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Range expansion of the invasive Nile tilapia *Oreochromis niloticus* (Perciformes: Cichlidae) in Java Sea and first record for Kangean Island, Madura, East Java, Indonesia

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ABSTRACT

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Nile tilapia *Oreochromis niloticus* (Linnaeus, 1758) is native to Africa, with introductions reported from Bawean Island, Java Sea (Indonesia). On 17-18 April 2019 eight specimens of *O. niloticus* were captured from Batu Batu Estuary, conservation area in Kangean Island, Java Sea. This record is among first of this species from the East end of Java Sea. A description of meristic and morphometric features of a specimen are provided.

Key words: Nile tilapia, Kangean Island, Java Sea, Morphometric and meristic

Introduction

Oreochromis niloticus (Linnaeus, 1758) is a tilapia native to the Nile (Africa), ranging from the upper Nile River South to the equator and West to the Atlantic Coast and now introduced to many countries worldwide for aquaculture (Trewavas, 1983). *Oreochromis niloticus* exhibits highly omnivorous habits, euryhaline and a tolerance to new habitats (Peterson *et al.*, 2004). Because of this, *O. niloticus* has the potential to become an invasive species (Gu *et al.* 2015).

In Indonesia, *O. niloticus* is generally spread in mainland waters where aquaculture activities have been underway for some time (Basuki and Sri, 2014). In Java Sea, *O. niloticus* was described from freshwaters in the Danau Kastoba, Bawean Island

(Hasan and Tamam, 2019). Kangean Island, a medium, isolated island in the east end of Java Sea, is a conservation area, but there is no record of culturing tilapia there. The presence of *O. niloticus* in Kangean Island therefore constitutes a new record.

Materials and Methods

Study area

Eight (8) live specimens of *O. niloticus* were obtained from a local fisherman during a fieldwork carried out on 17-18 April, 2019 in Batu Batu estuary (6°55'19"S 115°19'43"E) (Fig. 1). Administratively, the site is located in Sumenep Regency, East Java Province, Indonesia. The fishing gear used by the fisherman was a medium hook with bottom and bait used were crustaceans (Stein *et al.* 2012).

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Fig. 1. Batu Batu Estuary (Kangean Island), showing the location where *O. niloticus* was collected

Fish identification

Diagnostic morphological characters of the specimens were analysed following Trewavas (1983). The measurement from 6 landmarks of the morphometric and meristic characters followed the description provided by Simon *et al.* (2010).

Results

Specimens' collection

The eight live specimens of *O. niloticus* had a total length between 99 mm and 222 mm. Five of them were used as preserved specimens in 96% alcohol solution and deposited at the Hydrobiology Laboratory, Universitas Brawijaya, Malang, Indonesia (HB.On.II.2019) (Fig. 2). The remaining three were kept as livestock at the Fish Reproduction Laboratory, Universitas Brawijaya, Malang Indonesia. The three live individuals were transported in polyethylene bags with oxygen.

Diagnosis

Morphometric and meristic characteristics of *O. niloticus* are given in Table 1. Other specific morphological characters are as follows: scales cycloid; gill rakers short; three rows of scales on cheek; maxilla and lower jaw equal; teeth widen; pectoral fin pointed; dorsal, pectoral and anal fins blunt; caudal scaly. Coloration: caudal fin covered with narrow vertical stripes, anal fin faintly barred, upper margin of dorsal fin black or grey, the melanin some-

Table 1. Morphometric and meristic of *O. niloticus* from the Batu Batu Estuary, Kangean Island ($n = 8$ specimens).

Character	Morphometric (mm)
Total length	126
Standard length	10.1
Head length	33
Body depth	73
Eye diameter	8
Snouth length	7.2
Character	Meristic
lateral line scales	30
Dorsal fin	XV+10
Pectoral fin	11
Pelvic fin	I+5
Anal fin	VIII+10

times slightly mixed with red, orange or vermilion even in breeding males. Head and trunk of breeding male suffused with red; in some localities lower jaw, chest, pelvics and anterior part of anal fin black; caudal and soft dorsal fin sharply barred; about nine narrow dark bars on sides body; dark blotch at corner of operculum. All of these characters were found in every specimen collected from the Batu Batu Estuary, Kangean Island, Indonesia



Fig. 2. Specimen of *O. niloticus* caught on 18 April 2019 from the Batu Batu Estuary, Kangean Island.

(Fig. 2).

Discussion

O. niloticus has been introduced to more than 90 countries around the world for both brackish and fresh water aquaculture (Fitzsimmons, 2001). This species is one of the top ten introduced species of animals in the world (Picker and Griffiths, 2011).

Indonesia is the second largest producer of *O. niloticus* in the world after China (FAO, 2017). Due to intensive aquaculture, *O. niloticus* now occurs in all brackish and fresh waters of mainland Indonesia.

Its presence in the Kangean Island, in the East end of Java Sea and 150 km from the nearest mainland (East Java) and 350 km from type locality (Bawean Island) (Fig. 3), is new record.

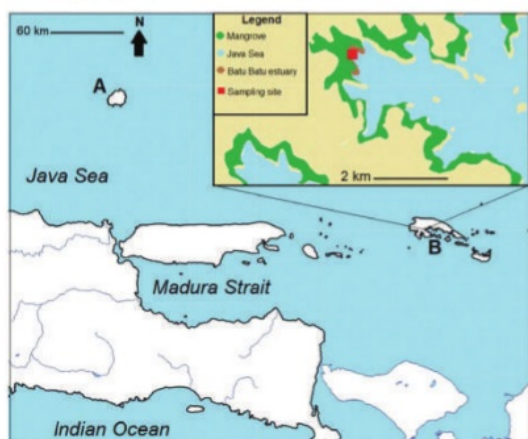


Fig. 3. Distribution of *O. niloticus* in Java Sea. (A) is the previous known localities of the species in the Bawean Island. (B) is the recent record from the Kangean Island.

We speculate that *O. niloticus* was released into Batu Batu Estuary in Kangean Island by exotic fish hobbyists but the purpose is not clear. As the island does not have an aquaculture industry, further investigation is warranted to determine the source of *O. niloticus* in Kangean Island. The control and prevention of further introductions is needed so that *O. niloticus* does not disturb the natural ecosystem (Ishikawa et al., 2012; Vicente and Fonseca-Alves, 2013).

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