Workshop Rodent-Borne Diseases

Optimal control model for rodent-borne leptospirosis in Salvador, Brazil

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Within the next three decades, two million people worldwide will live in urban slums, making up around 70% of the urban population in poor countries. Slum communities face a myriad of political, economic, and health challenges, yet often lack sufficient resources or central (governmental) planning to address them. In low to medium income countries, infectious diseases of poverty are common, including globally distributed zoonoses such as leptospirosis, which impart their greatest burden on the urban poor. In Brazil alone, 12,000 people annually are infected with *Leptospira*, a zoonotic bacteria carried and shed in urban settings mainly by brown rats (*Rattus norvegicus*). Few studies have evaluated the effectiveness of interventions, such as application of rodenticide or habitat modification. Rodenticides temporarily reduce rodent abundance while habitat modification such as closing of sewers reduces both carrying capacity of rat populations and survival of *Leptospira* in the environment. Given the scarcity of resources and need for intervention, it is important to evaluate the cost-effectiveness of different combinations of time-dependent intervention scenarios. We here present a mathematical model based on optimal control theory, using age-structured model for leptospire infection in a rat populations and parameters inferred from empirical studies in five slum communities in the city of Salvador, Brazil. An optimal control models optimizes time-dependent interventions through incorporating both the cost of an intervention and the cost of an infection. Our results suggest that habitat modification, despite being relatively more expensive; can reduce infection prevalence in rat populations. Continuous application of rodenticide reduces rat populations sufficiently to diminish human risk. The models presented here, using leptospirosis as a case study, can guide the optimal allocation of resources to reduce zoonotic risk.

459
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Jens Jacob, Jana Eccard (Editors)

6th International Conference of Rodent Biology and Management and 16th Rodens et Spatium

Potsdam, Germany, 3-7 September 2018

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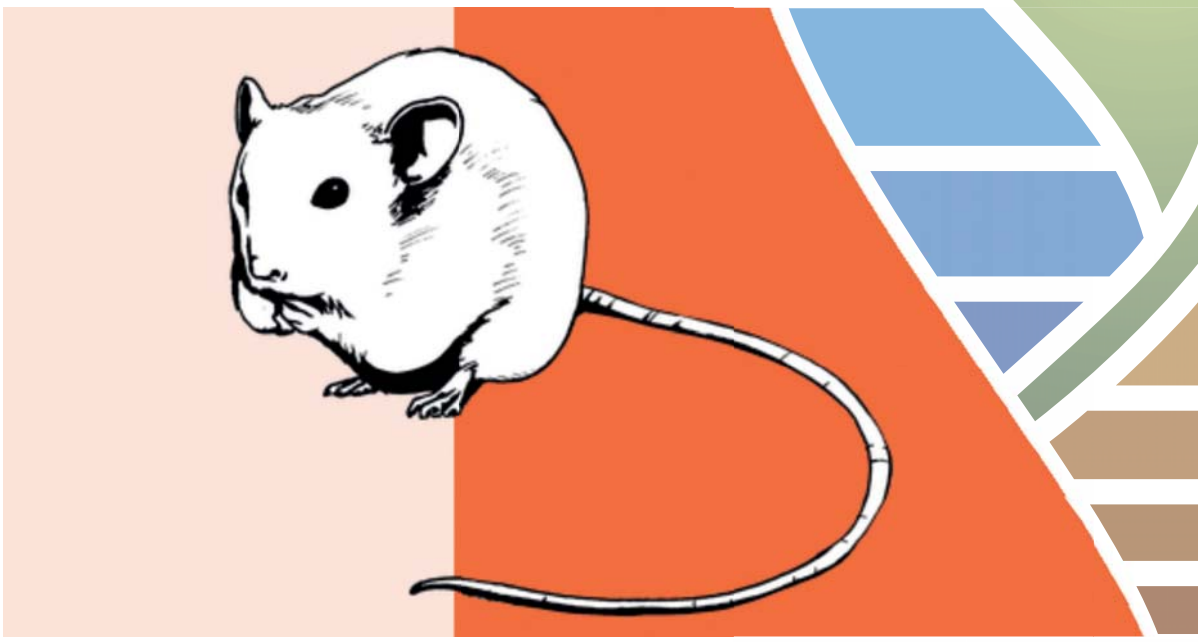

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459
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Bibliografische Information der Deutschen Nationalbibliothek
Die Deutsche Nationalbibliothek verzeichnet diese Publikation
In der Deutschen Nationalbibliografie: detaillierte bibliografische
Daten sind im Internet über http://dnb.d-nb.de abrufbar.

ISSN 1868-9892
ISBN 978-3-95547-059-3
DOI 10.5073/jka.2018.459.000

Printed in Germany by Arno Brynda GmbH, Berlin.