

First record of *Pygocentrus piraya* (Cuvier 1819) (Characiformes: Serrasalminidae), a new predatory species introduction in the middle and lower Doce River Basin

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ABSTRACT: This is the first report of the occurrence of *P. piraya* in the Doce River. The introduction of this species adversely affects the fish community, mainly through competition and predation of native species.

The Characiformes Family Serrasalminidae is known by pacus and piranhas. The distribution of Serrasalminidae is strictly neotropical and the presence of representatives in other regions of the world is due to their introduction into the environment. The Family comprises around 80 species distributed on 15 genera (Jégu 2003) of which *Pygocentrus* with three species (Fink 1993).

Pygocentrus piraya (Cuvier 1819) is popularly known as the black piranha (Figure 1) and has a medium-sized tall body which is extremely laterally compressed (Britski *et al.* 2007). This species, widely distributed throughout the São Francisco River basin (Britski *et al.* 1986), differs from the other species by a rayed adipose fin (Fink 1993).

Some species of the Family Serrasalminidae as the piranhas of the genus *Pygocentrus* have the ability to adapt to new environments, especially those with lentic characteristics, such as lakes and reservoirs (Agostinho and Júlio-Junior 1999; Camargo and Queiroz 2005; Agostinho *et al.* 2007; Duponchelle *et al.* 2007). In Brazil these biological characteristics have been historically associated to sport fishing, since the introduction of the dourado *Salminus brasiliensis* (Alves *et al.* 2007) and in the last decades, to aquaculture activities (Dergam *unpubl.*). This biodiversity-erosive process is well documented

in the Doce River Basin (Sunaga and Verani 1985; 1991; Godinho and Formagio 1992; Godinho *et al.* 1994; Petrere-Junior and Latini 2004).

A series of environmental impacts occur after species introduction, such as competition, predation, transmission of pathogens, diseases and parasites (Smith *et al.* 2005; Tundisi 2006), reduced fertility rate of native species, economic and social losses, hybridization, introgression and extinction of species (Novak 2007; Alves *et al.* 2007).

This study was conducted in six regions of the Doce River, two in Guandu River and two in Manhuaçu River. These regions extend from the town of Colatina, Espírito Santo State (ES) to Resplendor, Minas Gerais State (MG), Brazil, where the Mascarenhas and Aimorés hydroelectric plants are located. The animals were collected with gill nets and were preserved in formalin 10%. Voucher specimens were deposited in the fish collection of the Museu de Zoologia João Moojen, Universidade Federal de Viçosa (Voucher - MZUFV 3946), Minas Gerais, Brazil. Fishes were collected under the IBAMA (02001.009572/2009-15) and IEMA license (09/09-NUPECA/DIPRAM/ES).

We collected 12 individuals of the black piranha *P. piraya* in only three regions during the inventory of the ichthyofauna made between the middle and lower reaches of the Doce River (Figure 2).

Through information obtained from local fishermen, it is possible that the black piranha may have been introduced into the region due to accidental escapes from regional breeding farms. However, we cannot rule out the possibility that this species has been introduced through stocking actions. These two possibilities are considered since the introduction of exotic species may be related to an increase in fishery resources (Delariva and Agostinho 1999) or accidental escapes from breeding tanks (Orsfi and Agostinho 1999).

Thus, the black piranha is considered exotic in the Doce River and was probably introduced *in situ*, as was the African catfish *Clarias gariepinus* (Burchell 1822) in



FIGURE 1. Photographic record of the black piranha *Pygocentrus piraya* collected in the lower and middle course of the Doce River, states of MG and ES, Brazil (Voucher specimens - MZUFV 3946).

the states of Minas Gerais (Alves *et al.* 1999) and Bahia (Rocha 2008) and the red piranha *P. nattereri* and other exotic fish (Godinho and Formagio 1992; Alves *et al.* 2007) that occur in the Doce River. The species of piranhas *Pygocentrus* introduced in the Doce River were identified from morphological characteristics identified in studies conducted in the São Francisco (Britski *et al.* 1986; Britski *et al.* 2007) and taxonomic revision carried out by Fink (1993).

It is likely that the black piranha has become established in the region due to a preference for regions of lentic water, as can be found in the hydroelectric reservoirs of the middle and lower Doce River, as observed in the study by Luz (2009) for Lake Curralinho (middle São Francisco), and in Três Marias reservoir (Pinto-Coelho 2006).

This study is the first report the black piranha occurrence along the Doce River Basin. Other studies such as those of Godinho and Formagio (1992), Alves *et al.* (2007) and Vieira (2009) did not identify the occurrence

of the black piranha in the Doce River. We can therefore assume that the number of native and exotic species in the Doce River is underestimated.

The introduction of the black piranha is a worrying situation with regard to environmental balance, since this species has the ability to reproduce throughout the year in areas with lentic characteristics (Pinto-Coelho 2006). Moreover, it is considered an important predator and competitor, limiting the survival of native fish species. The introduction of exotic species is the second leading cause of extinction in the world (Clavero and García-Berthou 2005). Currently, the introduction of exotic fish is considered one of the factors responsible for modifying the structure of native ichthyofauna, generating a series of ecological and socio-environmental problems (Vitule 2009). This already occurs in the lower Doce River basin, due to the existence of several exotic species, and has generated the need for corrective or preventive actions to preserve the native fish fauna (Vieira 2009).

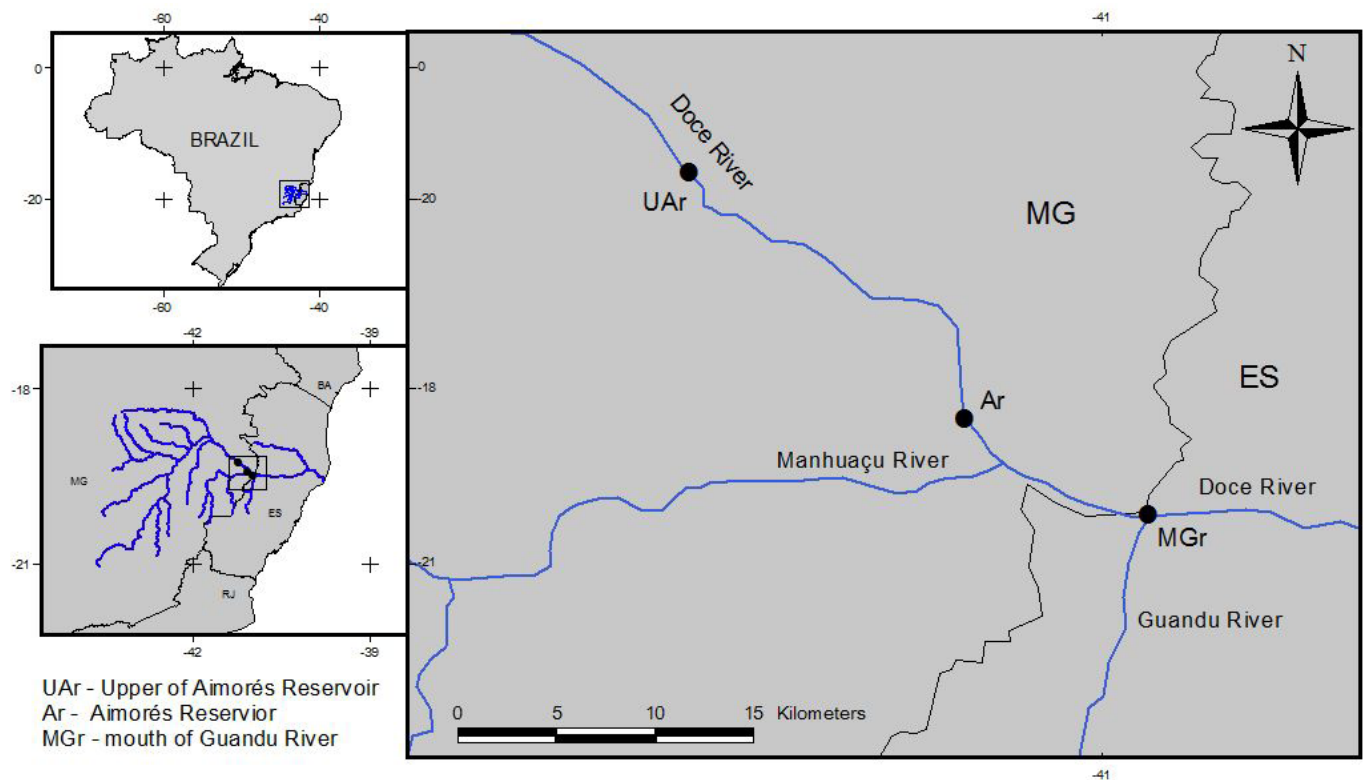


FIGURE 2. The black circles represent the regions where individuals of the black piranha *Pygocentrus piraya* were collected. MG: Minas Gerais state; ES: Espírito Santo state.

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LITERATURE CITED

- Agostinho, A.A. and H.F. Júlio-Júnior. 1999. Peixes da bacia do alto rio Paraná; p. 374-400 In R.H. Lowe-McConnell (ed.). *Ecologia de comunidades de peixes tropicais*. São Paulo: EDUSP.
- Agostinho, A.A., L.C. Gomes and F. M. Pelicice. 2007. *Ecologia e Manejo de Recursos Pesqueiros em Reservatórios do Brasil*. Maringá: EDUEM. 501 p.
- Alves, C.B.M., F. Vieira, A.L.B. Magalhães and M.F.G. Brito. 2007. Impacts of non-native fish species in Minas Gerais, Brazil: present situation and prospects. p. 291-314 In T.M. Bert (ed.). *Ecological and Genetic*

Implications of Aquaculture Activities. Dordrecht: Springer.

- Alves, C.B.M., V. Vono and F. Vieira. 1999. Presence of the walking catfish *Clarias gariepinus* (Burchell, 1822) (Siluriformes: Clariidae) in Minas Gerais state hydrographic basins, Brazil. *Revista Brasileira de Zoologia* 16(1): 259-263.
- Britski, H.A., Y. Sato and A.B.S. Rosa. 1986. *Manual de identificação de peixes da região de Três Marias (com chaves de identificação para os peixes da bacia do São Francisco)*. Volume II. Brasília: Codevasf. 115 p.
- Britski, H.A., K.Z.S. Silimon and B.S. Lopes. 2007. *Peixes do Pantanal: manual de identificação*. Volume II. Brasília: Embrapa. 230 p.
- Camargo, M. and H. Queiroz. 2005. Um ensaio sobre a adaptação de *Pygocentrus nattereri* à variação sazonal das águas do lago Mimirauá: Reserva de Desenvolvimento Sustentável Mimirauá. *Uakari* 1(1): 65-70.
- CTA. 2009. *Peixes de Água doce do Rio Doce: na área de influência da UHE Mascarenhas*. Vitória: CTA/EDP. 74 p.
- Clavero, M. and E. García-Berthou. 2005. Invasive species are a leading cause of animal extinctions. *Trends in Ecology and Evolution* 20(3): 110.

- Delariva, R.L. and A.A. Agostinho. 1999. Introdução de espécies: uma síntese. *Acta Scientiarum* 21(2): 255-262.
- Duponchelle, F., F. Lino, N. Hubert, J. Panfili, J.F. Renno, E. Baras, J.P. Torrico, R. Dugué and J. Nuñez. 2007. Environment-related life history trait variations of the red-bellied piranha, *Pygocentrus nattereri*, in two river basins of the Bolivian Amazon. *Journal of Fish Biology* 71(4): 1113-1134.
- Fink, W.L. 1993. Revision of the piranha genus *Pygocentrus* (Teleostei, Characiformes). *Copeia* 1993(3): 665-687.
- Godinho, A., M.T. Fonseca and L.M. Araújo. 1994. The ecology of predator fish introductions: the case of Rio Doce valley lakes; p. 77-83 In R.M. Pinto-Coelho, A. Giani and E. Von Sperling (ed.). *Ecology and Human Impact on Lakes and Reservoirs in Minas Gerais*. Belo Horizonte: SE-GRAC.
- Godinho, A.L. and P.S. Formagio. 1992. Efeitos da introdução de *Cichla ocellaris* e *Pygocentrus sp.* sobre a comunidade de peixes da lagoa Dom Helvécio; p. 93-102 In *Anais do X Encontro Anual de Aquicultura de Minas Gerais*. Belo Horizonte: Associação Mineira de Aquicultura.
- Jégu, M. 2003. Subfamily Serrasalminae; p. 182-184 In R.E. Reis, S.O. Kullander and C.J. Ferraris Jr. (ed.). *Check list of the freshwater fishes of South and Central America*. Porto Alegre: Edipucrs. 729 p.
- Latini, A.O., M. Petrere-Jr. 2004. Reduction of a native fish fauna by alien species: an example from Brazilian freshwater tropical lakes. *Fisheries Management and Ecology*, 11(2): 71-79.
- Luz, S.C.S., A.C.A. El-Deir, E.J. França, and W. Severi. 2009. Fish assemblage structure in a marginal lake disconnected from the submedium São Francisco River. *Biota Neotropical* 9(3): 117-129.
- Novak, S.J. 2007. The role of evolution in the invasion process. *Proceedings of the National Academy of Sciences* 104(10): 3671-3672
- Orsfi, M.L. and A.A. Agostinho. 1999. Introdução de espécies de peixes por escapes acidentais de tanques de cultivo em rios da bacia do Rio Paraná, Brasil. *Revista Brasileira de Zoologia* 16(2): 557-560.
- Pinto-Coelho, R.M. 2006. *A ictiofauna do reservatório de Três Marias, Rio São Francisco, MG*. Belo Horizonte: FUNDEP-UFMG. 66 p.
- Rocha, G.R.A. 2008. The introduction of the African catfish *Clarias gariepinus* (Burchell, 1822) into Brazilian inland waters: a growing threat. *Neotropical Ichthyology* 6(4): 693-696.
- Smith, W.S., E.L.G. Espíndola and O. Rocha. 2005. As introduções de espécies de peixes exóticos e alóctones em bacias hidrográficas brasileiras; p. 25-44 In O. Rocha, E.L.G. Espíndola, N. Fenerich-Verani, J.R. Verani and A.C. Rietzler (ed.). *Espécies Invasoras em Águas Doces: estudos de caso e propostas de manejo*. São Carlos: Universidade Federal de São Carlos.
- Sunaga, T. and J.R. Verani, 1985. Preliminary report of comparative study on fish community of the rio Doce Valley lakes. *Water Research Institute*, 1:167-174.
- Sunaga, T. and J.R. Verani. 1991. The fish communities of the lakes in rio Doce valley, Northeast Brazil. *Proceedings of the International Association of Theoretical and Applied Limnology*. 24: 2563-2566.
- Tundisi, J.G. 2006. Aqüicultura: impactos, gerenciamento integrado, perspectivas para o Brasil; p. 331-339 In A.T. Silva-Souza (ed.). *Sanidade de organismos aquáticos no Brasil*. Maringá; Abrapoa.
- Vieira, F. 2009. Distribuição, impactos ambientais e conservação da fauna de peixes da bacia do rio Doce. *MG. Biota* 2(5): 5-22.
- Vitule, J.R.S. 2009. Introduction of fishes in Brazilian continental ecosystems: Review, comments and suggestions for actions against the almost invisible enemy. *Neotropical Biology and Conservation* 4(2): 111-122.

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