

Invasion note

Introduction of the African catfish *Clarias gariepinus* (BURCHELL, 1822) into Southern Brazil

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Abstract

We record here the introduction of the African catfish *Clarias gariepinus* into the Guaraguaçu River basin in Paraná State, Brazil, an area with an extremely rich endemic fish fauna, including many catfishes. *C. gariepinus* was introduced as escapees from ponds built for recreational angling. These catfishes are very large and hard predators, thus posing serious potential for impact on the native fish fauna. The impact of *C. gariepinus* needs study with emphasis on finding means for controlling its spread.

The Atlantic Forest of South America is one of the richest and endangered ecosystems on the planet (Myers et al. 2000). Several rivers flow through the coastal plain of this ecosystem, which contain many endemic fish species. Much of the fish fauna is potentially endangered because of habitat degradation by human activities (Menezes et al. 1990). A new and potentially serious threat to this fauna is the invasion of alien fishes.

Even though the negative effects of introduced species are widely recognized, many of them are still being released into the aquatic ecosystems of Brazil without considering their potential impact on native fish and fisheries (Agostinho and Julio Jr. 1996; Agostinho et al. 2005).

However, there is an increasing interest in detecting and studying introduced species in Brazil to develop solutions to solve the ecological problems they create. Therefore, the *Laboratório de Ecologia de Rios (EcoRios)* of the *Universidade Federal do Paraná*, has developed a program aimed at detecting exotic fish species in the

Guaraguaçu River basin, Paraná state, Brazil (25°45' S and 48°35' W). Of particular concern is the African sharptooth catfish (*Clarias gariepinus*), which has recently been introduced as escapees from ponds built for aquaculturists. In Brazil, only four specimens have been reported previously (Alves et al. 1999; Braun et al. 2003) and their potential impact on the native fauna has been recognized for sometime (Agostinho and Julio Jr. 1996). In this paper, we report the spread and probable establishment of this species and stress upon the potential problems resulting from its introduction.

The Guaraguaçu River is the largest river east of the sub-basin of Paranaguá Bay, Paraná coast, Brazil. Its headwaters are in the Serra do Mar, 766 m above sea level, in the Saint-Hilaire/ Hugo Lange National Park and it discharges into the Paranaguá Bay (Bigarella 1999; Maack 1981). Its drainage area is 395.5 km² (APPA/FUNPAR/CEM, 2005, in press), much of it an extensive coastal plain where the meandering river floods a large area rich in swamps and lateral lakes. This

region has a tropical, super-humid climate, without dry seasons (IAPAR 1978). The rain is distributed throughout the year, but July is the driest month with precipitation of 60 mm, and February is the rainiest month. The annual water levels are superior to 1000 mm and the mean temperature is between 17 and 21 °C (Maack 1981).

Fish sampling was done in November 2002, and May–September 2004 using gill nets, long-lines, cast nets, beach seines and fish traps. A total of 23 individuals of *C. gariepinus* were captured in different regions of the Guaraguaçu basin. All the individuals collected were weighed, measured, and preserved.

Clarias gariepinus is widely distributed in Africa and parts of Asia (Israel, Syria and south of Turkey). Its main habitats are calm lakes, rivers and swamps in areas that flood on a seasonal basis (De Graaf and Janssen 1996; Winemiller and Kelso-Winemiller 1996). *C. gariepinus* has pseudo-lungs, long bodies and a high capacity to produce mucous as adaptations to live in stagnant environments or out of water (Doneelly 1973). In its natural range it is omnivorous, feeding on plant material, plankton, arthropods, mollusks, fish, reptiles, and amphibians (Yalçın et al. 2001a). 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 (Van der Waal 1974; De Graaf et al. 1995; Yalçın et al. 2001b).

During the 1990s, *C. gariepinus* started to be cultivated in fish farms throughout Europe, Asia and Latin America including Brazil (Verreth et al. 1993). It was cultivated in fish farms in Paraná state (south region of Brazil), even though Brazil has one of the most diverse catfish faunas in the world and the Environmental Federal Brazilian Legislation, prohibits the introduction, transfer, cultivation and commercialization of *C. gariepinus* in the Amazon and Paraguay hydrographic basins (IBAMA 1994). However, it was not popular in the local markets, therefore fish farmers began using this species in sport fish ponds (in Brazil named as *pesque-pague* = ‘fish-and-pay’) (Agostinho and Julio Jr. 1996; Richter 2000), stimulating an increase in the number of such

ponds. Unfortunately, the catfish ponds do not have any protective apparatus to avoid the escape of species, resulting in the invasion of this species into rivers and lakes.

Our interest in *C. gariepinus* was stimulated by fishermen of this area who reported catching African catfish while also observing a decline in the catch of native fishes. Concern over the impact of the species was expressed by local fishermen who knew well the fish fauna before the introduction of *C. gariepinus*. Moreover, most commercial and sport fishermen with whom we talked have either caught the species or know someone who has captured it (personal observation).

The data obtained so far indicate that *C. gariepinus* has become widespread in the new environment, because specimens were caught at distances between 10 and 15 km from the cultivation center. The length of animals varied between 334 and 785 mm (Table 1). Half of the individuals had their stomachs with more than 50% of their capacity filled, and the content included various species of the native fauna (mollusks, aquatic and terrestrial arthropods, fish and amphibians). Moreover, three mature females were captured, indicating their reproductive potential in the area. These facts and the known hardiness and colonization capacity of the clariids (Fuller et al. 1999; Cambray 2003a) suggest that *C. gariepinus* is already established in the area.

The topographic and physiognomic aspects of the Guaraguaçu river basin are bound to favor the establishment and dispersion of *C. gariepinus*, because in their natural environment the species live in shallow lakes and ponds and in marginal swamps subject to low oxygen levels (Winemiller and Kelso-Winemiller 1996) and is able to move at speeds up to 1 km/day (Willoughby and Tweddle 1978). Moreover, the river and floodplain has also been widely colonized by *Brachiaria* spp., an African grass that creates a shallow environment with plenty of food and protection for *C. gariepinus* (personal observation).

The potential problems created by the *C. gariepinus* invasion are seen in the problems created by the related walking catfish, *Clarias batrachus*. The walking catfish has rapidly colonized the

Table 1. General data about sampled individuals.^a

Month/year	Lt (mm)	Mt (g)	SEX	MT	WT (°C)	SECTOR	MT
Nov./2002	370	373.00	M	NA	NA	Medium	Longline
Nov./2002	435	686.00	F	X	NA	Medium	45 mm net
Nov./2002	500	900.00	M	NA	NA	Medium	Longline
Nov./2002	515	1044.00	F	X	NA	Medium	Longline
Nov./2002	490	856.00	F	NA	NA	Medium	45 mm net
Nov./2002	605	1582.00	M	NA	NA	Medium	Longline
Nov./2002	650	1801.00	M	NA	NA	Upstream	60 mm net
Mai/2004	345	294.33	F	NA	NA	Medium	Fish rods
Mai/2004	334	262.88	F	NA	NA	Medium	Fish rods
July./2004	785	3070.00	M	NA	16.5	Medium	Longline
July./2004	357	364.43	M	NA	16.5	Upstream	45 mm net
July./2004	397	458.10	M	NA	16.5	Upstream	45 mm net
Ago./2004	780	3535.00	M	NA	19.7	Medium	60 mm net
Ago./2004	745	3250.00	M	NA	19.7	Medium	Longline
Ago./2004	600	1650.00	F	NA	19.7	Medium	Fish rods
Ago./2004	605	1820.00	F	NA	19.7	Medium	Fish rods
Sept./2004	629	1088.00	F	NA	21.4	Medium	50 mm net
Sept./2004	629	1924.00	F	NA	21.4	Medium	60 mm net
Sept./2004	774	3568.00	F	NA	21.4	Medium	Longline
Sept./2004	684	2371.00	M	NA	21.4	Medium	Longline
Sept./2004	700	2562.00	F	X	21.4	Medium	60 mm net
Sept./2004	740	3000.00	F	NA	21.4	Medium	50 mm net
Sept./2004	640	1620.00	F	NA	21.4	Medium	60 mm net

^aLt, Total length; Mt, total mass; SEX, (M – male, F – female); MT, mature individuals are marked with X; WT, median monthly water temperature; SECTOR, region in relation with head or mouth of river: Upstream, Medium, Downstream; MT, methodology; NA, data not available.

Southeastern United States, invading aquaculture farms to prey on fish stocks and is regarded as a threat to native fishes in regional waters (Fuller et al. 1999). This species is listed in the Global Invasive Species Database as among the ‘one hundred of the worst invasive alien species’ (<http://www.issg.org>). Unfortunately, in Brazil there are few reliable lists of alien species and despite the knowledge on the subject, many species with a high potential impact are being cultivated without previous studies of any kind.

The reduction of the native fish fauna due to the introduction of alien fish species was found in lakes of the Atlantic Forest, southeastern Brazil (Latini and Petrere Jr. 2004). The possible impact of the invaders on native species, mainly through predation, can be high because of the high degree of endemism and the generally small size of the native fishes. Therefore, *C. gariepinus* has the potential for high impact on the fish fauna of the Guaraguaçu River where many of the endemic species are already considered to be endangered, including some catfish species, such as *Glanidium*

melanopterus, *Hypostomus punctatus*, *Corydoras macropterus*, *C. nattereri* and *C. steindachneri* (Abilhoa and Duboc 2004). Moreover, many cichlids of the region, such as *Crenicichla* spp. and *Geophagus brasilienses* possess morphological, ecological and behavioral characteristics similar to those of African cichlids that are common prey of *C. gariepinus* (Willoughby and Tweddle 1978; Bruton 1979; Winemiller and Kelso-Winemiller 1996).

It is important to determine the extent of spread of *C. gariepinus* in Brazil and to determine its impact on native fish and fisheries because it is a top predator, that reaches a large size and can withstand extreme environmental conditions. Therefore, a study is being developed to verify if *C. gariepinus* is already established in this hydrographic basin of the Atlantic Forest, what impacts it may have on the native fish community, and which methods are best for capture and control of this species. We believe such information could contribute to the development of management plans aimed at minimizing

possible impacts of this invasive species. Such plans must include increasing the awareness of invasive species by scientists, farmers, fishermen, legislators and general public (Perry and Vanderklein 1996; Cambray 2003b), as well as a rigorous application of existing laws.

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