



Natureza & Conservação

Brazilian Journal of Nature Conservation

Supported by Boticário Group Foundation for Nature Protection

<http://www.naturezaeconservacao.com.br>



Essays and Perspectives

How to avoid fish introductions in Brazil: education and information as alternatives



Valter M. Azevedo-Santos^{a,*}, Fernando Mayer Pelicice^b,
Dilermundo Pereira Lima-Junior^c, André Lincoln Barroso Magalhães^d,
Mario Luis Orsi^e, Jean Ricardo Simões Vitule^f, Angelo Antonio Agostinho^g

^a Laboratório de Ictiologia, Department of Zoology, Universidade Estadual Paulista “Júlio de Mesquita Filho”, Botucatu, SP, Brazil

^b Núcleo de Estudos Ambientais, Universidade Federal de Tocantins, Porto Nacional, TO, Brazil

^c Laboratório de Ecologia e Conservação de Ecossistemas Aquáticos do Cerrado, Department of Biological and Health Sciences, Universidade Federal do Mato Grosso, Pontal do Araguaia, MT, Brazil

^d Post-Graduate Program in Technologies for Sustainable Development, Universidade Federal de São João Del Rei, Ouro Branco, MG, Brazil

^e Museu de Zoologia, Department of Animal Biology and Plant, Universidade Estadual de Londrina, Londrina, PR, Brazil

^f Laboratório de Ecologia e Conservação (LEC), Department of Environmental Engineering, Sector of Technology, Universidade Federal do Paraná, Curitiba, PR, Brazil

^g Núcleo de Pesquisas em Limnologia, Ictiologia e Aqüicultura (NUPELIA), Department of Biology, Universidade Estadual de Maringá (UEM), Maringá, PR, Brazil

ARTICLE INFO

Article history:

Received 15 January 2015

Accepted 30 June 2015

Available online 19 September 2015

Keywords:

Aquaculture

Fishkeeping

Sport fishing

Biological invasions

Environmental legislation

ABSTRACT

In Brazil, the introduction of non-native fish is commonplace, and the only existing measure to address this problem is the normative approach (i.e., laws and inspections). However, this approach has failed to control or prevent introductions because enforcing laws in a country the size of a continent, where inspections and monitoring are minimal or non-existent, is difficult. In addition, society is generally unaware of this issue. More effective actions or complementary preventive measures are urgently needed, and the most promising approach is to change human behavior via educational opportunities. In this short essay, we propose that exposing society to high quality information is a powerful alternative because well-informed people naturally make more rational and balanced decisions. For example, informed stakeholders may be more cautious when handling non-native species, may adopt appropriate management practices and may cease deliberate releases. Moreover, a well-informed society will naturally avoid or prevent harmful activities that may lead to the introduction of alien species. From this perspective, this short essay explores opportunities to implement educational practices for containing new introductions. First, we present the primary activities that are responsible for the introduction of non-native fish in Brazil (i.e., aquaculture, fishkeeping and sport fishing) and then suggest simple educational pathways that are specific to each activity. In addition, we advocate for the inclusion of invasion biology in formal education to educate society as a whole. If the topic receives the necessary attention in the

* Corresponding author.

E-mail address: valter.ecologia@gmail.com (V.M. Azevedo-Santos).

<http://dx.doi.org/10.1016/j.ncon.2015.06.002>

1679-0073/© 2015 Associação Brasileira de Ciência Ecológica e Conservação. Published by Elsevier Editora Ltda. All rights reserved.

educational curriculum, then education will play a central role in creating new behavioral standards, awareness and responsibility at different societal levels, with the primary goal of reducing the rate of new fish introductions.

© 2015 Associação Brasileira de Ciência Ecológica e Conservação. Published by Elsevier Editora Ltda. All rights reserved.

Introduction

The introduction of non-native fish has become extremely common in Brazil (Lima Junior et al., 2012; Pelicice et al., 2014). Although several studies have reported negative impacts (e.g., Agostinho et al., 2007; Latini and Petrere, 2004; Figueredo and Giani, 2005; Pinto-Coelho et al., 2008; Pelicice and Agostinho, 2009; Attayde et al., 2011), authorities have made few efforts to prevent new introductions. These introductions are a matter of considerable concern because disruptions to native biodiversity tend to be more difficult to detect and to mitigate in mega-diverse countries (Vitule, 2009; Lövei et al., 2012) such as Brazil. Moreover, the Amazon basin, which is the home of the richest biodiversity of freshwater fish in the world, remains relatively unaffected by the invasion of non-native fish; however, this status may change with the construction of dams and fish farms in the primary tributaries of this basin (e.g., Tocantins, Xingú, Madeira, and Tapajós).

Fish introductions are widespread in Brazil because coercive norms are the only methods that are used to deter introductions (Alves et al., 2007; Agostinho et al., 2007) and because inspections and monitoring are minimal to non-existent. The primary laws that address the introduction of non-native fish are 5197/67 and 9605/98, which prohibit the release of non-native organisms. The first law establishes that: “No species can be introduced into the country without a favorable official report and a license issued according to the law” (“Nenhuma espécie poderá ser introduzida no País, sem parecer técnico oficial favorável e licença expedida na forma da Lei”). Law 9605/98 establishes criminal sanctions for those individuals who “introduce an animal specimen into the country without a favorable technical decision and a license issued by the competent authority” (“Introduzir espécime animal no País, sem parecer técnico oficial favorável e licença expedida por autoridade competente”). The ineffectiveness of the normative approach stems from the difficulty in enforcing the laws because these inspections must cover a country that is the size of a continent. We must consider also that some routes are difficult to regulate (e.g., accidental escapes; Hulme et al., 2008). In addition, these laws explicitly prohibit introductions but leave room for re-interpretation, particularly regarding legal definitions (see Agostinho et al., 2007; Alves et al., 2007); for example, the term “native” has multiple meanings (Agostinho et al., 2006). Moreover, proposals to change these regulations to facilitate the use of non-native fish for aquaculture (Pelicice et al., 2014) are fueled by current policies that are aimed at short-term economic gains. Given this situation, the tools to prevent the introduction of non-native fish in Brazil (i.e., laws and inspections) have little effect, and uncontrolled fish introductions in Brazil are not surprising.

Laws are necessary to regulate the use of non-native resources in countries (Hulme et al., 2008; Roy et al., 2014). However, the normative approach alone cannot prevent the torrent of new introductions occurring in Brazil. More effective actions or complementary preventive measures are urgently needed. Exposing society to high quality information is a powerful alternative (Vitule, 2009; Speziale et al., 2012); well-informed people naturally make more rational and balanced decisions. Education establishes new behavioral standards and awareness, and creates new perspectives regarding a problem. In turn, this education profoundly changes the attitudes and routines of stakeholders. For example, informed stakeholders may be more cautious when handling non-native species, may adopt appropriate management practices and may cease deliberate releases. Moreover, a well-informed society will naturally avoid or minimize harmful activities that may lead to the introduction of alien species. A lack of awareness regarding invasion biology is usually the underlying cause behind deliberate and accidental introductions (Agostinho et al., 2007; Vitule, 2009; Speziale et al., 2012). However, despite the more permanent and internalized results and the wide range of options for implementing educational measures, no official Brazilian programs or incentives exist for establishing strategies with the specific aim of developing environmentally responsible practices for reducing fish introductions. One such approach with preventive and lasting effects and with medium- to long-term results would complement the traditional normative approach, necessary to regulate the trade and use of non-native fish.

Given the current situation, this article explores opportunities to implement educational practices for preventing new introductions. First, we present the primary activities that are responsible for the introduction of non-native fish in Brazil (i.e., aquaculture, fishkeeping and sport fishing) and then suggest simple educational pathways that are specific to each activity. In addition, we recommend educating society as a whole by including invasion biology in formal education. If implemented, these educational actions may produce novel attitudes for coping with non-native organisms, with the primary goal of reducing the rate of new fish introductions to a constant low level.

Primary pathways of fish introductions

Most fish introductions in Brazilian inland waters originate from aquaculture (Orsi and Agostinho, 1999; Azevedo-Santos et al., 2011; Agostinho et al., 2007; Daga et al., 2015; Ortega et al., 2015), aquarium fishkeeping (Langeani et al., 2007; Alves et al., 2007) and sport fishing (Júlio Júnior et al., 2009; Britton and Orsi, 2012). These activities are responsible for the introduction and spread of several species across the country

Download English Version:

<https://daneshyari.com/en/article/4400844>

Download Persian Version:

<https://daneshyari.com/article/4400844>

[Daneshyari.com](https://daneshyari.com)