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Natural and Non-natural Distribution of African Catfish *Clarias gariepinus* (Burchell, 1822) in Turkey

Funda TURAN*, Cemal TURAN

Iskenderun Technical University, Faculty of Marine Sciences and Technology, 31200, Iskenderun-Hatay-Turkey

ABSTRACT

African catfish, *Clarias gariepinus* (Burchell, 1822) is a widespread freshwater species found in the Middle East, and throughout Central and South Africa. *C. gariepinus*, inhabits natural lakes, fishponds, streams, and natural ponds in both deep and shallow waters. *C. gariepinus* is naturally found in the Asi, Seyhan, Ceyhan, Goksu Rivers. It was reported that *C. gariepinus* was translocated to the Aksu River by General Directorate of State Hydraulic Works. African catfish has increasing commercial importance in fisheries and aquaculture in Turkey. A recently introduced population of *C. gariepinus* has established in the Sakarya River (Eskişehir) due to aquaculture purposes in the north part of the Turkey. *C. gariepinus* introduction has negative effects on macro invertebrate community that was reflected by decrease in diversity, richness and biomass. There is also community-level impact of introduction that results variation in macro invertebrate composition in the rivers. Stomach contents of *C. gariepinus* basically rely on Pisces, Arthropod, Mollusca and plant materials to a considerable extent. Therefore, introduction of *C. gariepinus* in dams, rivers and lakes can cause food competitions with native fish and make irreversible changes in the fish community and cause loses of native fish. The present paper reviews published literature, reports and working papers about distribution and management of *C. gariepinus* in Turkey's reservoirs.

Keywords: African catfish, *Clarias gariepinus*, distribution, negative effects

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CORRESPONDING AUTHOR

funda.turan@iste.edu.tr
Tel : +90 326 614 16 93
Fax: +90 326 614 18 66

Karabalık *Clarias gariepinus* (Burchell, 1822)'un Türkiye'deki Doğal ve Doğal Olmayan Dağılımı

Öz: Karabalık *Clarias gariepinus* (Burchell, 1822), Güney Afrika, ve Orta Doğu'da geniş bir dağılım gösteren bir tatlısu türüdür. *C. gariepinus*, doğal göllerde, havuzlarda, akarsularda hem sığ hem de derin bölgelerde doğal yaşam alanlarına sahiptir. *C. gariepinus*'un Türkiye'deki doğal yayılım alanları Asi, Seyhan, Ceyhan ve Göksu nehirleridir. Daha sonraları bu türün DSI tarafından Aksu Nehri'ne aşılandığı rapor edilmiştir. Karabalık, Türkiye'de gerek avcılık gerekse yetiştiricilik açısından ekonomik bir değere sahiptir. Yetiştiricilik amaçlı Türkiye'nin kuzey bölgesine götürülen Karabalık Sakarya Nehri'nde (Eskişehir) zamanla doğal bir populasyon oluşturmuştur. *C. gariepinus*, çeşitlilik, biması azaltarak makro omurgasız kommünitesi üzerinde olumsuz bir etkiye neden olmaktadır. *C. gariepinus'un* mide içeriği incelendiğinde başlıca balık, Arthropoda ve Mollusca ile beslendiği, bitkisel materyalinde çok fazla tüketildiği tespit edilmiştir. Bu nedenle *C. gariepinus*, giriş yaptığı göl, gölet ve nehirlerdeki yerli türlerle besin rekabetine girebilir ve bu da zamanla yerli balık popülasyonları üzerinde geri dönüşü olmayan değişikliklere ve türlerin kaybına neden olabilir. Bu çalışmada, Türkiye'deki tatlısu kaynaklarında yaşayan *C. gariepinus'*un dağılımı ve yönetimi hakkında yapılmış olan çalışmalar, raporlar ve veriler değerlendirilmiştir.

Anahtar kelimeler: Karabalık, *Clarias gariepinus*, dağılım, olumsuz etkiler

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Introduction

Family Clariidae at present consists of 14 genera, which comprise 92 species distributed in Africa and South-East Asia (Teugels 1986). African catfish, *Clarias gariepinus* Burchell, 1822 is of great commercial importance both in fisheries and aquaculture. *C. gariepinus* is a native species of Africa and has drawn attention of aquaculturists because of its biological attributes that include faster growth rate, resistance to diseases and possibility of high stocking density (Lal et al. 2003). It has an almost Pan African distribution (absent from

Maghreb, the upper and lower Guinea, the Cape province, probably Nogal province), and also naturally occurs Jordan, Israel, Lebanon, Syria and southern Turkey (Teugels 1996). *C. gariepinus* inhabits natural lakes, fishponds, streams, and natural ponds in both deep and shallow waters (Figure 1). This fish has pseudo-lungs, a long body, high growth rate and a remarkable capacity to live in stagnant environments and adapt easily to new environments (Mwebaza-Ndawula 1984). In natural environments, the reproduction of African catfish *C. gariepinus* is associated with the rainy season, and individuals can reach up to 1.5 m in total length (Yalçın et al. 2001a). In its natural range, it is omnivorous (Yalçın et al. 2001a), and exhibits seasonal reproduction with high fecundity (Yalçın et al. 2001b), Its reproduction is seasonal with gonadal maturation associated to periods of flooding. The maturation process is influenced by changes in water temperature and photoperiod, but the increase of water level is the principal factor for their reproduction (Yalçın et al. 2001b; De Graaf et al. 1995).

Figure 1. A general view of African catfish *Clarias gariepinus* from the Asi River (photo by F.Turan).

Distribution in Turkey

C. gariepinus is naturally found in the Asi, Seyhan, Ceyhan, Goksu Rivers (Geldiay and Balık 1988). It was reported that *C. gariepinus* was translocated to the Aksu River by D. S. İ. (General Directorate of State Hydraulic Works) (Balık 1988; Küçük and Ikiz 2004). Furthermore, *C. gariepinus* was translocated to the Sakarya River in the north part of the Turkey for the purposes of scientific studies (Erençin 1978) (Figure 2).

The general distribution and extension of *C. gariepinus* in Turkish Rivers are summarised according to relevant studies as given in Table 1.

Figure 2. Natural (green coloured) and non-natural (red coloured) distribution of *Clarias gariepinus* in Turkish freshwaters.

Table 1. Data on distribution of *Clarias gariepinus* from Turkish rivers.

River	Locality, province	Specimens	Range of total length (cm)	Fishing method	References
Asi (Orontes)	Büyük Karaçay stream of the River Orontes	56	-	Gill nets , cast nets and Electroshocker	(Özcan and Altun 2015)
	Orontes river	4	-	Electroshocker, small hand net and gill nets	(Özcan 2013)
	Güzelburc, Gölbası, Samandağ	523	25.05- 53.66	Nets (38x38mm - 54x54mm)	(Yalçın et al. 2001b)
Seyhan	Seyhan	2	40.0	Gill nets , cast nets	(Alagöz2005)
Ceyhan	Aslantas	26	27.0-44.0	Gill nets, cast nets	(Yeşilbudak et al. 2013)
	Gavur and Kumasır	7	22.84-14.98	Electroshocker	(Kara et al. 2004)
Göksu	Celtikci, Kurtuluş	28	20.4-25.8	Gill nets	(Kaya 2009)
	Silifke	4	23.0 -40.0	Electroshocker, Gill nets, trammel nets, seine nets and cast nets.	(Küçük et al. 2007)
Aksu	Serik	14	12.0-38.0	Electroshocker, Gill nets, trammel nets, seine nets, cast nets	(Küçük and Ikız 2004)
Sakarya	Çifteler Pond	High density	-	Electroshocker, gill nets	(Emiroğlu 2011)
	Ahiler	High density	-	Roller fishhook and scoop net	(Emiroğlu 2011)

C. gariepinus has increasing commercial importance in fisheries and aquaculture in Turkey (Turan and Gürağaç 2014). A recently introduced population of *C. gariepinus* was established in the Sakarya River (Eskisehir) due to aquaculture purposes in the North part of the Turkey (Turan et al. 2005; Emiroğlu 2011). *C. gariepinus* has recently begun to threaten the wetland ecology in the Sakarya River basin by demonstrating a high level of adaptation to its new habitat (Emiroğlu, 2011).

The food variety of *C. gariepinus* is broad in natural environments. *C. gariepinus* feed on arthropods, molluscs, fish, reptiles, amphibians and plants (Yalçın et al. 2001b; Bruton 1979). Toleration of large environmental variation of *C. gariepinus*, e.g. of temperature and dissolved oxygen, leads to rapid acclimation to new environments. The wide prey options of *C. gariepinus* associated with its ability to adapt to different ecosystems facilitate its fast growth and air breathing capability, partly explains the wide dispersal area (Rabelo and Soares 2014). Owing to its enormous potential as an aquaculture fish during the 1990s, cultivation of *C. gariepinus* spread throughout Europe, Asia and Latin America (Verreth et al. 1993; Vitule et al. 2006). The fish quickly finds its way to nearby natural waters, mostly through river flooding and escapes from aquaculture ponds (Vitule et al. 2006). Because of its prolific predatory nature (Lal et al. 2003; Amin et al. 2009), competition for food and ability to alter food web structure (Khan and Panikkar 2009), and introgression with wild populations (Na-Nakorn 1999; Peh 2010), *C. gariepinus* became a potential threat to many of the native freshwater fishes in its regions of introduction. *C. gariepinus* was also reported to exacerbate habitat degradation and the spread of diseases and parasites (Booth et al. 2010).

Risk assessments under the European Commission (EC) Council Regulation No 708/2007 concerning the use of alien and locally absent species

in aquaculture (ASR), the European Non-native Species in Aquaculture Risk Assessment Scheme (ENSARS) are briefly summarised, and the "Organism" module is applied to the 24 species listed in ASR's Annex IV. For the 'Risk of Introduction' section of the "organism" module, African catfish, *Clarias gariepinus*, was attributed to the highest score, followed by Japanese clam (*Ruditapes philippinarum*) and common carp (*Cyprinus carpio*) (Copp et al. 2014). Tarkan et al. (2014) also assessed the invasive potential of introduced non-native and translocated fishes in Turkey (Anatolia and Thrace) by applying the Fish Invasiveness Screening Kit (FISK), a risk identification tool for freshwater fishes that *C. gariepinus* was evaluated as translocated native invasive species with a mean value of calibration score 25.8, high risk species.

Conclusion

It is important to determine and monitor the extent of spread of *C. gariepinus* in Turkey and control its impact on native fish and fisheries because it is a top predator that reaches a large size and can withstand extreme environmental conditions. Also, prolific predatory nature and high food competitional ability of *C. gariepinus* are potential threat to many of the native freshwater fishes in its regions of introduction. Therefore, a monitoring programme should be developed to verify if *C. gariepinus* is already established in relevant environment and its impacts on the native fish community should be revealed, and methods should be developed to control its expansion. Such information can contribute to the development of management plans that aims to minimize possible impacts of this species. Such plans must include increasing the awareness of this invasive species by scientists, farmers, fishermen, legislators and general public, as well as a rigorous application of existing laws.

References

Alagöz S. 2005. Determination of Ichthyofauna in the Seyhan Dam Lake (Adana) [Master's Thesis]. University of Çukurova, Adana, 85 pp. [in Turkish]

Amin M N, Ali M Y, Salequzzaman M. 2009. "Identification and impact analysis of invasive species: A case study in the Mongla sea port area of Bagerhat district of Bengladesh." Daffodil International University J. Sci. and Technol. 4: 35–41.

Balık S. 1988. The zoogeographical and systematical on freshwater fish in Mediterrenaen region in Turkey, Doğa T. Zool. Der., 12 (2):156-179. [in Turkish]

Booth A J, Traas G R L, Weyl O L F. 2010. "Adult African sharptooth catfish, *Clarias gariepinus*, population dynamics in a small invaded warm-temperate impoundment." Afr Zool. 45: 299–308. doi: 10.3329/diujst.v4i1.4353

Bruton M. 1979. "The food and feeding behaviour of *Clarias gariepinus* (Pisces: Clariidae) in Lake Sibaya, South Africa, with emphasis on its role as a predator of cichlids." *The Transactions of the Zoological Society of London* 35(1): 47–114. doi: 10.1111/j.1096-3642.1979.tb00057.x

Copp G H, Godard M J, Russell I C, Peeler E J, Gherardi F, Tricarico E, Miossec L, Goulletquer P, Almeida D, Britton J R, Vilizzi L, Mumford J, Williams C, Reading A, Rees E M A, Merino-Aguirre R. 2014. A Preliminary Evaluation of the European Non-Native Species in Aquaculture Risk Assessment Scheme Applied to Species Listed on Annex IV of the EU Alien Species Regulation. Fish Manag Ecol. 1–9. doi: 10.1111/fme.12076

De Graaf G, Galemoni F, Banzoussi B. 1995. "The artificial reproduction and fingerling production of the African catfish *Clarias gariepinus* (Burchell, 1822) in protected and unprotected ponds." Aquac Res. 26: 233–242.

Emiroglu O. 2011. "Alien fish species in upper Sakarya River and their distribution." Afr J Biotechnol. 10(73): 16674–16681.

Erençin Z. 1978. Ankara Üniversitesi Veteriner Fakültesinin Çifteler Sakaryabaşı'ndaki Yeni Uygulama İstasyonunda Kültür Balıkçılığı Yönünden Önemli Ilımlı Balıklarının Yetiştirilmesi Olanakları Üzerinde Görüşler, Ankara University Journal of Faculty of Veterinary Medicine 2(25): 307-314.

Geldiay R, Balik S. 1988. Freshwater Fishes of Turkey. I. Edition. Ege University Publications, No: 97, Izmir, Turkey. 520p. [in Turkish]

Kara C, Alp A, Erer M. 2004. Distribution of Fish Fauna on Upper and Middle River Basin in Ceyhan Region, University of Kahramanmaraş Sütcü Imam, Presidency of Research Projects and The Management Unit, Kahramanmaraş, 2004. [in Turkish]

Kaya F. 2009. Karyology of some economically important fishes living in the Göksu River. Phd Thesıs Unıverstıy of Mersin, Mersin, 118 pp. [in Turkish]

Khan M F, Panikkar P. 2009. "Assessment of impacts of invasive fishes on the food web structure and ecosystem properties of a tropical reservoir in India." Ecol. Model. 220: 2281–2290.

Küçük F, Ikiz R. 2004. "Fish fauna of streams discharging to the Antalya Bay." Turkish J Aqua Sci. 21(3-4): 287–294.

Küçük F, Gümüş E, Gülle I, Güçlü S S. 2007. "The Fish Fauna of the Goksu River (Türkiye) Taxonomic and Zoogeographic Features." Turk J Fish Aquat Sci. 7: 53–63.

Lal K K, Singh R K, Mohindra V, Singh B, Ponniah A G. 2003. "Genetic makeup of exotic catfish, *Clarias gariepinus* in India." Asian Fish. Sci. 16: 229–234.

Mwebaza-Ndawula L. 1984. "Food and feeding habits of *Clarias mossambicus* from four areas in the Lake Victoria basin, East Africa." Env. Biol. Fish. 10:69–76. doi: 10.1007/BF00001663

Na-Nakorn U. 1999. Genetic factors in fish production. A case study of the catfish, *Clarias*, pp. 175–187. In: Mustafa, S. (ed.). Genetics in Sustainable Fisheries Management. Fishing News Books, Malden MA.

Ozcan G. 2013. A contribution to knowledge of the freshwater fish of Orontes River, Hatay, Turkey. Proc Int Acad Ecol Environ Sci., 3(2), 143-147.

Ozcan G, Altun A. 2015. Ichthyofauna and Its Conservation Status of Büyük Karaçay Stream, Hatay, Turkey, Croatian Journal of Fisheries, 73, 63-66.

Peh K S.H. 2010. "Invasive species in south East Asia: The knowledge so far." Biodivers. Conserv. 19: 1083-1099.

Rabelo LB, Soares L S H. 2014. "Feeding interaction of the non-native african catfish *Clarias gariepinus* (Burchell, 1822) in Itanhém River Estuary, Bahia, Brazil." Braz. J. Oceanogr. 62(3): 179–186.

Tarkan A S, Ekmekçi FG, Vilizzi L, Copp G H. 2014. Risk screening of non-native freshwater fishes at the frontier between Asia and Europe: first application in Turkey of the fish invasiveness screening kit. J Appl Ichthyol. 30(2), 392-398.

Teugels G G. 1986. "A systematic revision of the African species of the genus Clarias (Pisces; Clariidae)." Koninklijk Museum Voor Midden-Africa Tervuren, Belgie. Zool. Weten.-Ann. 247: 35–41.

Teugels G G. 1996. "Taxonomy, phylogeny and biogeography of catfishes (Ostariophysi, Siluroidei): an overview." Aquat. Living Resour. 9: 9–34.

Turan C, Yalcin S, Turan F, Okur E, Akyurt I. 2005. "Morphometric comparisons of African catfish, *Clarias gariepinus*, populations in Turkey." Folia Zool. 54: 165–172.

Turan F, Gürağac R. 2014. "Induction of triploidy with caffeine treatment in the African catfish (*Clarias gariepinus*)." Iran J Fish Sci. 13(4): 1014–1020.

Verreth J, Eding EH, Rao GRM, Huskens F, Segner H. 1993. "A review of feeding practices, growth and nutritional physiology in larvae of the catfishes *Clarias gariepinus* and *Clarias batrachus*." J World Aquacult Soc. 24: 135–144. doi: 10.1111/j.1749- 7345.1993.tb00002.x

Vitule J R, Umbria S C, Aranha J M R. 2006. "Introduction of the African catfish *Clarias gariepinus* (Burchell, 1822) into Southern Brazil." Biol. Invasions. 8:677–681. doi: 10.1007/s10530-005-2535-8

Yalçın S, Akyurt I, Solak K. 2001a. "Stomach contents of the catfish *Clarias gariepinus* (Burchell, 1822) in the River Asi (Turkey)." Turk J Zool. 25: 461–468.

Yalçın S, Akyurt I, Solak K. 2001b. "Certain reproductive characteristics of the catfish (*Clarias gariepinus* Burchell, 1822) living in the River Asi, (Turkey)." Turk J Zool. 25: 453–460.

Yeşilbudak B, Duran S, Tunçsoy M, Erdem C. 2013. Some Morphometric Properties of *Clarias gariepinus* (Burchell, 1822) Population in Aslantaş Dam Lake (Osmaniye), J Aquacult Eng Fish Res., 9(2): 1-7.