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Range Expansion of Introduced Tilapia Species (*Oreochromis niloticus*, L. 1758, Cichlidae) in Turkey

Ramazan Mert and Erdogan Cicek
Department of Biology, Faculty of Science and Literatures,
Nevsehir University, Nevsehir, Turkey

Abstract: Two individual of *Oreochromis niloticus* were caught in August and September 2009 by gillnet. The present study reported to most northerly record of introduced tropical freshwater fish species in Turkey. This record indicates its ability to adapt even cold regions with respect to it is a tropical climate fish species. However, there is not a clear explanation to the replacement of the Tilapia in Cappadocia. Therefore it should be confirmed the presence of the tilapia is accident or established in Nevsehir.

Key words: Damsa dam lake, *Oreochromis niloticus,* range expansion, invasion, tilapia, Turkey

INTRODUCTION

Introductions of fish species could be the result of accidents such as the careless release of live specimens from home aquaria, dumping unused bait fish or escapes from nearby aquaculture facilities. Other causes of exotic introductions include the negligent transfer of fertilized eggs of unknown species during stocking, opening connective channels with introduced fish to native habitats or simply undocumented stocking (Coad, 1996; Innal and Erkakan, 2006; Cowx, 1998).

An introduced species might become invasive if it can out-compete native species for resources such as physical space or food. Invasive species often coexist with native species for an extended time and gradually the superior competitive ability of an invasive species becomes apparent as its population grows larger and denser and it adapts to its new location and restructuring aquatic communities in the area. Biotic invasion is one of the five top drivers for global biodiversity loss (Copp *et al*., 2005; Innal and Erkakan, 2006).

If the introduced species have fast growth, rapid reproduction rate and low first maturiy age-length, high dispersal ability, tolerance of a wide range of environmental conditions and ability to live off of a wide range of food types, these characteristics have allowed it to dominate many of their introduced ranges by displacing native species where they have established by means of escape from confinement or deliberate release (Lowe *et al*., 2004).

Tilapia is the common name applied to three genera of fish belonging to Cichlidae family of fish known as Cichlids: Oreochromis, Sarotherodon and Tilapia. These include over 70 species of fish at least eight of which have spread worldwide through introductions for aquaculture (De Silva *et al*., 2004). They are omnivorous and feed on almost anything from algae to insects. Additionally, these freshwater fishes have the ability to establish themselves even in highly salinated waters, only being held back by a low tolerance to cold water (Thomas and Michael, 1999; De Silva *et al*., 2004; Chervinski, 1982).

Because of Cichlids are easily raised as they are resilient and prolific and have a high gain-to-feed conversion rate, relative ease of culture and rapid reproduction rates, Worldwide introductions for use in aquaculture have provided an essential source of protein to many nations. Established populations of Cichlids in the wild are as a result of intentional release or escapes from fish farms (Ozulug *et al*., 2005; Innal and Erkakan, 2006). The unavoidable escape and establishment of wild tilapia from fish farms have sometimes resulted in other serious problems such as the decline of culturally valued native fish species particularly cichlids and the alteration of natural benthic communities (De Silva *et al*., 2004; Gindelberger, 1981; Aypa, 1993). Although tilapia is generally known as a food fish some the smaller and less aggressive species are ideal for aquarium became of their colors and hardiness.

Due to its high fecundity, aggressive behavior and ecological plasticity it has the potential for rapid, explosive invasion and has become a significant pest in introduced ranges. Mozambique tilapia (*Oreochromis mossambicus*) has been listed in 100 of the world's worst invasive alien species (Lowe *et al*., 2004).

Corresponding Author: Ramazan Mert, Department of Biology, Faculty of Science and Literatures, Nevsehir University, Nevsehir, Turkey

Previous studies of the Tilapia have focused almost entirely on its suitability for aquaculture in Mediterranean Region (Sarihan and Toral, 1982; Sarihan *et al*., 1990; Polat *et al*., 1994), adaptation of salt water habitat (Dikel, 2006) and its meat quality (Dikel and Celik, 1998; Celik and Gokce, 2003; Gokce *et al*., 2003) in Turkey. Few studies have been conducted on the distribution and range expansion. This study describes new finding of the expansion of *O. niloticus* in Nevsehir.

MATERIALS AND METHODS

On 9 August 2009 and 12 September 2009 (Fig. 1), two *Oreochromis niloticus* individuals were captured from entrance of the Damsa Dam Lake by gill net with 55 mm mesh size and stored in deepfreeze and transformed to laboratory in 96% ethanol (38°32'54,21"N-34°55'24,66"E, altitude 1223 m). Sampling locality are shown in Fig. 2. The specimens were weighed and morphometric and meristic analysis of the specimens was performed. The specimens were deposited at the zoological collection of the Department of Biology Nevsehir University.

Fig. 1: Two *Oreochromis niloticus* specimens caught on 9 August 2009 (A: 18,0 cm TL) and 12 September 2009 (B: 20, 6 cm TL)

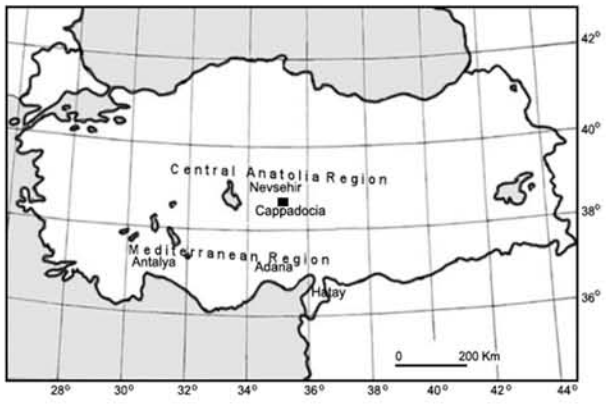

Fig. 2: Map of the capture locality of two *Oreochromis niloticus* specimens

RESULTS AND DISCUSSION

The morphometric and meristic characteristics of the specimens are shown in Table 1. Diagnostic features of the individuals accord with previous descriptions of the *Oreochromis* sp. According to specimens morphologic and meristic characters (Table 1) fully agrees with the typical diagnostic features of *Oreochromis niloticus* (Kottelat and Freyhof, 2007).

Various fish species are used in Turkey for experimental studies in weed and organic matter control, physiology, ecology, genetics, medical and other disciplines. A total of 41 fish species were determined in Turkish inland water as an exotic fish species (Innal and Erkakan, 2006). They represent nearly 15% of the current freshwater fish fauna list (Kuru, 2004).

Five species belonging to family Cichlidae were introduced for aquaculture purpose in 1973 by Cukurova University (Innal and Erkakan, 2006; Cetinkaya, 2006). *Tilapia rendalli*, *T. zilli* and *Oreochromis aureus* are found in cage culture in Seyhan Dam Lake and *Sarotherodon galileus* and *O. niloticus* are found in Cukorova University's fisheries stations. *O. mossambicus* was introduced in Koycegiz Lake (Caliskan and Yerli, 2000). *Tilapia* escaped from culture stations and they are now well established and they are regularly present in commercial catch both rivers (Celik and Gokce, 2003;

Table 1: Some metric and meristic characteristics of the two captured individuals

	Individuals	
Metric characters (cm)	1	2
Total length	18.0	20.6
Standard length	14.4	16.0
Fork length	17.5	20.3
Head length	4.7	5.4
Interorbital distance	1.7	2.1
Prepectoral length	5.1	5.4
Preorbital length	1.6	2.3
Body depth	2.3	3.1
Body width	4.8	6.5
Pectoral fin length	8.6	10.7
Anal fin length	3.5	3.3
Dorsal fin length	8.0	8.8
Ventral fin length	6.4	8.7
Eye diameter	1.2	1.4
Length of snout	2.3	2.2
Total weight (g)	69.8	155.1
Meristic characters (number)		
Anal fin rays	III-10	III-9
Dorsal fin rays	XVI-11	XVI-11
Pectoral fin rays	11	12
Ventral fin rays	I-5	I-5

Table 2: Monthly distribution of surface water temperature of Damsa Dam Lake (°C)

Years	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2007	-1	4	14	20	20	23	26	28	18	4	10	7
2008	-1	6	14	14	16	18	22	24	20	15	10	6
2009	2	8	10	11	18	23	24	23	17	15	-	-

Bostanci, 2006) and dams (Gokce *et al*., 2003; Alagoz, 2005) in Mediterranean Region has Mediterranean Climate characterized by warm to hot, dry summers and cool, rainy winters (Anonymous, 2009). Artificial connections among river basins in Northern Mediterranean region may be an important factor for translocations indicated by Balon *et al*. (1986).

Presence of two tilapia specimens in Nevsehir are showed that good ability to adapt to different environment. Indeed, this species seems to feed omnivorous and regardless of the habitat type and water temperature. Because the water temperature almost is under 8°C from December to February, even surface water of the dam can be ice during winter cold days (Table 2), it is very surprise the species could not be alive under the 8°C for a long time in this area. It can be speculated that such a successful adaptation to the prevailing environmental conditions have been facilitated by global climatic changes as suggested by Vitousek *et al*. (1996) according to Kara and Oudjane (2009). By the way, it is probable to alive in the depth of Damsa Dam Lake during the months have cold surface water under 8°C. No data was provided about depth water temperature of Damsa Dam Lake.

Unknown numbers of cichlid species were introduced in early 1980s in Greece (Economidis *et al*., 2000). Economidis *et al*. (2000) reported that the acclimatization of this species to the cold natural waters of the latter is expected to be unsuccessful.

With the present record, *O. niloticus* has been reached the northern most localities of first introduced region (Mediterranean region). This expansion demonstrated that *O. niloticus has* a great capability to adapt to the cold region in respect to Mediterranean Climate. It had not captured any juvenile individual of *O. niloticus*.

CONCLUSION

In this study, there are not a clear explanations to the replacement of the *O. niloticus* in Nevsehir. So it should be confirmed the presence of the *Tilapia* species is accident or established in Nevsehir.

In future studies it should be confirmed to establish successfully wild in Nevsehir and it should be study to determine its potential effects (negative or beneficial) on the local fish communities of the Damsa Dam Lake should be emphasized.

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