

INVASÕES BIOLÓGICAS E A SUSTENTABILIDADE DA TILAPICULTURA NO BRASIL



Realidade ou ilusão?



lecufpr_invasions



188

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1.100

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688

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Laboratório de Ecologia e Conservação



Os principais objetivos do laboratório são:

- Produzir e divulgar conhecimento referente à diversos aspectos da biologia da conservação e interações ecológicas.
- Desenvolver estudos referentes às hipóteses fundamentais sobre invasões biológicas e seus efeitos na biodiversidade nativa.
- Entender como espécies não-nativas e impactos antrópicos promovem mudanças na funcionalidade e composição de comunidades de peixes no espaço-tempo

Nossa pesquisa é conduzida principalmente em ambientes fluviais (rios, riachos, estuários), realizando-se revisões teóricas, estudos práticos de campo e experimentos em laboratório.

Entre os tópicos abordados encontram-se:

- Homogeneização biótica
- Efeitos da predação
- Estrutura da comunidade
- Diversidade de espécies



DOI:[10.4013/nbc.2009.42.07](https://doi.org/10.4013/nbc.2009.42.07)

Neotropical Biology and Conservation

4(2): 111-122, may-august 2009

© by Unisinos - doi: 10.4013/nbc.2009.42.07

Introdução de peixes em ecossistemas continentais brasileiros: revisão, comentários e sugestões de ações contra o inimigo quase invisível

Jean Ricardo Simões Vitule¹
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Resumo

A introdução de espécies é uma grande ameaça para a conservação da diversidade biológica, e a principal precursora da homogeneização global. Em se tratando de percepção, controle ou erradicação, espécies aquáticas encontram-se entre as mais problemáticas. Neste sentido, os peixes tomam-se graves ameaças, pois são organismos muito dissemina-



Introdução de espécies não nativas e invasões biológicas

Non-native species introduction and biological invasions

Jean Ricardo Simões Vitule^[a], Viviane Prodocimo^[b]

Resumo

Os seres humanos vêm modificando a distribuição das espécies no planeta em taxas crescentes. A introdução, acidental ou deliberada, de espécies não nativas por diferentes vetores é atualmente uma das principais mudanças globais, resultando em uma série de problemas locais e globais. Embora nem todas as introduções de espécies não nativas possuam efeitos negativos, muitas das espécies não nativas podem apresentar efeitos indesejáveis sobre a biodiversidade, desde o nível genético até o de paisagens. Além dos problemas ecológicos de curto prazo, introduções de espécies não nativas podem se tornar invasões biológicas e ocasionar mudanças que só serão percebidas em longo prazo e larga escala espacial (ex.: homogeneização biótica). Em vista da magnitude da taxa de novas introduções de espécies não nativas e invasões biológicas e da crescente produção científica interdisciplinar, que ocorre desproporcionalmente entre regiões globais, apresentamos uma revisão atual sobre o tema com comentários, conceitos e sugestões de abordagens emergentes a serem exploradas em estudos futuros.

Palavras-chave: Biodiversidade. Bioinvasão. Consequências ecológicas. Conservação biológica. Manejo.

Abstract

Humans beings have been changing species distribution at increasing rates. The accidental or deliberate introduction of the non-native species by different vectors is currently one of the major global changes, resulting in a series of local and global problems. Even though not all non-native introduced species have negative effects, many non-native species often have undesirable effects on biodiversity at levels from genes to landscapes. In addition to the short-term ecological problems, non-native species intro-



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Brasil > 5.600 espécies de peixes de água doce!



So I'm happy!



FUNÇÕES ECOSSISTÊMICAS!

SCIENTIFIC REPORTS

OPEN Global functional diversity of freshwater fish is concentrated in the Neotropics while functional vulnerability is widespread

Received: 19 October 2015

Accepted: 05 February 2016

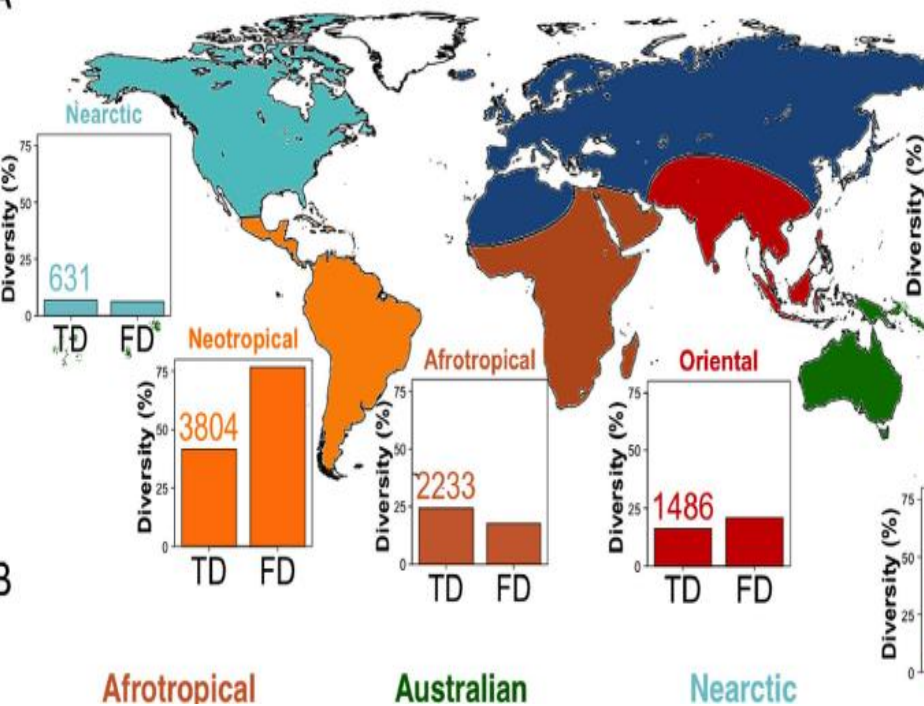
Published: 16 March 2016

A. Toussaint¹, N. Charpin¹, S. Brosse^{1,*} & S. Villéger^{2,*}

Biodivers Conserv (2017) 26:757–762

DOI 10.1007/s10531-016-1258-8

COMMENTARY



We need better understanding about functional diversity and vulnerability of tropical freshwater fishes

Jean R. S. Vitule^{1,2} · Angelo A. Agostinho^{3,4} · Valter M. Azevedo-Santos⁵ · Vanessa S. Daga^{1,6} · William R. T. Darwall⁷ · Daniel B. Fitzgerald⁸ · Fabrício A. Frehse^{1,2} · David J. Hoeinghaus⁹ ·

Dilermundo P. Lima-Junior¹⁰ · André L. B. Magalhães¹¹ · Mário L. Orsi¹² · André A. Padial^{2,13} · Fernando M. Pelicice¹⁴ · Miguel Petrere Jr.^{15,17} · Paulo S. Pompeu¹⁶ · Kirk O. Winemiller⁸

Received: 6 September 2016 / Revised: 4 November 2016 / Accepted: 11 November 2016 /

Published online: 19 November 2016

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Abstract Here we extend a discussion initiated by Toussaint et al. (Sci Rep 6:2016) concerning the relationship between global patterns of freshwater fish functional diversity (FD) and its vulnerability to human impacts. Based on a set of morphological traits, they concluded that Neotropical freshwater fishes have highest FD, but low vulnerability given high levels of functional redundancy. This conclusion implies that conservation efforts for freshwater fishes should emphasize temperate regions.









19 12:51





19 12:16

Na Mata Atlântica (bioma) brasileira onde trabalho e foram detectadas várias populações de tilápia e outras espécies exóticas **invasoras** estabelecidas em unidades de conservação restritivas.





Occurrence of non-native species in a subtropical coastal River, in Southern Brazil

Ocorrência de espécies não-nativas em um rio costeiro subtropical no Sul do Brasil

Larissa Faria^{1*} , Fabrício de Andrade Frehse¹ , Thiago Vinícius Trento Occhi¹ ,
Barbara Maichak de Carvalho¹ , Daniel Vicente Pupo² , Sibelle Trevisan Disaró² ,
and Jean Ricardo Simões Vitule¹ 

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Paraná – UFPR, Campus Centro Politécnico, Setor de Ciências Biológicas, Av. Coronel Francisco
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Cite as: Faria, L. et al. Occurrence of non-native species in a subtropical coastal River, in Southern Brazil. *Acta Limnologica Brasiliensia*, 2021, vol. 33, e101.

Abstract: Aim: This paper aims to concatenate and update the records of non-native species in a subtropical River, in Southern Brazil, warning about their possible impacts in this and other water bodies. **Methods:** Monitoring was carried out in the Guaraguaçu River, the largest River of the Paraná coastal plain, located in the Atlantic Rainforest biome. Fishes were sampled in two periods: from 2002 to 2007 (monthly) and from 2016 to 2018 (semiannually), and the other organisms were collected in isolated samplings. **Results:** The monitoring recorded the presence of six non-native species of animals in this River – four species of fish (*Clarias gariepinus*, *Ictalurus punctatus*, *Oreochromis niloticus* and *Salminus brasiliensis*), one invertebrate (*Macrobrachium rosenbergii*) and























Physiological tools to predict invasiveness and spread via estuarine bridges: tolerance of Brazilian native and worldwide introduced freshwater fishes to increased salinity

Silvia Maria Millan Gutierrez^A, Jean Ricardo Simões Vitule^B,
Carolina Arruda Freire^A and Viviane Prodocimo^{A,C}

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Abstract. Non-native freshwater fishes may spread via estuaries, invading nearby basins. The Brazilian natives *Rhamdia quelen* and *Geophagus brasiliensis*, and the worldwide introduced *Clarias gariepinus*, *Ictalurus punctatus*, *Oreochromis niloticus* and *Cyprinus carpio* were acutely exposed (6 h) to salinities 15 and 30. Hypothetically, the introduced species display greater physiological plasticity than do the natives. Exposure to salinity 30 was lethal after 1.5–3 h to all species except for *O. niloticus* and *G. brasiliensis*. Increase in plasma osmolality was inversely related to muscle water content, mainly in salinity 30 for all species. *R. quelen* and *C. gariepinus* displayed increased expression of heat-shock protein 70 (HSP70) on salinity increase; differently, *I. punctatus*, *O. niloticus* and *C. carpio* showed high constitutive levels already in freshwater. Species with high constitutive expression of HSP and/or high degree of osmolytic plasticity could potentially have estuarine or bridge dispersal capacity through ranges of salinity <15.

Há muitos registros e evidências

- Ejemplo de documentos que destacan los impactos negativos de peces no nativos:
- p.ej. tilapias nuestros '*top models*' en acuicultura e.g.

<https://doi.org/10.1111/j.1467-2979.2008.00312.x>



FISH and FISHERIES, 2009, **10**, 98–108

Introduction of non-native freshwater fish can certainly be bad

Jean Ricardo Simões Vitule¹, Carolina Arruda Freire¹ & Daniel Simberloff²

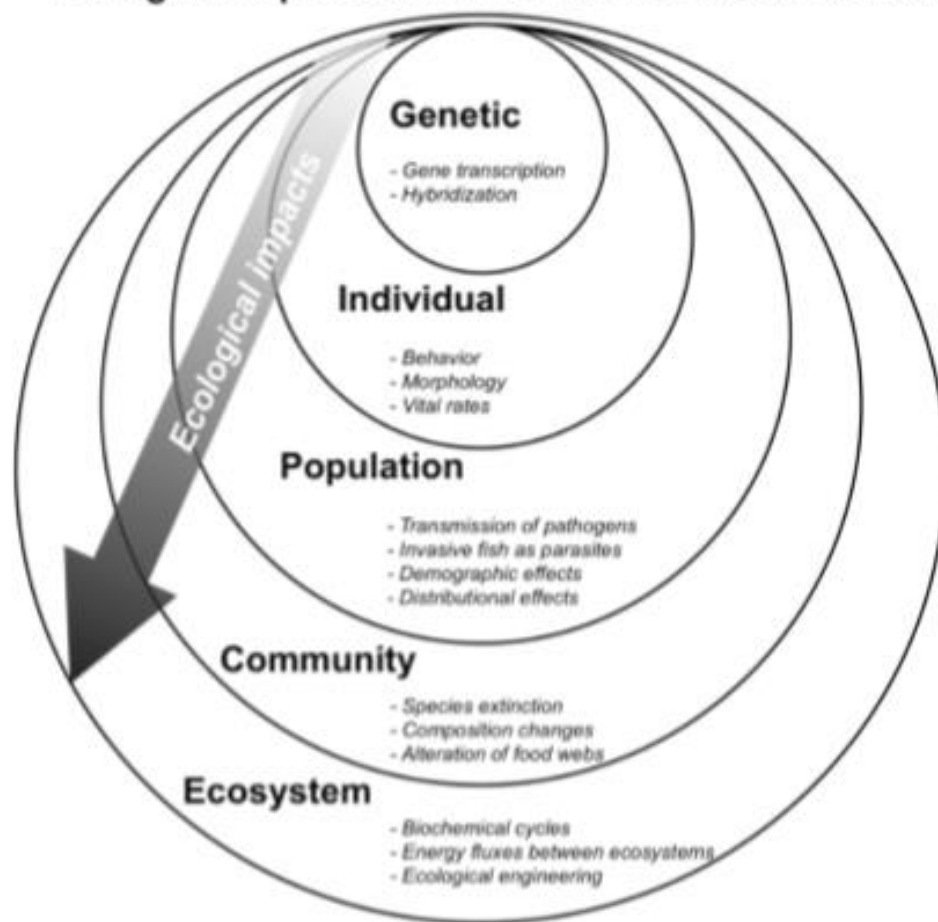
¹Departamento de Fisiologia, Setor de Ciências Biológicas, Universidade Federal do Paraná, Curitiba, PR, CEP 81531-990;

²Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN 37996-1610

Invasão biológica - Impactos ecológicos

Vitule et al 2009

Ecological Impacts of Nonnative Freshwater Fishes



Cucherousset & Olden (2011)

Aquicultura



Pesca esportiva



Aquariofilia



América do Sul: maior biodiversidade do mundo, e ameaças são ignoradas pela falsa ideia de ambientes ainda intocados

Journal of Fish Biology (2016) **89**, 12–47

doi:10.1111/jfb.13016, available online at wileyonlinelibrary.com

Fish biodiversity and conservation in South America

R. E. REIS*†, J. S. ALBERT‡, F. DI DARIO§, M. M. MINCARONE§, P. PETRY||
AND L. A. ROCHA¶

Journal of Fish Biology (2017) **90**, 1182–1190

doi:10.1111/jfb.13239, available online at wileyonlinelibrary.com

Comment on ‘Fish biodiversity and conservation in South America by Reis *et al.* (2016)’

J. R. S. VITULE*†‡, A. P. L. DA COSTA*†, F. A. FREHSE*†, L. A. V. BEZERRA†§, T. V. T. OCCHI*†, V. S. DAGA*|| AND A. A. PADIAL†§

Received: 24 August 2018

Revised: 20 February 2019

Accepted: 28 February 2019

DOI: 10.1111/faf.12365

ORIGINAL ARTICLE

WILEY



A network meta-analysis of threats to South American fish biodiversity

Luis Artur Valões Bezerra¹  | Matheus Oliveira Freitas² | Vanessa Salette Daga² |
Thiago Vinicius Trento Occhi² | Larissa Faria² | Ana Paula Lula Costa² |
Andre Andrian Padial¹ | Viviane Prodocimo³ | Jean Ricardo Simões Vitule²

Goal 1

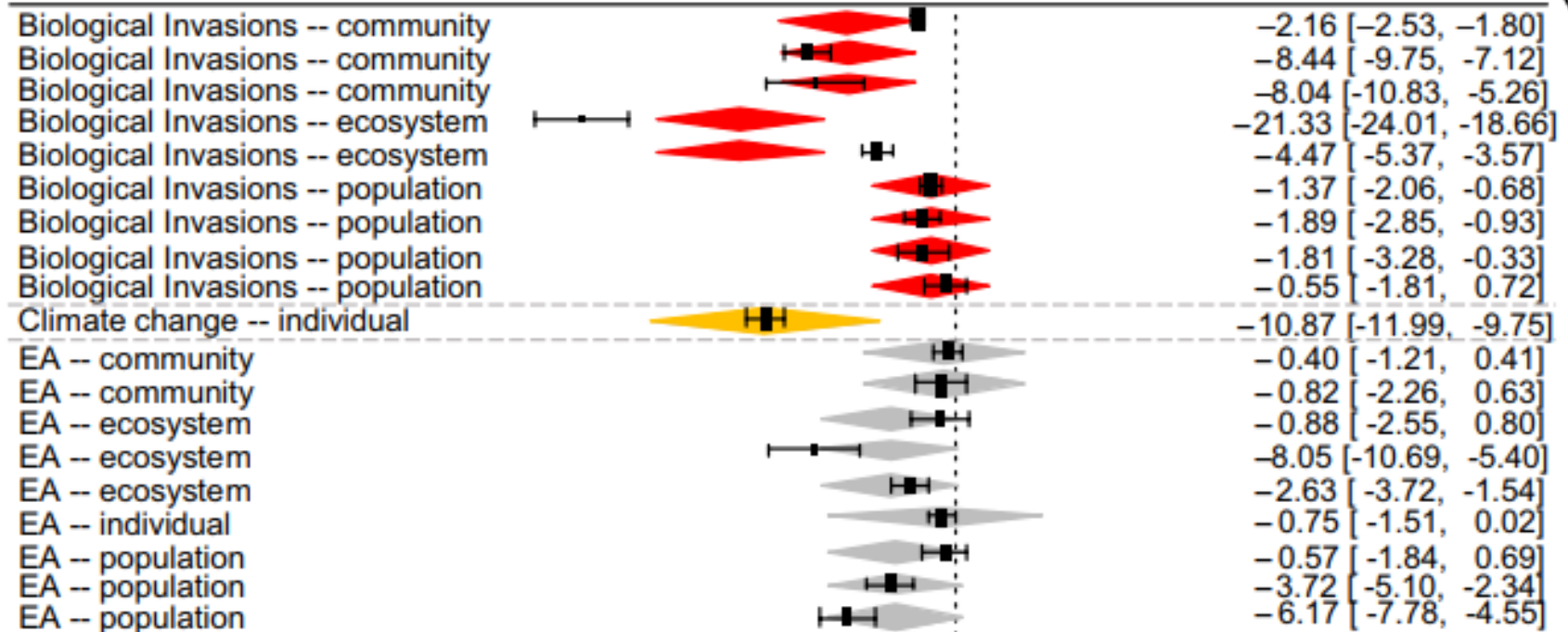
Quantificar e comparar ameaças à biodiversidade de peixes da América do Sul
Revisão meta-analítica de estudos que quantificam ameaças antropogênicas:

80 artigos após o protocolo PRISMA;

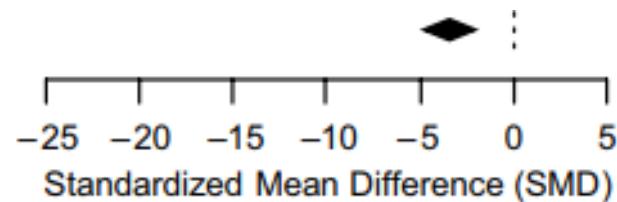
59 tamanhos de efeito disponíveis

Result 1

Anthropogenic effects ($R^2 = 12.12\%$; $p = 0.07$)



Summary effect

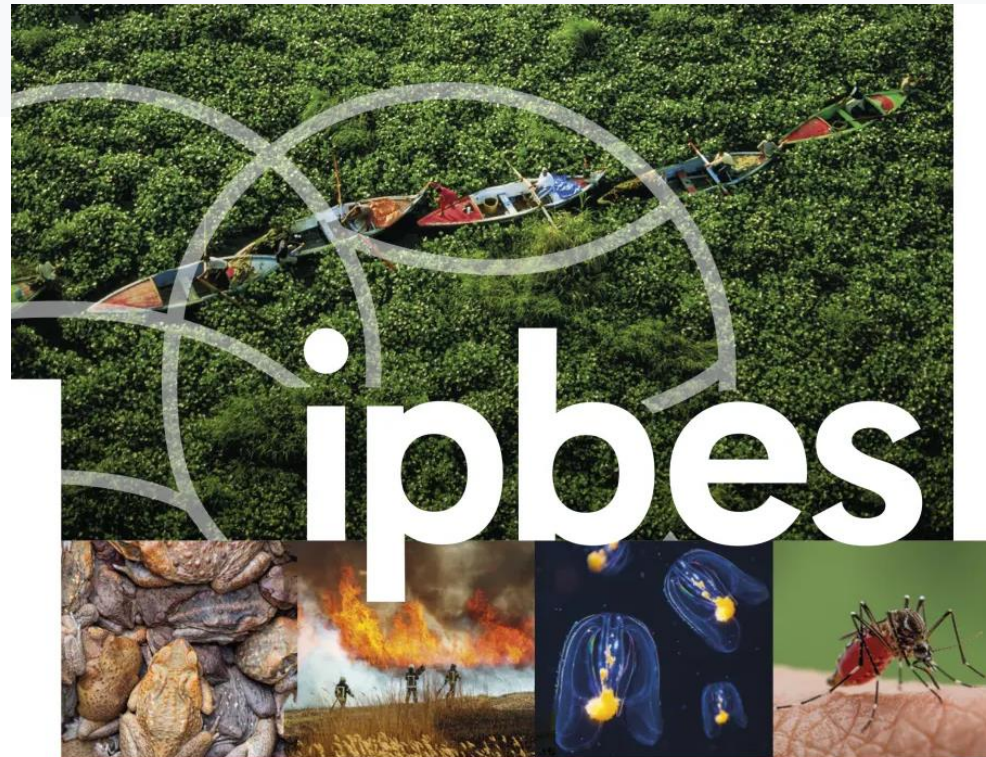




<https://www.ipbes.net/ias>

Thematic Assessment Report on Invasive Alien Species and their Control

NEW



The thematic assessment report on
**INVASIVE ALIEN SPECIES
AND THEIR CONTROL**

NEW



BPBES
Plataforma Brasileira
de Biodiversidade
e Serviços Ecossistêmicos

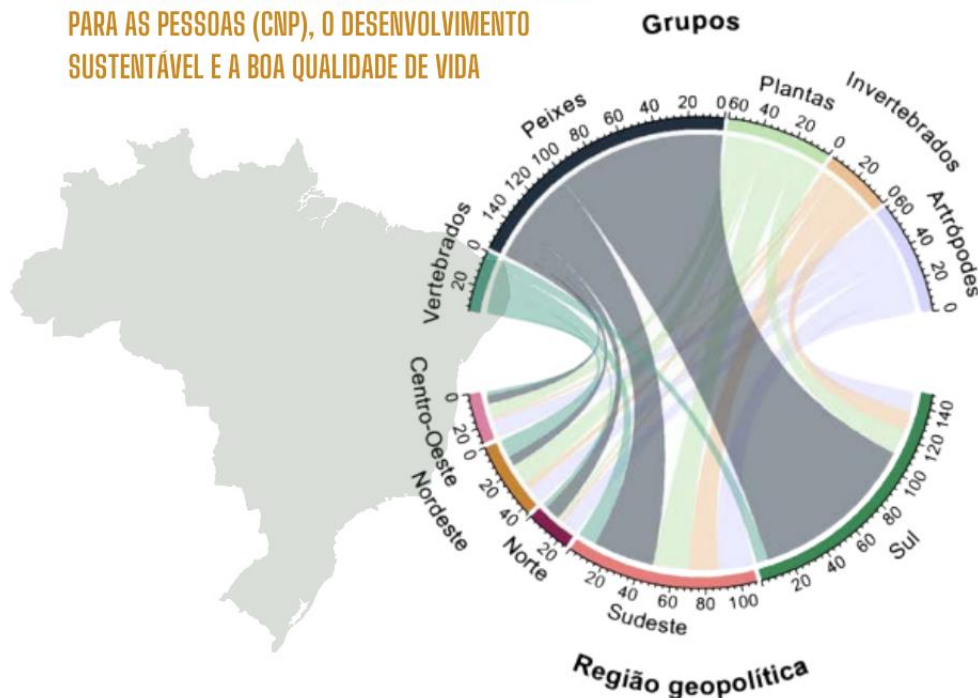
**Relatório Temático Sobre Espécies Exóticas Invasoras,
Biodiversidade e Serviços Ecossistêmicos**



Canal do Youtube do IEA –
www.youtube.com/@IEAUSPSP

Relatório Temático Sobre Espécies Exóticas Invasoras, Biodiversidade e Serviços Ecossistêmicos

CAPÍTULO 4: IMPACTOS DE ESPÉCIES EXÓTICAS INVASORAS SOBRE AS CONTRIBUIÇÕES DA NATUREZA PARA AS PESSOAS (CNP), O DESENVOLVIMENTO SUSTENTÁVEL E A BOA QUALIDADE DE VIDA



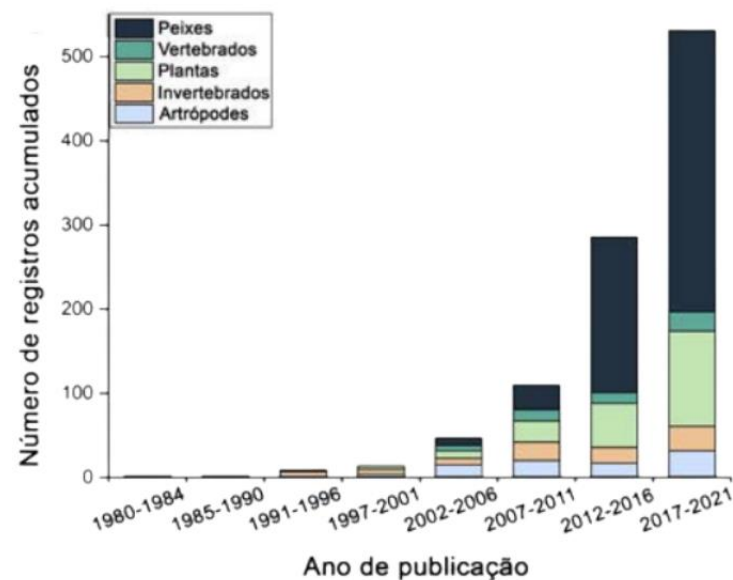
Received: 11 August 2023 | Revised: 14 December 2023 | Accepted: 3 January 2024
DOI: 10.1111/1440-1703.12452

DATA ARTICLE

ECOLOGICAL
RESEARCH | WILEY

Dataset of the impacts of invasive alien species in Brazil

Ana Clara Sampaio Franco¹ | Rosana Moreira da Rocha² | Vania R. Pivello³ |
André Lincoln Barroso Magalhães⁴ | Camila Fediuk de Castro⁵ |
Claudio C. da Cruz Neto⁶ | Dalva M. da Silva Matos⁷ |
George Gardner Brown⁸ | Gustavo Heringer^{9,10} |
Hugo Henrique Lanzi Saulino⁷ | Igor Oliveira¹¹ | Raul Rennó Braga¹² |
Ricardo Jessouroun Miranda¹³ | Roger Paulo Mormul¹⁴ |
Jean Ricardo Simões Vitule¹⁵



NEW



A **tilápia-do-Nilo** foi a **espécie com maior número de registros de impactos no Brasil:**

alterações tróficas de peixes nativos, declínio e extinção local de algumas espécies nativas e modificações no ecossistema.



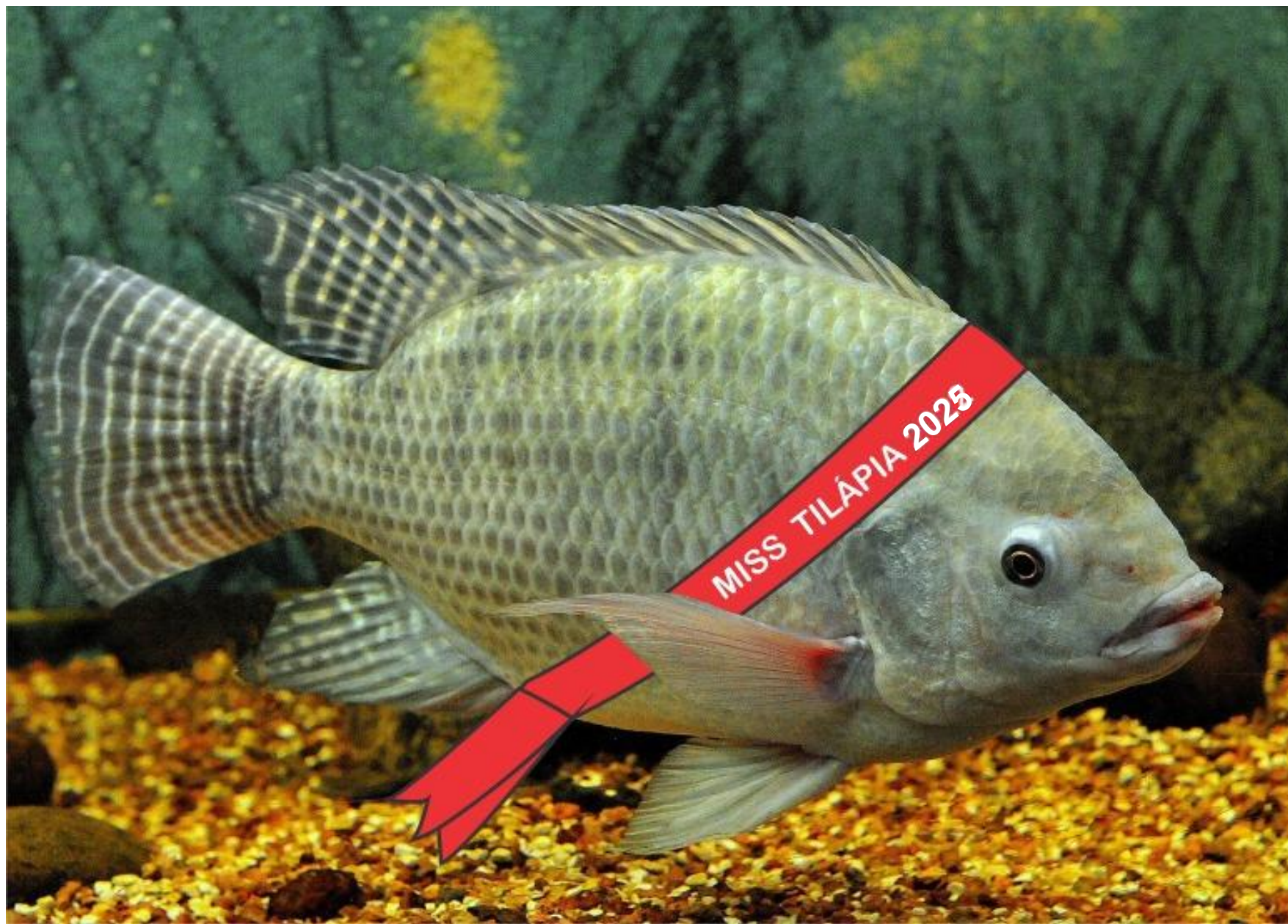
BPBES

Plataforma Brasileira
de Biodiversidade
e Serviços Ecosistêmicos

Relatório Temático Sobre Espécies Exóticas Invasoras,
Biodiversidade e Serviços Ecosistêmicos



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**POR SUS CURVAS Y MEDIDAS PODRIA
COMPETIR EN MISS UNIVERSO.**



**EL ALIMENTO COMPLETO PARA QUE TUS TILAPIAS
TENGAN MUCHAS CURVAS.**


maltaCleyton
El alimento en nutrición animal

Tilápia-do-Nilo – Introduções

PRODUÇÃO GLOBAL DE TILÁPIA (Mi/t/ANO)

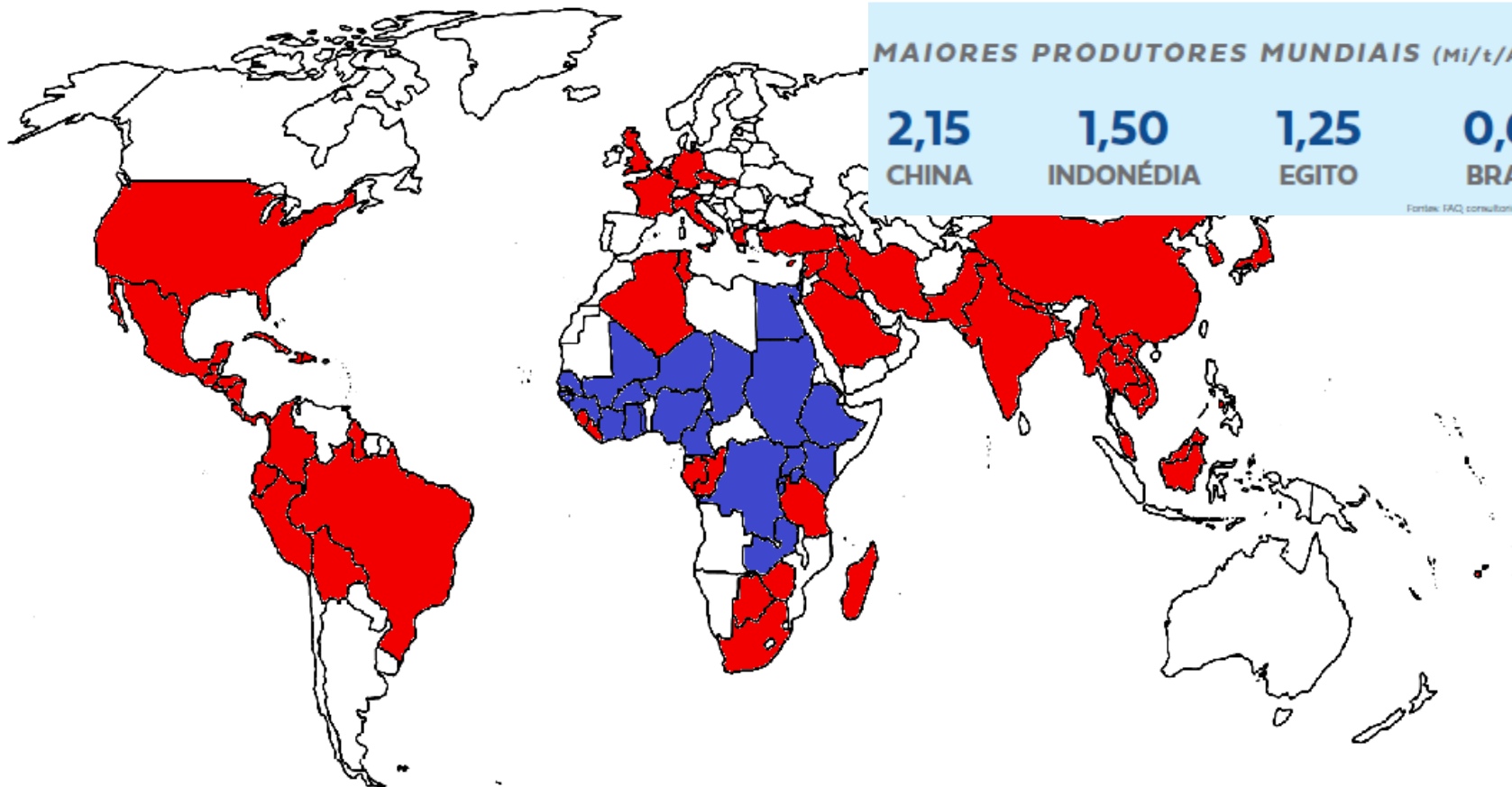
6,25	6,30	6,50	6,95	7,30
2021	2022	2023	2024	2025*

Fontes: FAO e consultorias internacionais

MAIORES PRODUTORES MUNDIAIS (Mi/t/ANO)

2,15	1,50	1,25	0,66
CHINA	INDONÉDIA	EGITO	BRASIL

Fontes: FAO, consultorias internacionais e Penaeus

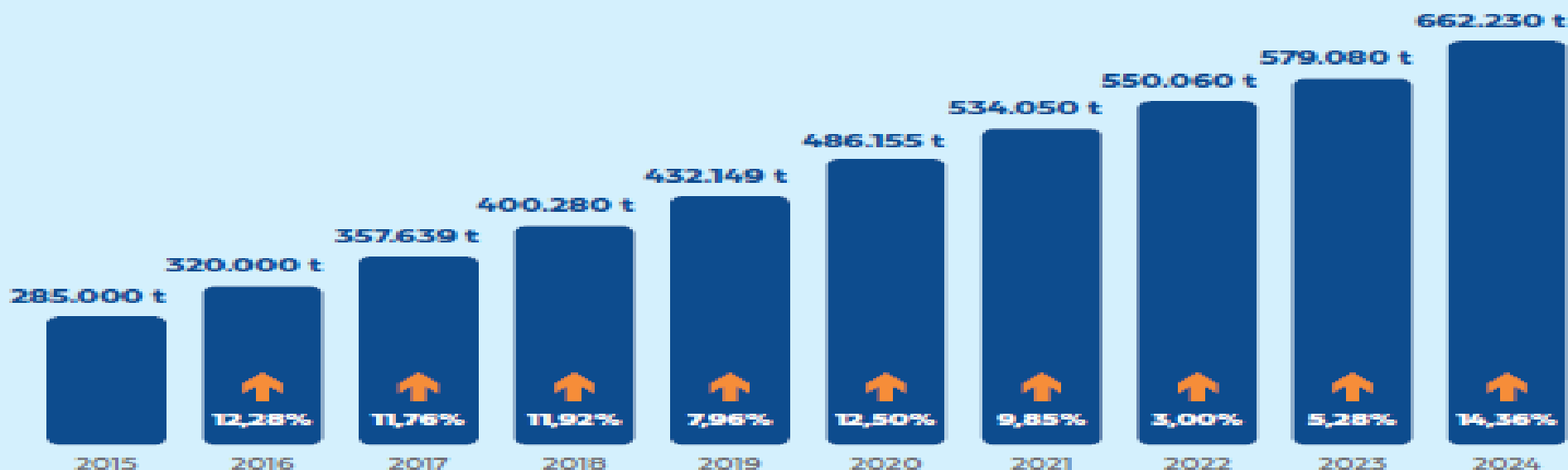


Nativa da África e Sudeste do Oriente Médio

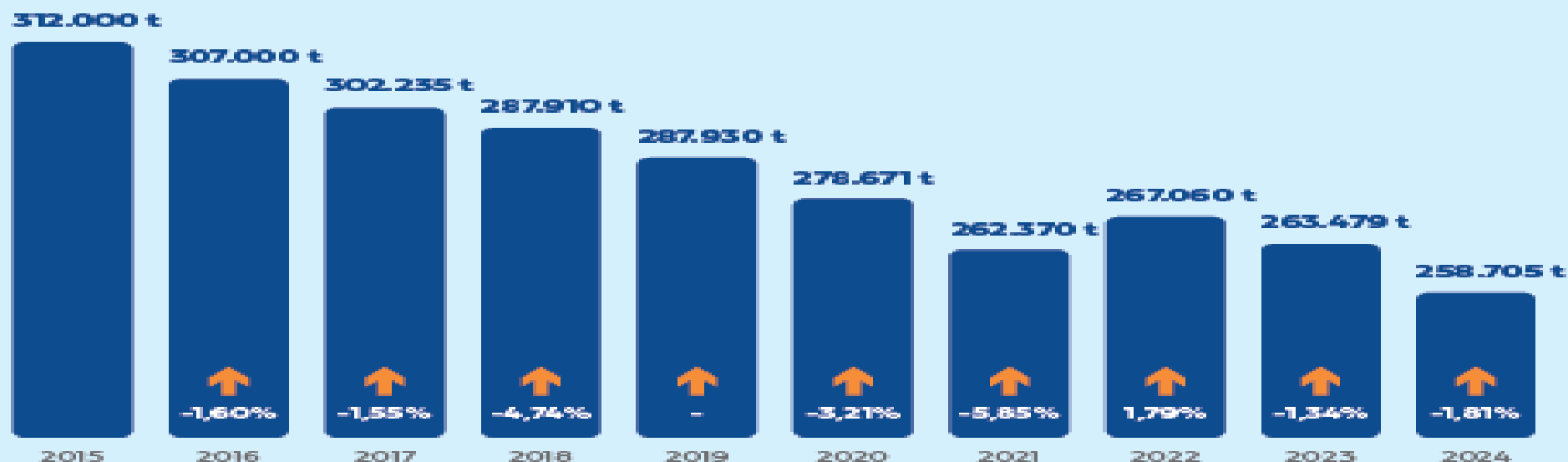
Principal exemplo de impacto negativo da aquicultura (Diana, 2009)

EVOLUÇÃO DA PRODUÇÃO DE TILÁPIA

ANUÁRIO 2025
Peixe BR da Piscicultura



EVOLUÇÃO DA PRODUÇÃO DE PEIXES NATIVOS



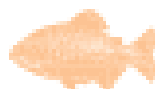
245.115 t

2.400 t

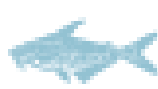
2.800 t



Tilápia

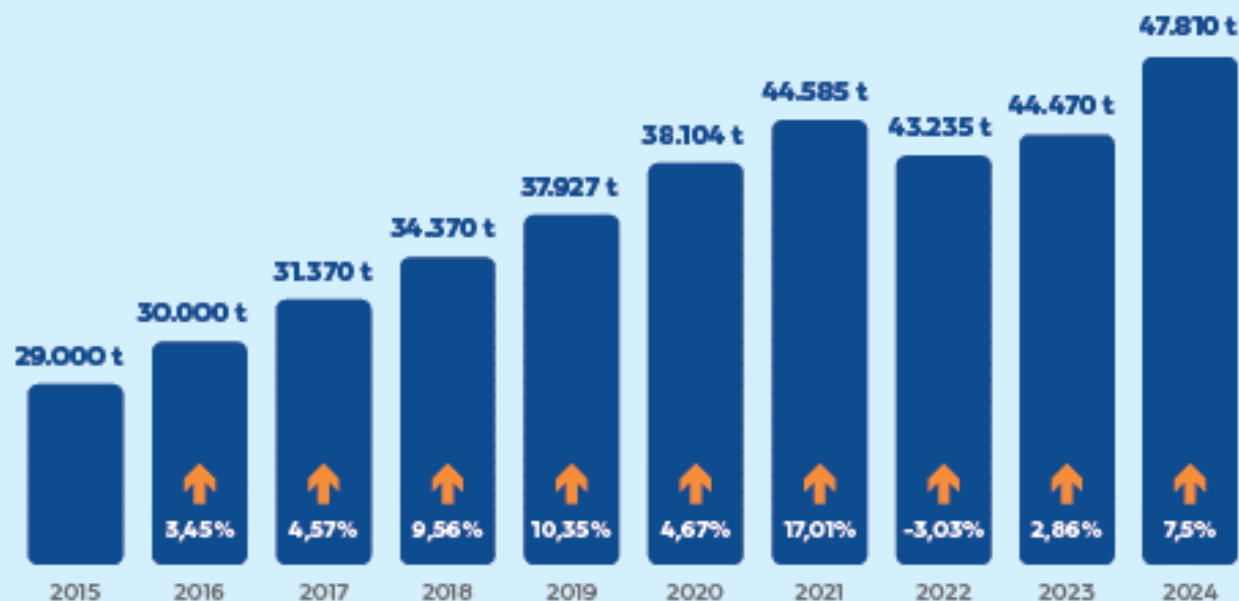


Nativos



Outros*

*Carpa, Truta e Pangá principalmente



Fonte: Pelos QR

O QUE PRODUZIMOS?

MAIORES PRODUTORES DE TILÁPIA

Fonte PeixeBR

1º PARANÁ

182.000 t



2º SÃO PAULO

76.140 t



3º MINAS GERAIS

47.000 t



4º SANTA CATARINA

41.700 t



5º MATO GROSSO DO SUL

34.450 t



O QUE PRODUZIMOS?

PARANÁ



Oeste 70%



PRODUÇÃO DA PISCICULTURA



CRESCIMENTO DE **9,3%**
EM RELAÇÃO A 2020

ESPÉCIES MAIS PRODUZIDAS



Tilápia



Nativos



Outros*

*Carpa, Truta e Panga principalmente

MAIORES MUNICÍPIOS PRODUTORES

RANKING

MUNICÍPIO

1º	NOVA AURORA
2º	TOLEDO
3º	PALOTINA
4º	ASSIS CHATEAUBRIAND
5º	MARIPÁ
6º	TUPÃSSI
7º	CAFELÂNDIA
8º	NOVA SANTA ROSA
9º	MARECHAL CÂNDIDO RONDON
10º	TERRA ROXA

Fonte: IBGE Pesquisa da Pecuária Municipal (dados preliminares 2020)

PRINCIPAIS ESTADOS EXPORTADORES DE TILÁPIA EM 2024 (EM US\$)

PARANÁ

35.721.772 FOB (US\$)

64%

SÃO PAULO

170.933 FOB (US\$)

30%

MATO GROSSO DO SUL

110.850 FOB (US\$)

3%

BAHIA

296.200 FOB (US\$)

1%

GOIÁS

165.950 FOB (US\$)

1%



Fonte: COMEXSTAT/Ministério da Economia (2025). Elaboração: Embrapa Pesca e Aquicultura



Crescimento



Uniformidade



Sobrevivência

- 29% mais crescimento
- 23% mais uniformidade
- 7% mais sobrevivência



E... sobre... A DIMENSÃO HUMANA E A PRECEPÇÃO?
INCLUINDO PESQUISADORES?:



Impacto = alcance x abundância x efeito per capita



Retardos temporais na percepção do impacto é comum!

Lag-times ~ 100 years!!!

Socioeconomic legacy yields an invasion debt

Franz Essl^{a,b,1}, Stefan Dullinger^{c,d,1,2}, Wolfgang Rabitsch^a, Philip E. Hulme^b, Karl Hülber^{c,d}, Vojtěch Jarošík^{e,f}, Ingrid Kleinbauer^c, Fridolin Krausmann^g, Ingolf Kühn^h, Wolfgang Nentwigⁱ, Montserrat Vilà^j, Piero Genovesi^k, Francesca Gherardi^l, Marie-Laure Desprez-Loustau^m, Alain Roquesⁿ, and Petr Pyšek^{e,f}

^aEnvironment Agency Austria, 1090 Vienna, Austria; ^bBio-Protection Research Centre, P.O. Box 84, Lincoln University, Lincoln 7647, Christchurch, New Zealand; ^cVienna Institute for Nature Conservation and Analyses, 1090 Vienna, Austria; ^dDepartment of Conservation Biology, Vegetation and Landscape Ecology, University of Vienna, 1030 Vienna, Austria; ^eInstitute of Botany, Academy of Sciences of the Czech Republic, 252 43 Průhonice, Czech Republic; ^fDepartment of Ecology, Faculty of Science, Charles University, 128 01 Praha 2, Czech Republic; ^gInstitute of Social Ecology, Alpen Adria Universität, 1070 Vienna, Austria; ^hUFZ, Helmholtz Centre for Environmental Research - UFZ, Department of Community Ecology, 06120 Halle, Germany; ⁱInstitute of Ecology and Evolution, University of Bern, 3012 Bern, Switzerland; ^jEstación Biológica de Doñana (EBD-CSIC), E-41092 Seville, Spain; ^kInternational Union for Conservation of Nature Species Survival Commission, Invasive Species Specialist Group, Institute for Environmental Protection and Research, I-00185 Rome, Italy; ^lDipartimento di Biologia Evoluzionistica "Leo Pardi", Università degli Studi di Firenze, 50125 Firenze, Italy; ^mInstitut National de la Recherche Agronomique, Unité Mixte de Recherche 1202 Biodiversité, Gènes et Communautés, Pathologie Forestière, 33140 Villenave d'Ornon, France; and ⁿInstitut National de la Recherche Agronomique UR633, Zoologie Forestière, 45075 Orléans, France

Edited by Harold A. Mooney, Stanford University, Stanford, CA, and approved November 23, 2010 (received for review August 6, 2010)

Globalization and economic growth are widely recognized as important drivers of biological invasions. Consequently, there is an increasing need for governments to address the role of international trade in their strategies to prevent species introductions. However, many of the most problematic alien species are not recent arrivals but were introduced several decades ago. Hence, current patterns of alien-species richness may better reflect historical rather than contemporary human activities, a phenomenon which might be called "invasion debt." Here, we show that across 10 taxonomic groups (vascular plants, bryophytes, fungi, birds, mammals, reptiles, amphibians, fish, terrestrial insects, and aquatic invertebrates) in 28 European

tightly correlated with current numbers of a wide range of alien plant and animal species. However, human population densities and economic performance of individual countries have not developed strictly in parallel during the past century, with some countries seeing more and others less rapid development (16) (Fig. S1). These differential histories offer an opportunity to explicitly test the invasion debt hypothesis: If lag times between introduction and establishment are short for a majority of species, we should expect current numbers of established alien species across different countries to be more closely related to contemporary rather

PNAS | January 4, 2011 | vol. 108 | no. 1 | 203–207

www.pnas.org/cgi/doi/10.1073/pnas.1011728108

On average for invasions ~ 100 years for large impacts after its introduction!!!! NO DATA TO BRAZIL?

Quero falar sobre a “invisibilidade” dos peixes não nativos E.G. no Brasil, em termos de:

- ▶ Limitações técnicas na detecção de algumas das espécies não nativas e seus impactos negativos.
- ▶ POR EXEMPLO. NO BRASIL REDES DE ESPERA E PETRECHO TRADICIONAIS!

TRADICIONAL



USAR NOVAS TECNOLOGIAS ?!

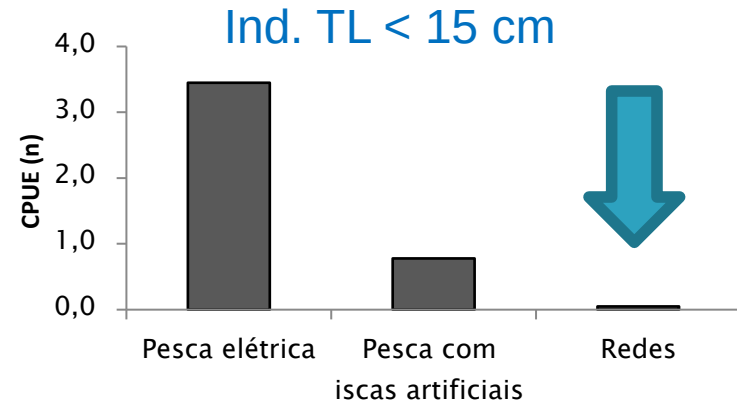
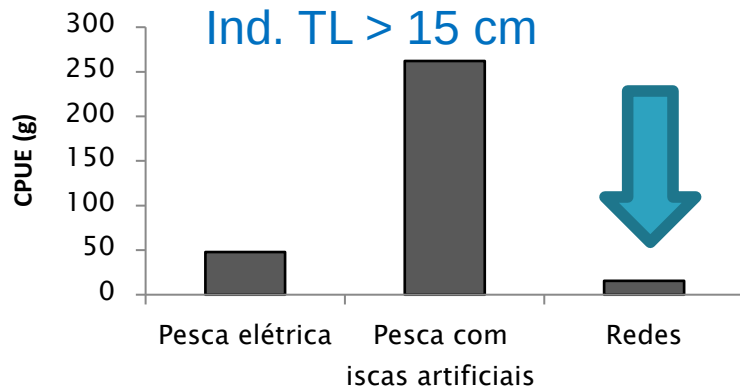


REDES DE ESPERA x IMAGENS SUBAQUÁTICAS x PESCA Elétrica

ESTAMOS COM DADOS IMCOMPLETOS E BASTANTE LIMITADOS!

Quero falar sobre a "Invisibilidade" dos peixes não nativos em termos de:

- ▶ Dificuldades em detectar algumas das espécies não nativas COM AMOSTRAGEM TRADICIONAL NO BRASIL



after Ribeiro *et al.* 2015



Um dia, 2
pessoas

Pescando

*Micropterus
salmoides*





Differential use of artificial habitats by native and non-native fish species in Neotropical reservoirs

Fabrício de A. Frehse  · Olaf L. F. Weyl · Jean R. S. Vitule

Received: 16 April 2020 / Revised: 8 February 2021 / Accepted: 3 March 2021

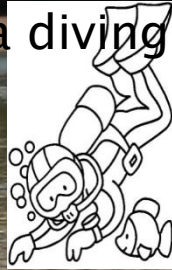
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Abstract The use of artificial habitats as tool for management and conservation of lentic freshwater ecosystems has been most studied in North America, with dominance of Centrarchidae fish. Contrary to north temperate ecosystems, Cichlidae species appear

experimentally the use of artificial habitats by fish in two Neotropical reservoirs between: (i) kind of habitats, (ii) Cichlidae and Centrarchidae, (iii) native and non-native species, and (iv) size classes. The results showed a higher number of individuals and

Uso de estructuras artificiales y BRUV (Baited encuestas videos remotos submarinos) para la detección de especies exóticas en ecosistemas naturales y embalses

Visual census by
scuba diving



Underwater
videos













**Pressão de propágulos por escapes de aquicultura
impulsiona o estabelecimento de populações não-
nativas de *Oreochromis niloticus***



Aquaculture facilities drive the introduction and establishment of non-native *Oreochromis niloticus* populations in Neotropical streams

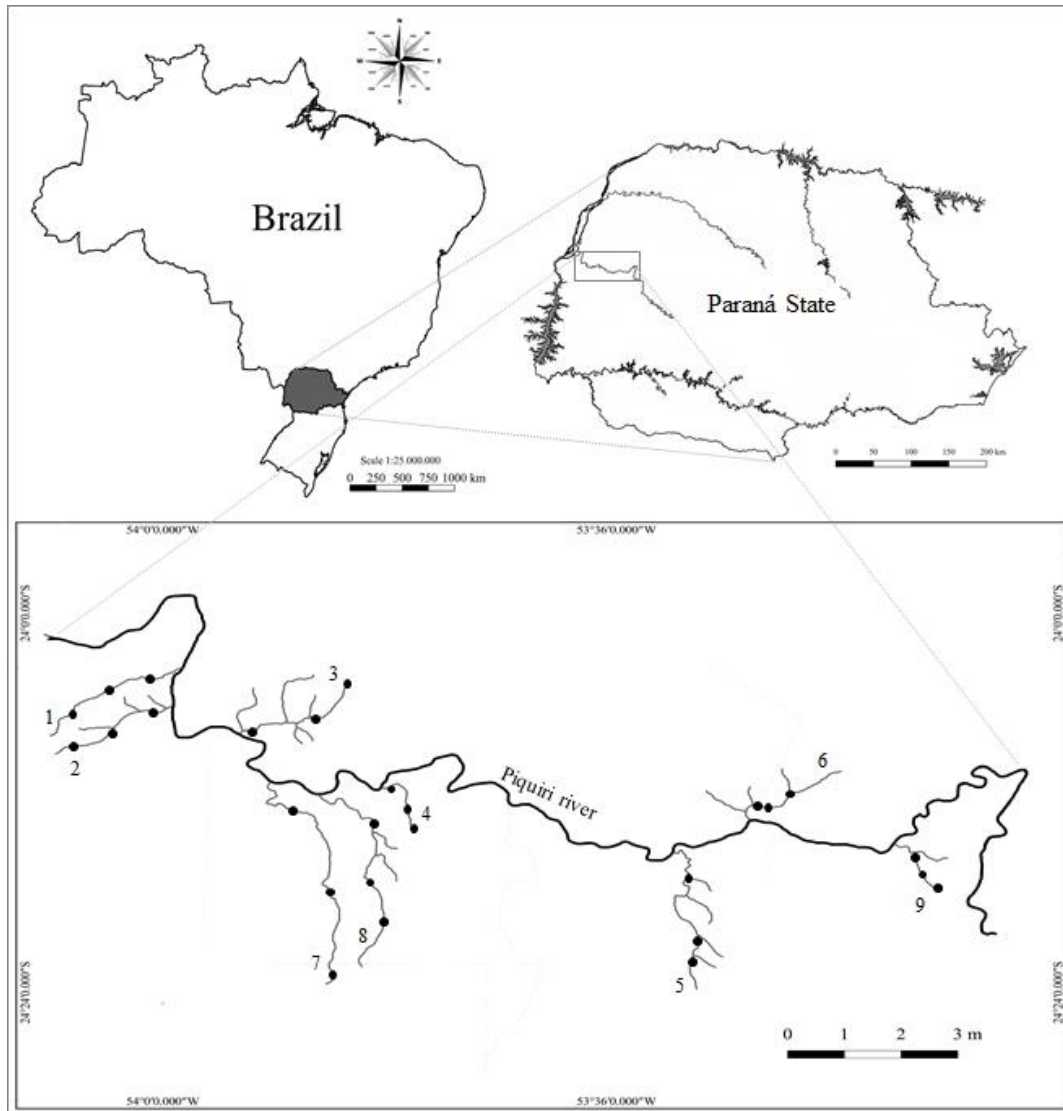
Sandra Carla Forneck  · Fabrício Martins Dutra · Mariele Pasuch de Camargo · Jean Ricardo Simões Vitule · Almir Manoel Cunico

Received: 30 March 2020 / Revised: 24 September 2020 / Accepted: 30 September 2020 / Published online: 14 October 2020
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Abstract This study investigated whether aquaculture facilities drive the introduction and establishment of the non-native Nile tilapia (*Oreochromis niloticus*) in Neotropical streams, Brazil. Samples were taken from nine streams with different aquaculture occupation intensities (no, moderate, and intense) using the percentage of occupation of micro-watersheds by

under intense propagule pressure, females prevailed and high densities of young individuals comparing to adults were recorded. It suggests that the species was reproductively successful in the natural environment. In the streams under moderate propagule pressure, males prevailed, which indicates the likely capture of individuals escaped from aquaculture facilities. In

Riachos com diferentes intensidades de ocupação aquícola – *proxy* para pressão de propágulos



Pressão de propágulos

- Ausente
- Moderada
- Intensa

Amostragens de campo



- 3 pontos de amostragem em cada riacho
- 50 metros amostrados
- 4 coletas trimestrais
- Pesca elétrica – passada tripla



Amostragens de campo



Biometria

Anestesiados
(eugenol)

Fixados
(formol 10%)

Identificados, medidos
e pesados

- Sexo
- Massa das gônadas
- Estádio de maturação gonadal



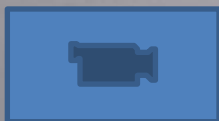






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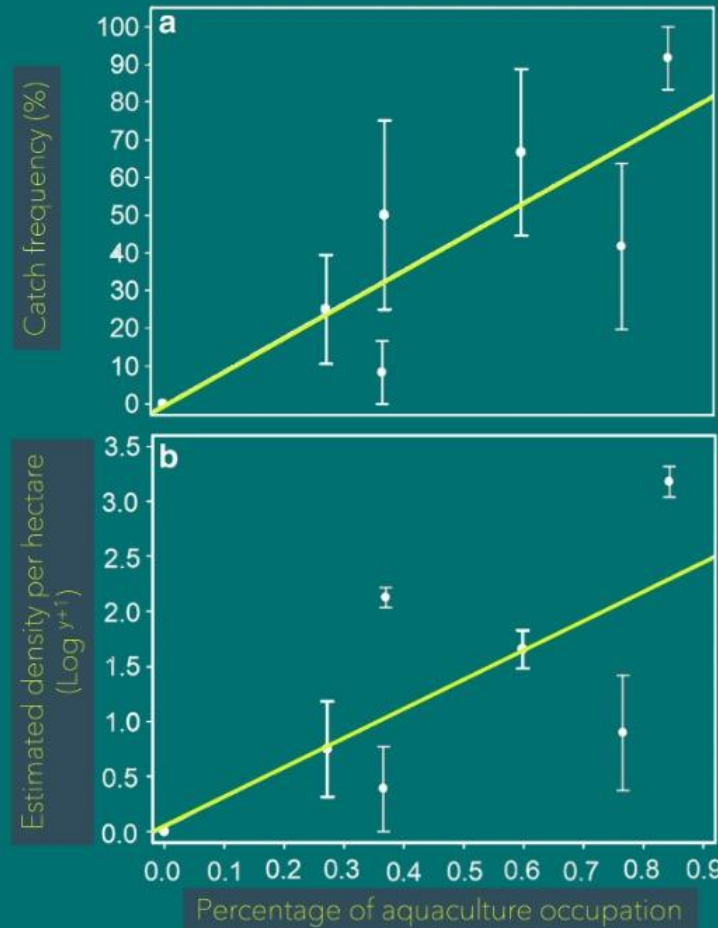
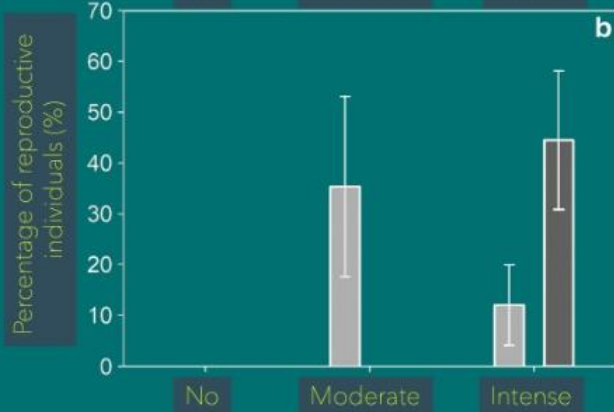
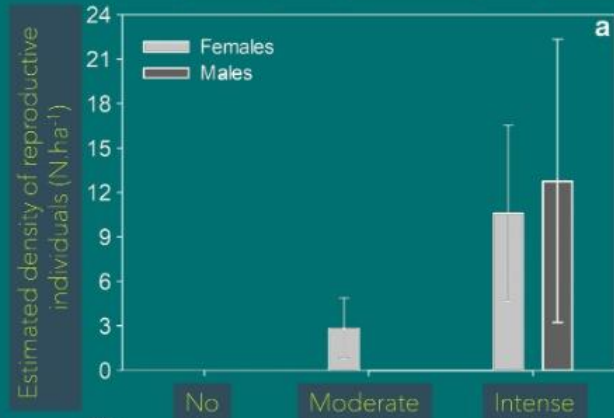
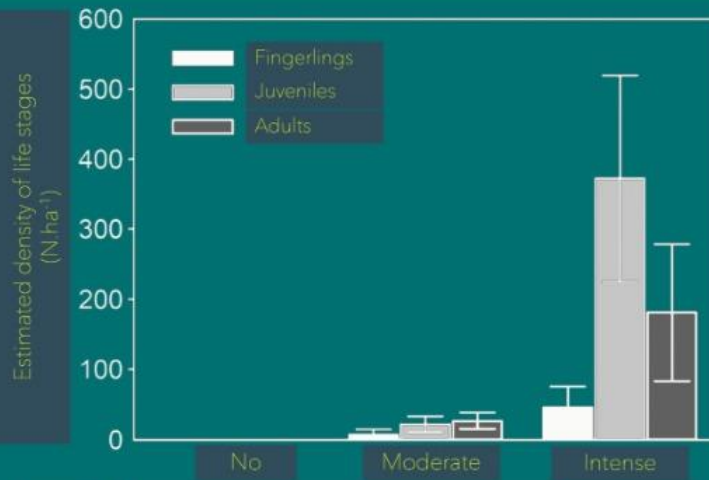




INVASIVE SPECIES III

Aquaculture facilities drive the introduction and establishment of non-native *Oreochromis niloticus* populations in Neotropical streams

Sandra Carla Forneck  · Fabrício Martins Dutra · Mariele Pasuch de Camargo · Jean Ricardo Simões Vitule · Almir Manoel Cunico





Tilapia venturing into high-salinity environments: A cause for concern?

Ana Clara Sampaio Franco  · Valter M. Azevedo-Santos · Marluce Aparecida Mattos de Paula Nogueira · Tommaso Giarrizzo · Rachel Ann Hauser-Davis · Erick Cristofore Guimarães · Roger Henrique Dalcin · Marcelo Soeth · Matheus Oliveira Freitas · Áthila A. Bertoncini · Vinícius Abilhoa · Almir Manoel Cunico · Johnatas Adelir-Alves · Bianca Bentes · José Luís Costa Novaes · Mauricio Hostim-Silva · Jonas Rodrigues Leite · Vagner Leonardo Macêdo dos Santos · Jean Ricardo Simões Vitule

Received: 7 March 2023 / Accepted: 30 September 2023 / Published online: 18 October 2023
© The Author(s) 2024, corrected publication 2024

Abstract Invasive species are continuously introduced in several ecosystems from human activities. Aquaculture activities are noteworthy among the many different species introduction vectors currently in place, generating a pattern of constant, frequent or massive release of propagules into aquatic ecosystems, increasing species establishment suc-

cesses, however, are still scarce. As aquaculture constantly generate propagules with the ability to employ these facilities as corridors to further spread to interconnected brackish and freshwater ecosystems, colonising high salinity systems, this study aimed to compile evidence of Tilapiines detected in Brazilian coastal marine and brackish ecosystems.

Ex: 2 cardumes Arraial do Cabo > 100
indivíduos





Invasive Nile tilapia dominates a threatened indigenous tilapia in competition over shelter

T. Champneys · M. J. Genner · C. C. Ioannou

Received: 26 April 2020 / Revised: 16 June 2020 / Accepted: 20 June 2020 / Published online: 11 August 2020
© The Author(s) 2020

Abstract Invasive species are one of the greatest threats to freshwater ecosystems globally. However, the causal mechanisms that drive negative impacts of many invasive species are poorly understood. In Tanzania, non-native Nile tilapia (*Oreochromis niloti-*

We found that *O. niloticus* were more aggressive and faster to initiate agonistic interactions than *O. amphimelas*. Furthermore, *O. niloticus* showed a strong competitive dominance in their interactions with *O. amphimelas*. One-sided dominance hierar-

figshare.com/articles/dataset/Nile_Tilapia_impacts_reference_list_/14551275

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Nile Tilapia impacts reference list LEC-UFPR

Cite

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Version 9

Dataset posted on 10.05.2021, 19:23 authored by Thiago Vinicius Occhi, Lais Carneiro, Larissa Faria, Natali Oliva Roman Miiller, Jean Ricardo Simões Vitule

The data is a list of scientific literature evidencing the impacts and consequences of the introduction of Nile Tilapia Oreochromis niloticus.

HISTORY

06.05.2021 - First online date

10.05.2021 - Posted date

REFERENCES

10.1126/science.abg1346

USAGE MET

593 views

CATEGORIE

Invasive

KEYWORDS

impacts

invasion p

Invasive S

Em escala local, impactos diretos e grandes nos parâmetros do ecossistema e na pesca artesanal e nas necessidades de mudanças sociais e legislações locais.

Hydrobiologia

DOI 10.1007/s10750-017-3432-8



INVASIVE SPECIES II

Food web changes associated with drought and invasive species in a tropical semiarid reservoir

Luis Artur Valões Bezerra  · Ronaldo Angelini · Jean Ricardo Simões Vitule ·
Marta Coll · Jorge Iván Sánchez-Botero

esa

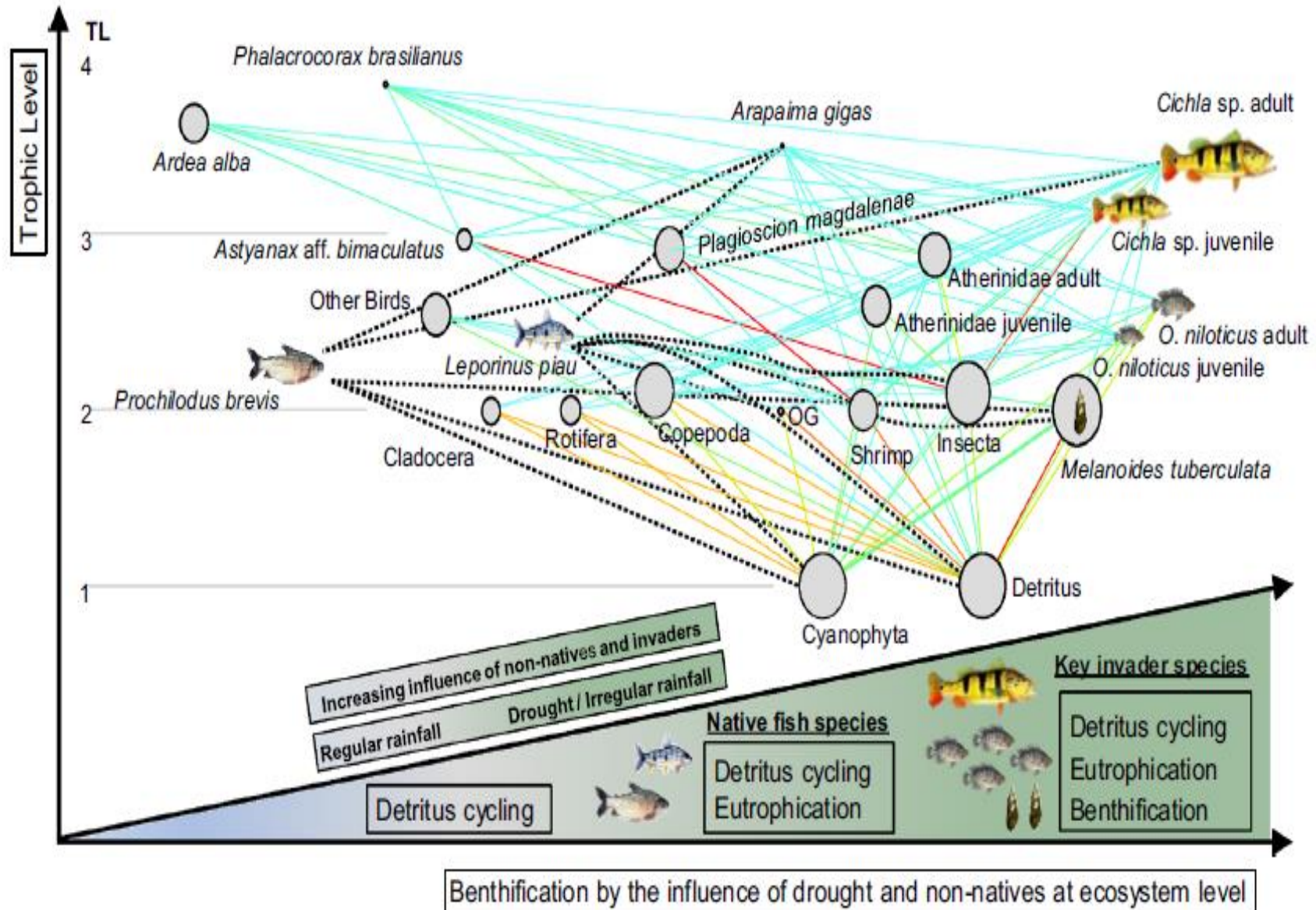
ECOSPHERE

Benthification, biotic homogenization behind the trophic downgrading in altered ecosystems

LUIS ARTUR VALÕES BEZERRA ^{1,5,†} VANESSA MARIA RIBEIRO,² MATHEUS OLIVEIRA FREITAS,^{2,3} LES KAUFMAN,⁴
ANDRE ANDRIAN PADIAL,¹ AND JEAN RICARDO SIMÕES VITULE^{2,3}

***BENTIFICAÇÃO → DAS TEIAS TRÓFICAS NA CONTA DA INTRODUÇÃO DE PEIXES DE OUTROS PAÍSES E DE OUTRAS BACIAS QUE ATUAM EM SINERGIA AUMENTANDO AS MAGNITUDES DOS EFEITOS!**

There are many examples of facilitations between non-native fishes and second tail effects such as invasional meltdown between tilapias and visual predator!! (e.g. Bezerra et al. 2017).



Impact of the invasion from Nile tilapia on natives Cichlidae species in tributary of Amazonas River, Brazil

Luana Silva Bittencourt¹, Uédio Robds Leite Silva², Luis Maurício Abdon Silva³, Marcos Tavares-Dias⁴

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2. Geógrafo. Mestrado em Desenvolvimento Regional, Universidade Federal do Amapá. Coordenador do Programa de Gerenciamento Costeiro do Estado do Amapá, Instituto de Pesquisas Científicas e Tecnológicas do Amapá - IEPA, Brasil. E-mail: uedio.leite@gmail.com

3. Biólogo. Doutorado em Biodiversidade Tropical, Universidade Federal do Amapá. Centro de Pesquisas Aquáticas, Instituto de Pesquisas Científicas e Tecnológicas do Amapá - IEPA, Brasil. E-mail: luis.abdon13@gmail.com

4. Biólogo. Doutorado em Aquicultura de Águas Continentais (CAUNESP-UNESP). Pesquisador da EMBRAPA-AP. Docente orientador do Programa de Pós-graduação em Biodiversidade Tropical (UNIFAP) e Programa de Pós-graduação em Biodiversidade e Biotecnologia (PPG BIONORTE), Brasil. E-mail: marcos.tavares@embrapa.br

ABSTRACT: This study investigated for the first time impact caused by the invasion of *Oreochromis niloticus* on populations of native Cichlidae species from Igarapé Fortaleza hydrographic basin, a tributary of the Amazonas River in Amapá State, Northern Brazil. As a consequence of escapes and/or intentional releases of *O. niloticus* from fish farms, there have been the invasion and successful establishment of this exotic fish species in this natural ecosystem, especially in areas of refuge, feeding and reproduction of the native cichlids species. The factors that contributed for this invasion and establishment are discussed here. The invasion of *O. niloticus* is pressuring the populations of native cichlids which are in a low populational density, as 72.7% of the biomass of cichlids (native and nonnative) is composed of *O. niloticus*. Consequently, the value of CPUE (2.489 kg.h^{-1}) for this invasive tilapia is much higher than the value of CPUE (0.641 kg.h^{-1}) for all the 16 species of native cichlids together. The results indicate the need for a management plan designed to control this invasive tilapia and thus avoid the extinction of native species of cichlids. Furthermore, results may also be useful for critical decision making of Brazilian governmental institutions regarding the approval of the introduction of any nonnative fish species in any other region from the country.

Keywords: Amazonia, exotic fish, *Oreochromis niloticus*, growth.

RESEARCH PAPER

OPEN ACCESS

Effects of Nile Tilapia (*Oreochromis niloticus*) on phytoplankton community structure and water quality: a short-term mesocosm study

Liqiong Zhang^{1,2,a}, Xueying Mei^{3,a}, Yali Tang^{1,2} , Vladimir Razlutskiy⁴, Jiří Peterka⁵ ,
William D. Taylor⁶, Luigi Naselli-Flores⁷ , Zhengwen Liu^{1,8,9}, Chunfu Tong^{10,*}
and Xiufeng Zhang^{1,2,*}

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¹⁰ State Key Laboratory of Estuarine and Coastal Research, East China Normal University, Shanghai 200062, China

Received: 14 November 2021 / Accepted: 12 March 2022

Abstract – Nile tilapia is a highly invasive fish species, deliberately introduced into many lakes and reservoirs worldwide, sometimes resulting in significant ecosystem alterations. A short-term mesocosm experiment with and without Nile tilapia (*Oreochromis niloticus*) was designed to test the hypotheses that the presence of tilapia may affect phytoplankton community structure, increase nutrients availability in water column and deteriorate water quality. Nutrients, total suspended solids (TSS) and biomass of phytoplankton in different size classes

OPINIÃO

CIÊNCIA, NEGACIONISMO, E *FAKE NEWS*: A CONTROVÉRSIA DO CULTIVO DE TILÁPIA EM ÁGUAS PÚBLICAS BRASILEIRAS

Larissa Faria¹

Laís Carneiro¹

Thiago Vinícius Trento Occhi¹

Jean Ricardo Simões Vitule^{1*}

¹**Universidade Federal do Paraná**, Laboratório de Ecologia e Conservação, Departamento de Engenharia Ambiental, Setor de Tecnologia, Campus Centro Politécnico, Jardim das Américas, CEP 81531-990, Curitiba, PR, Brasil.

*Autor correspondente: biovitule@gmail.com

Uma boa discussão científica, pautada em dados e evidências, é de grande valor para auxiliar tomadas de decisões, em particular sobre questões ambientais que afetam amplamente a sociedade.

ANÁLISES

Opinião não é artigo científico

A utilização de espécies exóticas como a tilápia pode causar diversos impactos negativos no meio ambiente e isso é um fato. Fingir ter a chancela de uma respeitável revista científica não vai mudar isso

LARISSA FARIA · LAÍS CARNEIRO · THIAGO VINICIUS TRENTA OCCHI · JEAN RICARDO SIMÕES VITULE ·

17 de maio de 2021 · 1 anos atrás



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ECONOTÍCIAS

PALAVRA DE ESPECIALISTA

ECOANDO

ENTREVISTA

TRANSFORMANDO O MUNDO

O LEITOR ESCREVE

Ed. 7 / Tema: Segurança alimentar



Larissa



Nem só de tilápia vive o homem: um peixe exótico invade as águas e a mesa dos brasileiros

Por Larissa Faria, Thiago V. T. Occhi, Patrícia Charvet, Jean Ricardo Simões Vitule • há um ano atrás

Favorites

Versão PDF

Num dos países com mais diversidade de peixes do mundo o peixe mais consumido não é nativo. Quais são os impactos dessa estratégia?



Anúncios Google

Não exibir mais este anúncio

Anúncio? Por quê? ⓘ

Post (10)

Rece

Reflexões sobre a alf
científica e nossas escolh
Por: Ana María Gómez Villegas

Para onde estamos caminhando:



What we have now... and...

Where we are going:

Lo que tenemos ahora ... y ...

A donde vas:

PRODUCTION SECTOR TRENDS IN BRAZIL AND SOUTH AMERICA



¡Peces no nativos en jaulas acuícolas en yacimientos hidroeléctricos del país!

A aquicultura como solução:

Decretos ESTÚPIDOS para a naturalização de NÃO NATIVOS



En Brasil no estamos escuchando a George Santayana:

In Brazil and South America we are not listening George Santayana:

“Those who do not learn from the past are destined to repeat it.”



POLICY PERSPECTIVE |  Open Access

A Serious New Threat to Brazilian Freshwater Ecosystems: The Naturalization of Nonnative Fish by Decree

Fernando Mayer Pelicice , Jean Ricardo Simões Vitule, Dilermando Pereira Lima Junior, Mário Luis Orsi, Angelo Antonio Agostinho

First published: 12 April 2013 | <https://doi.org/10.1111/conl.12029> | Cited by: 60

Editor: David Strayer



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Bring yo
research

!Aquellos que no aprenden del pasado están destinados a repetirlo!!!!!!!!!!!!!!!!!!!!!!



SHARE

LETTERS



Tilapia farming threatens Brazil's waters

Patricia Charvet^{1,*}, Thiago Vinicius Trento Occhi¹, Larissa Faria¹, Barbara Carvalho¹, Clemerson Richard Pedroso¹, Laís Carneiro¹, Matheus Freitas¹, Miguel Petrere-Junior², Jean Ricardo Simões Vitule¹

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Science 22 Jan 2021:
Vol. 371, Issue 6527, pp. 356
DOI: [10.1126/science.abg1346](https://doi.org/10.1126/science.abg1346)

Mais uma vez, o governo brasileiro ameaça a biodiversidade nativa ao facilitar a criação de espécies exóticas invasoras (1). A Secretaria de Aquicultura e Pesca do Brasil anunciou recentemente um Decreto Federal (10576/2020) para impulsionar a aquicultura por meio da implementação da criação de tilápia-do-nilo em 60 dos 73 reservatórios do Brasil.

TILÁPIA NÃO É GALINHA



Nenhum peixe tem o mesmo nível de dominância que mamíferos e pássaros!
A tilápia e a truta não são galinhas e causam impactos quando escapam para rios e lagos!

FISH and FISHERIES



FISH and FISHERIES

Levels of domestication in fish: implications for the sustainable future of aquaculture

Fabrice Teletchea & Pascal Fontaine

Research Unit Animal and Functionalities of Animal Products (URAFPA), University of Lorraine – INRA, 2 Avenue de la Forêt de Haye, BP 172, 54505, Vandœuvre-lès-Nancy, France

Abstract

The agricultural world today is dominated by a few domesticated mammal species, that is, animals modified from their wild ancestors through selective breeding in captivity for traits beneficial to human usages. As a result, a clear dichotomy exists between wild (from hunting) and domesticated mammals (produced in farms) used for human consumption. Similar to agriculture, aquaculture is often viewed as the only solution that can provide more fish products given that harvesting wild stocks have reached an upper limit. Aquaculture is considerably younger than agriculture relying on natural sources to farm numerous species. To better describe the diverse strategies for fish production, we propose a new classification comprising five levels of 'domestication' with 1 being the least to 5 being the most domesticated. Our classification places 70% of the 250 farmed finfish species recorded in the 2009 FAO database into levels 1, 2 and 3 representing a transitory form of fish production dependent on the availability of the wild resource. In contrast, only a few species, or more accurately populations, can be considered truly domesticated, similar to cattle or sheep. Based on this classification, two scenarios for the future of aquaculture are discussed: either the industry focuses on few truly domesticated species, similar to the path taken by agriculture, but avoiding its negative impacts or aquaculture proceeds with inter-specific diversification by focusing primarily on the domestication of native species.

Keywords Aquaculture, classification, diversification, domestication, fisheries, life cycle

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2011

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2012

Fish Domestication: An Overview

Teletchea Fabrice **IntechOpen**

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Abstract

The first trials of fish farming date back about 3500 years. Yet, this is only in the 1980s that the exponential development of aquaculture occurred, driven by the strong demand for aquatic products, whereas global capture fisheries started decreasing. The strong increase of aquaculture production has relied chiefly on the domestication of an increasing number of fish species. Nevertheless, only a limited number has reached a high level of domestication. The aim of this chapter is to describe the domestication history of five of the main farmed fish species globally in which all have reached Level 5 and one example that has reached Level 2 only. These six species were chosen because enough scientific literature was available to describe their domestication history that allows illustrating both ancient and recent fish domestication.

Keywords: domestication level, wild, domesticated, fish species, aquaculture, diversification



Status and recommendations for sustainable freshwater aquaculture in Brazil

André B. Nobile¹ , Almir M. Cunico² , Jean R. S. Vitule³, Jamile Queiroz⁴ , Ana P. Vidotto-Magnoni⁵ , Diego A. Z. Garcia⁵ , Mário L. Orsi⁵, Felipe P. Lima¹ , Aline A. Acosta⁶ , Reinaldo J. da Silva⁷ , Fernanda D. do Prado⁸ , Fábio Porto-Foresti⁸ , Heleno Brandão⁹ , Fausto Foresti¹ , Claudio Oliveira¹  and Igor P. Ramos¹⁰ 

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- 3 Laboratory of Ecology and Conservation, Department of Environmental Engineering, Federal University of Paraná, Curitiba, Brazil
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- 9 Federal Technological University of Paraná (UTFPR), Santa Helena, Brazil
- 10 Department of Biology and Animal Science, School of Engineering, São Paulo State University (UNESP), Ilha Solteira, Brazil

Correspondence

André B. Nobile, São Paulo State University (UNESP), Institute of Biosciences, Department of Morphology, Rua Professor Doutor Antônio Celso Wagner Zanin, nº 250, Botucatu, São Paulo CEP 13506-900, Brazil

Abstract

Brazil is a megadiverse country and is participant of fundamental environmental agreements for biodiversity conservation. However, the internal politics and the cultures that affect negatively the ecological integrity in Brazilian freshwater need

Solutions

Steps

Solutions

Risk analysis and thorough surveys to define target non-native species for aquaculture.

Development of technology to optimize production of native species

Purchase certified products
Preference by products from small-scale aquaculture based on multiple native species

Use of native species from local river basins)

Develop small-scale aquaculture based on multiple native species, integrated with other activities (e.g., agriculture)

Use non-native species, hybrids and transgenic organisms only in stringently closed systems

Use recirculating aquaculture systems (RAS)

Best operational strategies, controlling the escape of non-native species and associated aquaculture wastes involve the management of water, facilities and employees

Scientific research

Consumers

Society

Education and information

Aquaculture farmers

Public authorities

Decision makers

Best management practices of non-native species

Regulations

Certificate of registration

Inspections/monitoring

National aquaculture plans based on regionalization and Environmental Management System (EMS) practices

Governmental support to develop research on native species and Environmental Management System (EMS).

Official support to develop small-scale aquaculture based on multiple native species, Financial support to implement sustainable technologies in farms

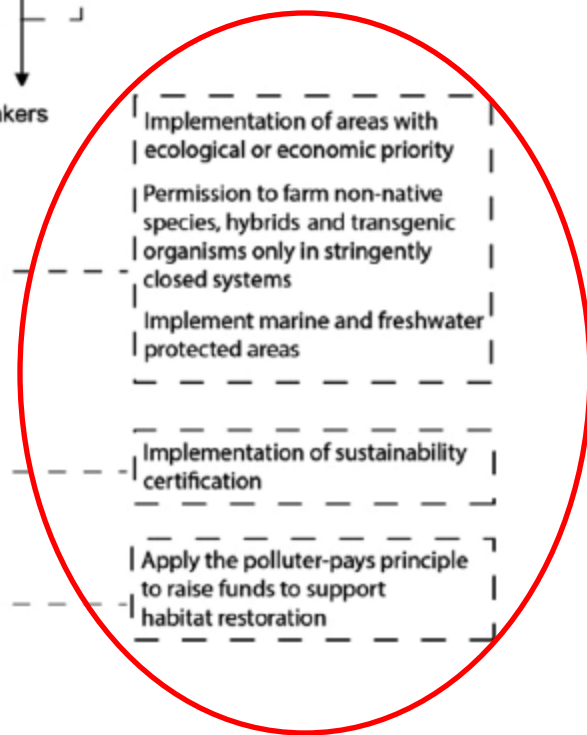
Implementation of areas with ecological or economic priority

Permission to farm non-native species, hybrids and transgenic organisms only in stringently closed systems

Implement marine and freshwater protected areas

Implementation of sustainability certification

Apply the polluter-pays principle to raise funds to support habitat restoration



REVIEWS IN Aquaculture



REVIEW

Introduction of non-native fish for aquaculture in China: A systematic review

Bin Kang ✉, Jean R. S. Vitule, Shan Li, Fangmin Shuai, Liangliang Huang, Xiaoxia Huang, Jinghui Fang, Xiaotao Shi ✉, Yugui Zhu, Dongpo Xu, Yunrong Yan, Fangrui Lou

First published: 22 October 2022

<https://doi.org/10.1111/raq.12751>

Funding information: Fundamental Research Funds for the Central Universities of China, Grant/Award Number: 201964002; Hubei International Science and Technology Cooperation Base of Fish Passage

Ativa as Janelas
Acesse Configurações

Por que devemos nos preocupar com pressão de propágulos de espécies exóticas no Brasil?

As pressões não são novas e nem unidimensionais e continuam a aumentar crescentemente com o tempo



A questão das pressões de propágulos e de colonização é algo complexo e requer uma visão cautelosa e equilibrada, incluindo a consideração dos efeitos de longo prazo e nossas dificuldade analíticas

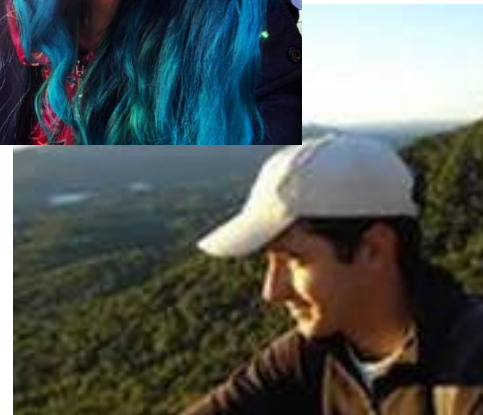
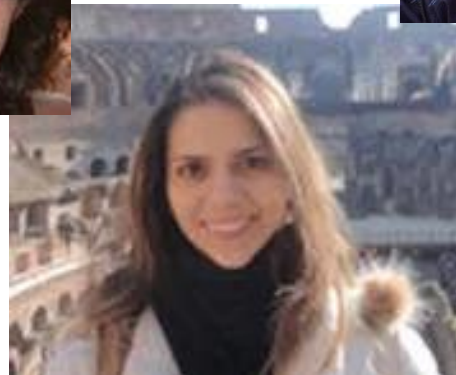
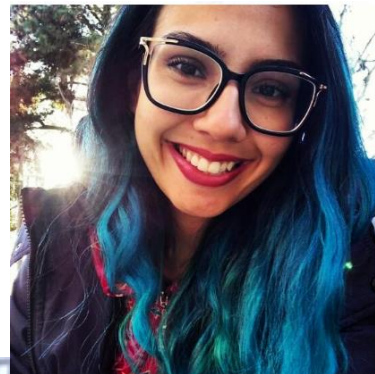
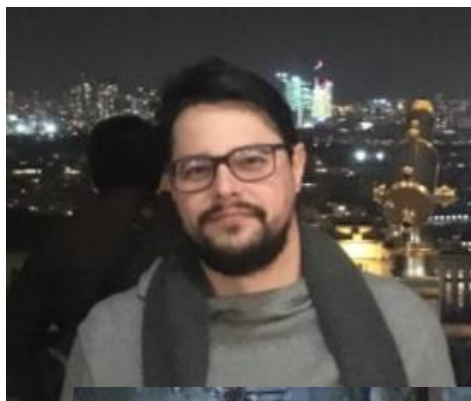


Nossa capacidade preditiva é limitada e continuará a sê-lo no futuro previsível

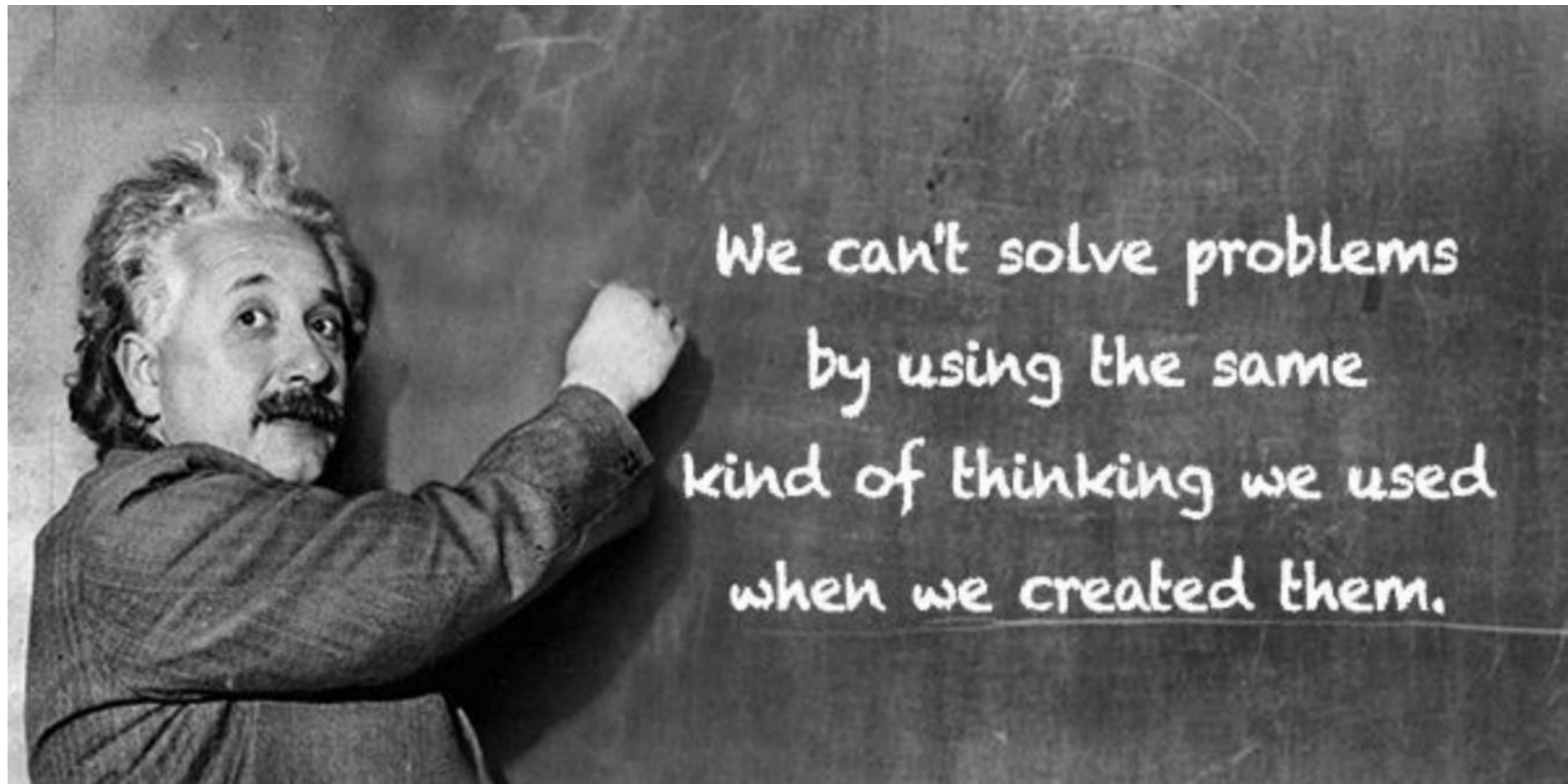


Temos uma diversidade e complexidade de imensa magnitude que deve ser considerada em diferentes escalas. Por exemplo, para peixes somos o maior doador de espécies não nativas em nosso próprio país. Isso tem fortes implicações para a conservação, gestão e economias locais e globais.

Thanks



LABORATÓRIO DE ANÁLISE E
SÍNTESE EM BIODIVERSIDADE



We can't solve problems
by using the same
kind of thinking we used
when we created them.



OBRIGADO!
Thank you!

