

# Range expansion of the Invasive Nile Tilapia *Oreochromis niloticus* (Perciformes: Cichlidae) in Sulawesi Sea and first record for Sangihe Island, Tahuna, North Sulawesi, Indonesia

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## ABSTRACT

*Oreochromis niloticus* (Linnaeus, 1758) is native species to North Africa, that has been introduced to many areas worldwide, including Indonesia. On 10-24 January 2020 specimens of *O. niloticus* were captured from Laine Waterfall in Sangihe Island, Indonesia, as a new record for this island. Introduced non-native fish would be able to have negative impacts on the aquatic species communities through competition food and other resources, so the existence of the *O. niloticus* is a risk. The characteristics of *O. niloticus* specimens were as follows dorsal spin rays 15, dorsal soft rays 11, pelvic spin rays 1, pelvic soft rays 5, pectoral fin rays 10, anal spin rays 8, anal soft rays 10. The specific morphological characters of a specimen are provided.

**Key words:** Cyprinid, Freshwater fish, Distribution, Sulawesi

## Introduction

Nile tilapia, valid as *Oreochromis niloticus* (Linnaeus 1758). Cichlidae: Pseudocrenilabrinae, is a native species to Northern and eastern Africa (Albertson *et al.*, 1999) and the most successful invasive species in worldwide (Martin *et al.*, 2010). Now, these species were introduced to a lot of areas for aquaculture reason, exotic pet and fishing sport (Canonica *et al.*, 2005) such as Ryukyu Archipelago (Sakai *et al.*, 2001), Cambodian (Rainboth, 1996), Korea (Lee and

Kim, 1996), India (Devi and Raghunathan, 1999), Ghana (Dankwa *et al.*, 1999), Pakistan (Rafique, 2000), Laos (Kottelat, 2001), Sudan and Egypt (Neumann *et al.*, 2016), South America (Bertaco *et al.*, 2016), Brazil (Costa *et al.*, 2017), El Salvador (McMahan *et al.*, 2013), Argentina (Angulo *et al.*, 2013); Madagascar (Fricke *et al.*, 2018); Malaysia (Ng *et al.*, 2019), Philippines (Labatos, 2017) and Indonesia (Miesen *et al.*, 2016).

In Indonesia, *Oreochromis niloticus* has been spread in many places, including the several remote

islands and conservation areas, such as Bawean Island (Hasan and Tamam, 2019) and Kangean Island in the Java Sea (Hasan *et al.*, 2019a; Hasan *et al.*, 2019b). Sangihe is one of a remote island in Indonesia, which is also a conservation area and in this location, there is no record of culturing *O. niloticus*. The existence *O. niloticus* in this island would be able to have negative impacts in freshwater communities through competition food and other resources, and also as a carrier of the disease (Cucherousset and Olden, 2011; Torchin *et al.*, 2013).

## Materials and Methods

### The fish sampling and description of the study sites

There were seven (7) live specimens of *O. niloticus* were obtained from a local fisherman on 10-24 January 2020 during the fieldwork carried out in the Laine waterfall, Sangihe Island (3°25'59"N; 125°35'56"E) (Figure 1). This area is located in Sangihe Island Regency, North Sulawesi Province, Indonesia. *O. niloticus* was caught by a cast net, fish trap and medium hook with the crustaceans bait (Stein *et al.*, 2012).



Fig. 1. Laine waterfall, Sangihe Island, showing the location where *O. niloticus* was found.

### Fish identification

The morphological analysis of *O. niloticus* was needed to confirm the validity of the species including the 6 landmarks of the morphometric and meristic characters following the method of the Trewavas (1983); Simon *et al.* (2010) and Hasan *et al.* (2019a).

## Results

### Specimens collection

The seven live specimens of *O. niloticus* had a total length between 110 mm and 120 mm. Four of them were preserved in 10% formalin solution to keep as specimens (Hasan *et al.*, 2019b) and deposited at the Zoology Laboratory, Generasi Biologi Indonesia Foundation, Gresik, Indonesia (Fig. 2). Three of them were transported in polyethylene bags with oxygen and kept as livestock at the Fish Reproduction Laboratory, Universitas Brawijaya, Malang Indonesia.



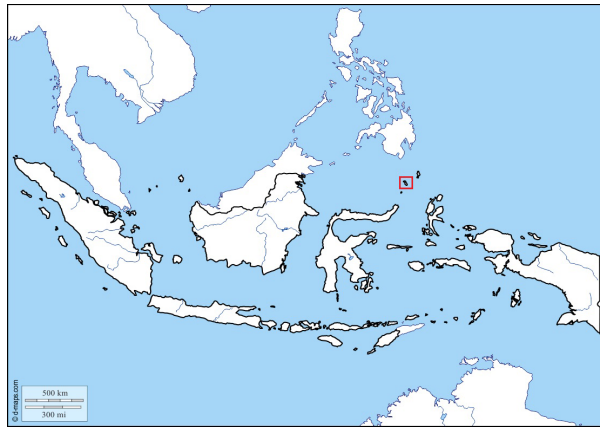
Fig. 2. Specimens of *O. niloticus* were captured on 10-24 January 2020 in the Laine waterfall, Sangihe Island North Sulawesi.

### Diagnosis

Morphometric and meristic characteristics of *O. niloticus* could be seen in Table 1. Other specific morphological characters of the *O. niloticus* are scales cycloid; teeth widen; three rows of scales on cheek; gill rakers short; maxilla and lower jaw equal; dorsal, pectoral and anal fins blunt; pectoral fin pointed; caudal scaly. Coloration: the melanin sometimes slightly mixed with red, upper margin of dorsal fin grey or black, caudal fin covered by narrow vertical stripes, anal fin faintly barred, Head and trunk of breeding male suffused with red; in several localities lower jaw, pelvic, chest and anterior part of anal fin are black; soft dorsal fin and caudal sharply; around nine narrow dark bars on sides body; dark blotch at the corner of operculum. All of these characters were discovered on each specimen collected from the Sangihe Island, North Sulawesi

**Table 1.** Morphometric and meristic of *O. niloticus* from the Sangihe Island Regency, North Sulawesi Province, Indonesia (n=7 specimens)

Character	Morfometric (mm)
Total length	120
Standard length	100
Head length	31
Body depth	42
Eye diameter	7
Snouth length	8
Character	Morfometric (mm)
Lateral line scales	29
Dorsal fin	XV+11
Pectoral fin	10
Pelvic fin	1+5
Anal fin	VIII+10



**Fig. 3.** Presence of *O. niloticus* in Sangihe Island North Sulawesi (Red Square)

Province, Indonesia.

## Discussion

*O. niloticus* is one of the top ten introduced species of animals on earth (Picker and Griffiths, 2011), that has been introduced for over 90 countries around the world for aquaculture reason (Fitzsimmons, 2001) including Indonesia. As the largest producer of *O. niloticus* in the world after China because of intensive aquaculture of *O. niloticus* that has been occurred in all brackish and fresh waters of the mainland (Hasan *et al.*, 2019a), Indonesia is also played in spreading of *O. niloticus*, especially on their islands.

We found *O. niloticus* as a new record Sangihe Islands Regency is located between Sulawesi Island and Mindanao Island, (Philippines) and is on the

edge of the Pacific Ocean (Fig. 3). Its presence about 245 km from the Bitung Regency, North Sulawesi. We consider that *O. niloticus* was released into Sangihe Islands Regency by exotic fish hobbyist but the reason is unclear. Because of this island does not have an aquaculture industry, further research is needed to determine the source of *O. niloticus* in the Sangihe Islands. The control and prevention of further introductions for *O. niloticus* is required to save the natural ecosystem (Ishikawa *et al.*, 2012; Vicente and Fonseca-Alves, 2013).

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