen (16) live specimens of *P. managuensis* had a total length between 9.9 cm and 26.6  
67 cm. Five (5) of them were preserved in 96% alcohol solution (Hasan and Tamam 2019) and deposited  
68 at the Hydrobiology Laboratory, Universitas Brawijaya, Malang, Indonesia (voucher no.  
69 Hb.Pm.I.2019). The remaining twelve (11) were kept as livestock at the Fish Reproduction  
70 Laboratory, Universitas Brawijaya, Malang, Indonesia. The 11 living specimens were transported in  
71 polyethylene bags with oxygen.

72

### 73 **Diagnosis**

74 The morphological characters of the specimens were as follows: large mouth, projecting lower  
75 jaw, prominent enlarged canine teeth, a more or less continuous black stripe between the eye and  
76 opercular margin, and another stripe between the eye and the lower angle of the opercle, and a row  
77 of black blotches along the middle of the side.

78

79 The fish could be distinguished from other members of the genus by having the expanded  
80 preopercle at the angle. It had silvery or golden-green to purple body colours and black spots on the  
81 fins and body. There were also numerous black spots on anal and caudal fins. The fish had moss green  
82 back, purple iridescence sides, and a whitish or yellowish belly. It also had whitish yellowish, or blue  
83 iridescence dorsal interspaces, and a black blotch on the caudal-fin base. All of these characteristics

83 were found in every specimen collected from the Karangkates Reservoir, East Java, Indonesia (Fig.  
84 2).

85



86

87 Figure 2 Specimen of *Parachromis managuensis* captured on 8 January 2019, Karangkates Reservoir,  
88 East Java

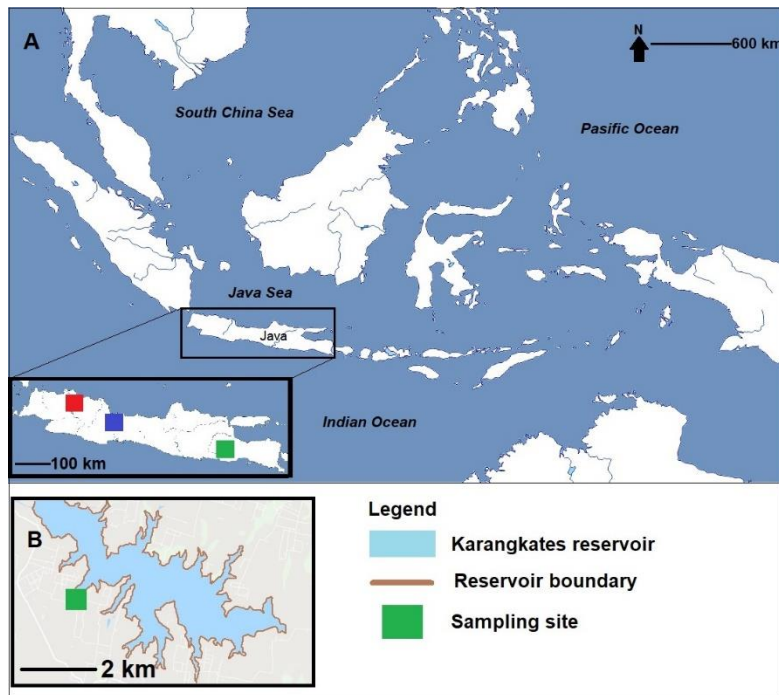
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### 90 **Distribution**

91 The discovery of *P. managuensis* in the Karangkates Reservoir is the first record of this  
92 species beyond its previous records (reservoirs in West Java and Central Java), and it represents an  
93 easterly extension of the previously-known distributions in Java by more than 490 km (Fig. 3). This  
94 record is an important contribution to the understanding of the dispersal of alien species in Indonesia.

95 We speculate that individual of *P. managuensis* were released into Karangkates Reservoir on  
96 East Java by Aquarists. They releasing their stocks usually without any specific reasons. Fishes simply  
97 outgrowing the tank, and they release them. As the reservoir does not used for any exotic fish culture  
98 industry, further investigation is warranted to determine the source of *P. managuensis* in East Java.  
99 Control and prevention of further introductions are needed to prevent *P. managuensis* from disturbing  
100 the local freshwaters ecosystems (Canonico et al. 2005; Zambrano et al. 2006).

101



102

103 Figure 3 A. Distribution of *Parachromis managuensis* in Java (red square: West Java, blue square:  
104 Central Java, green square: East Java). B. Location of Karangates Reservoir in East Java.  
105 The green square indicates the new record on *P. managuensis*.

106

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### CONCLUSION

108

109 *Parachromis managuensis* is a non-native fish that has not only spread on the mainland of  
110 West Java and Central Java, but this fish also exists on Karangates Reservoir whose position is at  
111 the eastern of Java. The existence of *P. managuensis* in East Java adds to the data on the distribution  
112 of alien fish in Indonesia.

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114

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