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Short communication

First record of *Branchiura sowerbyi* Beddard, 1892 (Oligochaeta: Tubificidae) in Azores

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Abstract

The present work reports the finding of an exotic and invasive annelid, *Branchiura sowerbyi* Beddard, 1892, in freshwaters of São Miguel Island – Azores archipelago (Atlantic Ocean). One specimen was found near the mouth of Ribeira Quente stream in the south of São Miguel on 7 May 2008. This study increases the number of freshwater Oligochaeta species occurring in the Azores from 8 to 9.

Key words: invasive species, oceanic islands, freshwater, Azores

The aquatic oligochaete, *Branchiura sowerbyi*, was first described by Beddard (1892) from a tank in the Royal Botanical Society's Garden in London, and is one of the most widespread freshwater oligochaetes in Europe and North America. It is also known from South-East Asia, South Africa, South America, Mauritius Island and Australia (Brinkhurst and Jamieson 1971). In Europe it could be found in 22 countries, including Portuguese mainland (Giani 2004). Its earliest records were restricted only to South-East Asia (Brinkhurst and Jamieson 1971) and to botanical gardens in Europe (Beddard 1892). Such distribution pattern led Grabowski and Jablonska (2009) to a conclusion that *B. sowerbyi* is a species originating from the Sino-Indian region, spread elsewhere due to human activity. It seems that this introduction could be connected with transport of plants from one part of the world to another or with import of fish for fish farming (Paunovic et al. 2005). Due to the fast dispersal, success in adaptation and mass occurrence in some recipient areas *B. sowerbyi* could be characterized as invasive species. Presence of this species could disturb relations within benthic community and, consequently, could have influence to the aquatic ecosystem food chain (Paunovic et al. 2005).

Dispersion of invasive species, a particularly important theme in islands, was recognized as one of the major threats to local biodiversity (Silva et al. 2008). Aquatic biotopes are, due to its unique features, among the most disposed ecosystems to this kind of disturbance. Moreover, *B. sowerbyi* lives with its heads buried in the sediment, whilst the tails wave actively in water layer above the bottom. As a conveyor-belt feeder that mixes sediments (Matisoff et al. 1999). Potentially, it can have a large impact on the recipient environment since they can make burrows to a depth of 20 cm and after a short period of time move to a new location to build new burrows. *B. sowerbyi* is a thermal water species, with huge ability of adaptation. It is typical for waters with current velocity under 0.5 ms^{-1} (Paunovic et al. 2005). In Serbia, soon after the first finding, dense populations of *B. sowerbyi* were observed in a several artificial, slow-running channels. The dispersal of *B. sowerbyi*, after initial introduction and population establishment, has been rapid (Paunovic et al. 2005).

In the Azores archipelago the Oligochaeta have been poorly studied with the exception of works of Sciaccmitano (1964) and Brinkhurst (1969), no further studies have been published in this subject resulting in a short previously known 8 species list, reinforced by the poorer character in terms of species richness of this young, isolated and oceanic islands (Malhão et al. 2007; Gonçalves et al. 2008; Raposeiro et al. 2009).

This short communication, reporting the occurrence of *B. sowerbyi* in the Ribeira Quente (São Miguel) results of the ongoing research of the freshwater ecosystems performed by the University of Azores (e.g., Malhão et al. 2007; Gonçalves et al. 2008; Raposeiro et al. 2009). In spite of the intense sampling carried out these last years in the Azores this is the first time we were able to find this species.

The Azores, located at 36º55'43"-39º43'02" North, and 24º46'15"-31º16'15" West, is an oceanic archipelago comprising nine islands and several islets (Figure 1). Being 1 300 km apart from the nearest continental coast (Cabo da Roca-Portugal), and 1,900 km from the American Continent, it is the most remote Macaronesian archipelago.

A single specimen of *B. sowerbyi* was collected from the Ribeira Quente (37º44'894"N, 25º14'315"W), on 7 May 2008, in a sedimentation unit of the stream with a hand net (500 μm), preserved in 96% industrial alcohol and stored in Departamento de Biologia – Universidade dos Açores with the label number DB_FW_SMG_0001 (Figure 2 A).

Description: Length 31 mm. Dorsal anterior chaetal bundles with 4 short hair (Figure 2B) chaetae and crotchet that vary from simple-pointed to bifid with short upper teeth. Posteriorly hairs fewer and shorter and non-hair chaetae with less replication of upper teeth. Ventral bundles with 10-11 bifid chaetae with upper teeth shorter than lower, even simple-pointed anteriorly. The presence of 41 long (longer than the body diameter) dorsal and ventral gill filaments on posterior half o the body (Figure 2A) makes this species easy to recognize from all the other aquatic oligochaetes occurring in Europe (Brinkhurst and Jamieson 1971).

Cosmopolitan (Brinkhurst 1971)

Based on species level identifications only (i.e. genus level identification), the finding of *B. sowerbyi* in the Azores increases the number of species occurring in the archipelago from 8 to 9 (Table 1), distributed across 4 families. In terms of the free-living Oligochaeta, several areas of the archipelago have been poorly studied. Therefore, we estimate that Oligochaeta species richness in the area is higher and more intensive investigation is needed.

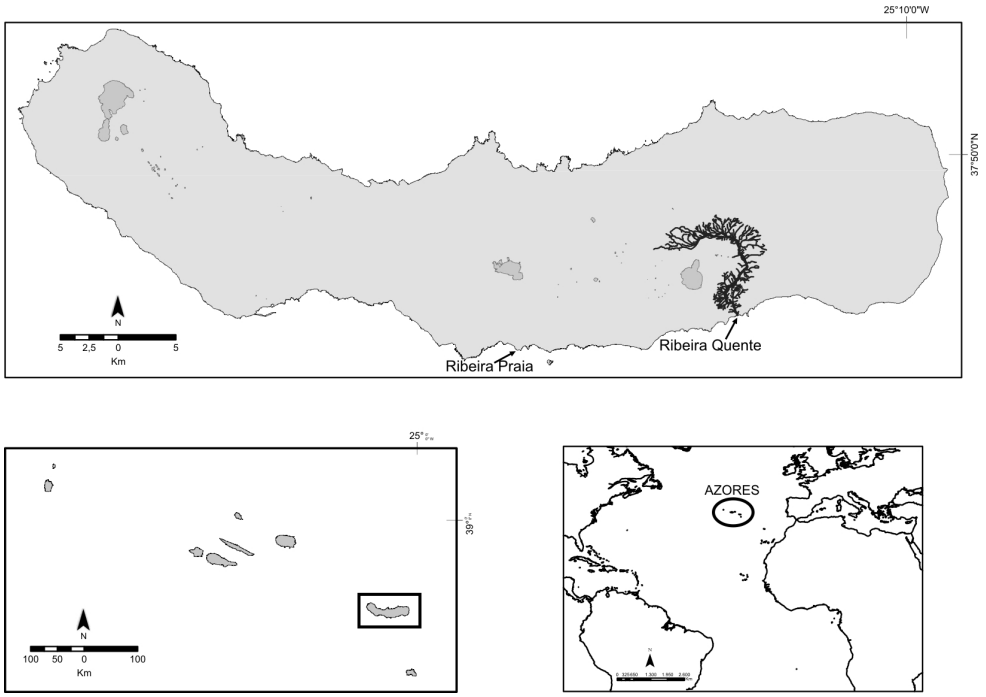

Figure 1. Location of Azores archipelago and respective surveyed stream

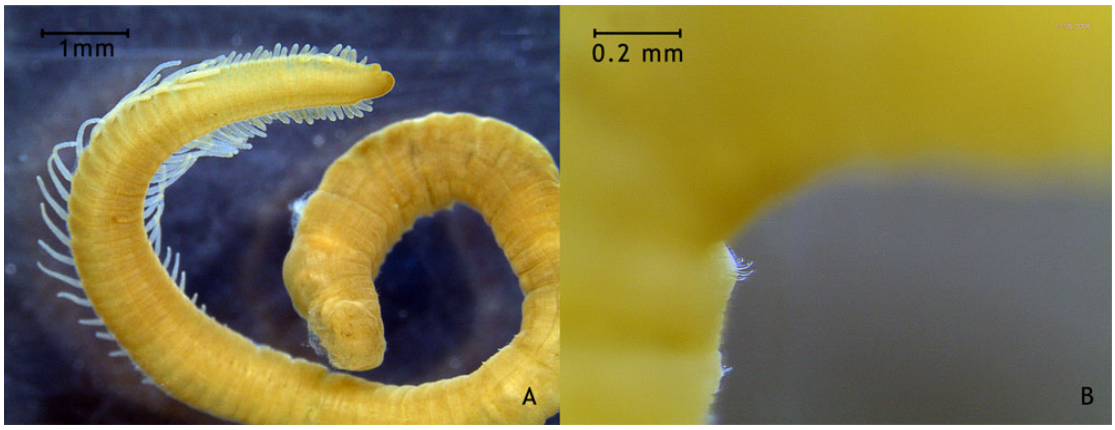

Figure 2. *Branchiura sowerbyi* from Ribeira Quente A) gill filaments; B) Anterior chaetal. Photograph by António Frias Martins

Table 1. Checklist of Azorean free-living freshwater Tubificidae, Naididae and Lumbriculidae

Family	Species
Lumbricidae	*Eiseniella tetraedra* (Savigny 1826)
Lumbriculidae	*Lumbriculus variegatus* (Müller 1774)
Naididae	*Dero pectinata* Aiyer 1930
	Nais communis Piguet 1906
	Nais elinguis Müller 1774
	Nais variabilis Piguet 1906
Tubificidae	*Limnodrilus hoffmeisteri* Claparede 1862
	Branchiura sowerbyi Beddard, 1892

The aquatic oligochaete, *B. sowerbyi* (Oligochaeta, Tubificidae), lives in aquatic sediments nearly devoid of oxygen (Brinkhurst and Jamieson 1971; Naqvi 1973), associated with shallow, stagnant or slowly flowing waters. It is thermophilous species. The reproductive cycle of this iteroparous worm was partly described by Casellato (1984) and after by Caselatto et al. (1987).

These are the conditions of the sampled location in the Ribeira Quente stream that present warm water due to its location just below the warm water effluent of Ribeira Quente power station.

In fact it is reported that in cooler temperate regions the species is found most frequently in artificially warmed waters (e.g Brinkhurst and Jamieson 1971). However, Prater et al. (1980) reported this species as abundant in Ohio in areas with moderate amounts of organic input. A high number of Oligochaeta was found in the same site where *B. sowerbyi* was collected, by Gonçalves et al. (2008) and Inova (2005, 2006) reports this location as influenced by organic enrichment as a consequence of urban pressures.

The presence of *B. sowerbyi* in Azores archipelago is probably due to human activity, and the fact that just one individual was sampled might indicate that this is an early stage of invasion, since the initial steps towards monitoring freshwater systems using benthic macroinvertebrates started in 2003. In fact, isolated islands have a reduced, but unique diversity (in compare with the mainland?) due to the different levels of separation caused by linear distance, strength and direction of water and wind currents and intervening depths. This makes these regions particularly vulnerable to biological invasions. Rare or occasional events that inoculate islands may be important in the establishment and colonisation of islands to form a native biota. However, in recent decades the efficient, diverse and far-ranging extent of transport modes has enabled access to a greater diversity of species from all world regions. Nevertheless many arrivals to islands can be predicted on account of their appearance and spread on nearby landmasses (Michin 2007). The establishment and consequences of introduced species has been object of a discussion in a lot of studies (e.g. Mooney and Hobbs 2000), but we are still not able to predict outcome of the introduction of particular species, as well as the impact of invasions in general to specific ecosystem. Therefore, every finding of non-indigenous species and effort to understand the way of transport, introduction establishment and

spread of species, is valuable in the process of defining of predictable models, as well as an attempt to warn to the problem of endangerment of native biodiversity caused by invaders. Therefore further work is required to elucidate the distribution and habitat preferences of *B. sowerbyi* in the Azores and possible effects to aquatic ecosystems. Presence of this species could disturb relations within benthic community and, consequently, could have influence to the aquatic ecosystem food chain (Paunovic et al. 2005). Moreover has been hypothesized that temporary or permanent climate change facilitates natural range expansion (Nehring 1998; Stachowicz et al. 2002).

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References

Beddard FE (1892) A new branchiate Oligochate (*Branchiura sowerbyi*). Quaterly Journal of Microscopical Science 33: 325-341

Brinkhurst RO (1969) Aquactic Oligochaeta of the Azores and Madeira. Boletim do Museu Municipal do Funchal 23: 46-48

Brinkhurst RO, Jamieson BGM (1971) Aquatic Oligochaeta of the world. Oliver & Boyd, Edinburgh, 860 pp

Casellato S (1984) Life-cycle and karyology of *Branchiura sowerbyi* Beddard (Oligochaeta, Tubificidae). Hydrobiologia 115: 65-69 doi:10.1007/BF00027895

Casellato S, Martinucci G, Zoja E (1987) Ultrastructural features of gametogenesis during the life cycle in *Branchiura sowerbyi* Beddard (Oligochaeta, Tubificidae). Hydrobiologia 155: 145-154 doi:10.1007/BF00025640

Giani N (2004) Fauna Europaea: Tubificidae. Fauna Europaea version 1.1. http://www.faunaeur.org (Accessed 25 June 2009)

Gonçalves V, Raposeiro P, Costa A (2008) Benthic diatoms and macroinvertebrates in the assessment of the ecological status of Azorean streams. Limnetica 27: 317-328

Grabowski M, Jabłońska A (2009) First records of *Branchiura sowerbyi* Beddard, 1892 (Oligochaeta: Tubificidae) in Greece. Aquatic Invasions 4: 365-367 doi:10.3391/ai.2009.4.2.10

Inova (2005) Monitorização da Qualidade de Águas Superficiais e Subterrâneas nas ilhas de São Miguel e Santa Maria - Caracterização Físico-Química e Microbiologica. INOVA, Ponta Delgada, 32 pp

Inova (2006) Monitorização da qualidade das águas superficiais e subterrâneas nas Ilhas de São Miguel e Santa Maria: caracterização físico-química e microbiológica. Relatório final. Instituto de Inovação Tecnológica dos Açores, Ponta Delgada (Portugal), 32 pp

Malhão V, Raposeiro P, Costa AC (2007) The Family Dugesiidae: New records for the Azorean Archipelago. Limnetica 26: 121-130

Matisoff G, Wang XS, McCall PW (1999) Biological redistribution of lake sediments by tubificid oligochaetes: *Branchiura sowerbyi* and *Limnodrilus hoffmeisteri*/*Tubifex tubifex*. Journal of Great Lakes Research 25: 205-219

Minchin D (2007) A checklist of alien and cryptogenic aquatic species in Ireland. Aquatic Invasions 2: 341-366 doi:10.3391/ai.2007.2.4.4

Mooney HA, Hobbs RJ (2000) Invasive species in a changing world. Island Press, Washington, D.C., USA: 357 pp

Naqvi SM (1973) Toxicity of twenty-three insecticides to a tubificid worm *Branchiura sowerbyi* from the Mississippi delta. Journal of Economic Entomology 66: 70-74

Nehring S (1998) Establishment of thermophilic phytoplankton species in the North Sea: biological indicators of climatic changes? ICES Journal of Marine Science 55: 818-823 doi:10.1006/jmsc.1998.0389

Paunovic M, Miljanovic B, Simic V, Cakic P, Djikanovic V, Jakovcev-Todorovic, Stojanovic D, Veljkovic B (2005) Distribution of non-indigenous tubificid worm *Branchiura sowerbyi* (Beddard, 1892) in Serbia. Biotechnology & Biotechnological Equipment 3: 91-97

Prater BL, Smith KR, Loden MS, Jackson WB (1980) The aquatic oligochaeta of the Sandusky River, Ohio. Ohio Acad. Sci. 80: 65-70

Raposeiro P, Hughes SJ, Costa AC (2009) Chironomidae (Diptera: Insecta) in oceanic islands: New records for the Azores and biogeographic notes. Annales de Limnologie - International Journal of Limnology 45: 59-67 doi:10.1051/limn/2009012

Sciaccmitano I (1964) Oligochaeta des Açores. Boletim do Museu Municipal do Funchal 18: 123-128

Silva L, Land EO, Luengo JLR, Daehler C (2008) Biological Invasions. In: Silva LLand EO, Luengo JLR (eds), Invasive Terrestrial Flora & Fauna da Macaronesia. TOP 100 in Azores, Madeira and Canaries. ARENA, Ponta Delgada. pp 137-157

Stachowicz JJ, Fried H, Osman RW, Whitlatch RB (2002) Biodiversity, invasion resistance and marine ecosystem function: reconciling pattern and process. Ecology 83: 2575-2590