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WILDLIFE HEALTH GHENT

INFECTIOUS DISEASES IN EUROPEAN AMPHIBIANS

Frank Pasmans & An Martel

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CHYTRIDIOMYCOSIS: BD

- Fungal disease
- Globally distributed
- Origin Asia
- All amphibian orders, post metamorphosis
- Extinction: meso America, Australia, western USA

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BD IN EUROPE

ELSEVIER

Biological Conservation 97 (2001) 331–337

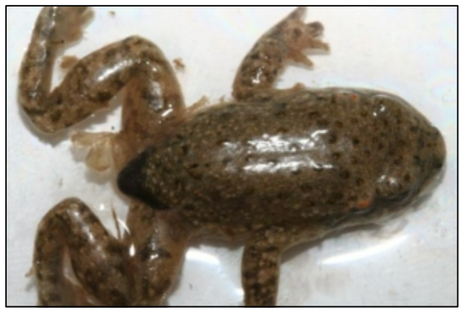
BIOLOGICAL CONSERVATION

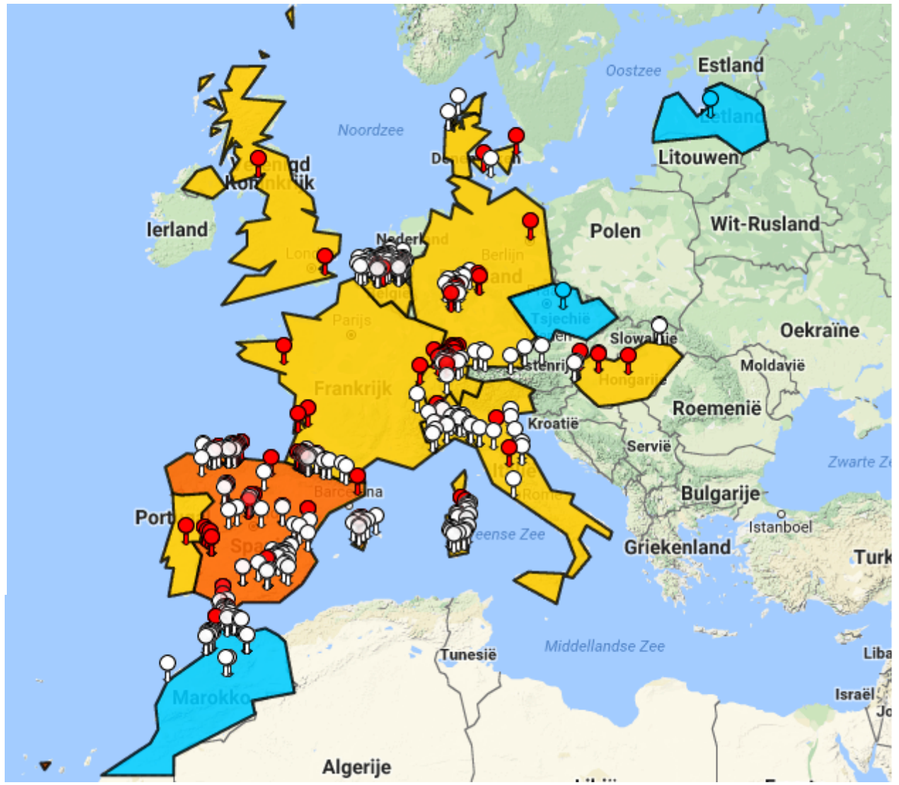
www.elsevier.com/locate/biocon

Evidence of a chytrid fungus infection involved in the decline of the common midwife toad (*Alytes obstetricans*) in protected areas of central Spain

Jaime Bosch *, Iñigo Martínez-Solano, Mario García-París

Museo Nacional de Ciencias Naturales, CSIC, José Gutiérrez Abascal 2. 28006 Madrid, Spain





http://www.bd-maps.net/

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BD IN EUROPE

- Introduction linked to trade
- Impact: declines – apparent stability
  - Local variation, poorly understood

Amphibia-Reptilia 32 (2011): 419-423

Clinically healthy amphibians in captive collections and at pet fairs: A reservoir of *Batrachochytrium dendrobatidis*

Annemarieke Spitzen-van der Sluijs[1], An Martel[2], Emma Wombwell[3], Pascale Van Rooij[2], Ronald Zollinger[1], Tonnie Woeltjes[1], Matthew Rendle[3], Freddy Haesebrouck[2], Frank Pasmans[2,*]

EcoHealth 13, 456–466, 2016
DOI: 10.1007/s10393-016-1138-4

ECOHEALTH

CrossMark

Original Contribution

Detection of *Batrachochytrium dendrobatidis* in Amphibians Imported into the UK for the Pet Trade

Emma Louise Wombwell,[1,2] Trenton W. J. Garner,[1] Andrew A. Cunningham,[1] Robert Quest,[3] Susie Pritchard,[3] J. Marcus Rowcliffe,[1] and Richard A. Griffiths[2]

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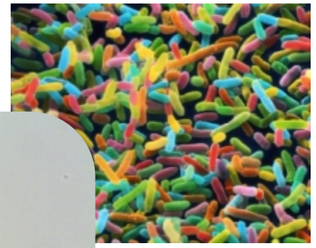
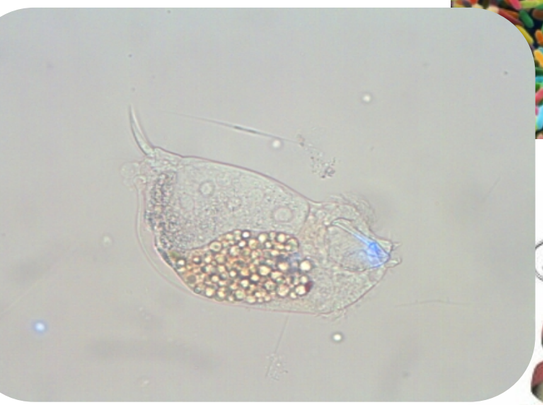
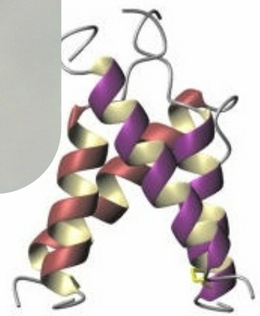
Susceptibility: intra vs interspecies differences

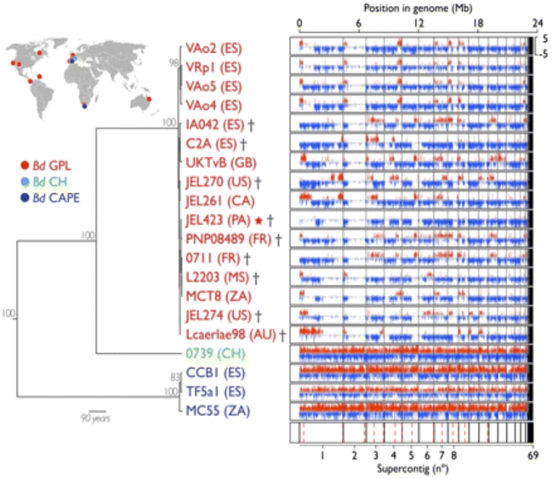




Raimondo et al., PNAS, 2005

~ Bd strain
~ host factors
~ environment





?

Oikos 118: 783–791, 2009
doi: 10.1111/j.1600-0706.2008.17202.x,

Subject Editor: Tim Benton. Accepted 28 November 2008

Research

Life history tradeoffs influence mortality associated with the amphibian pathogen *Batrachochytrium dendrobatidis*

Trenton W. J. Garner, Susan Walker, Jaime Bosch, Stacey Leech, J. Marcus Rowcliffe, Andrew A. Cunningham and Matthew C. Fisher

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FUTURE SCENARIOS IN EUROPE?

– Cf talk A. Spitzen

Conservation Biology

Contributed Paper

Environmental Determinants of Recent Endemism of *Batrachochytrium dendrobatidis* Infections in Amphibian Assemblages in the Absence of Disease Outbreaks

ANNEMARIEKE SPITZEN-VAN DER SLUIJS,*† AN MARTEL,† CASPAR A. HALLMANN,‡§ WILBERT BOSMAN,* TRENTON W. J. GARNER,¶ PASCALE VAN ROOIJ,† ROBERT JOORIS,** FREDDY HAESEBROUCK,† AND FRANK PASMANS†

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DIAGNOSTICS / MITIGATION

- qPCR / necropsy / histopathology
- Mitigation:
  - OIE listed
  - Captivity: eradication possible
  - Natural populations: ?

PHILOSOPHICAL TRANSACTIONS B

rstb.royalsocietypublishing.org

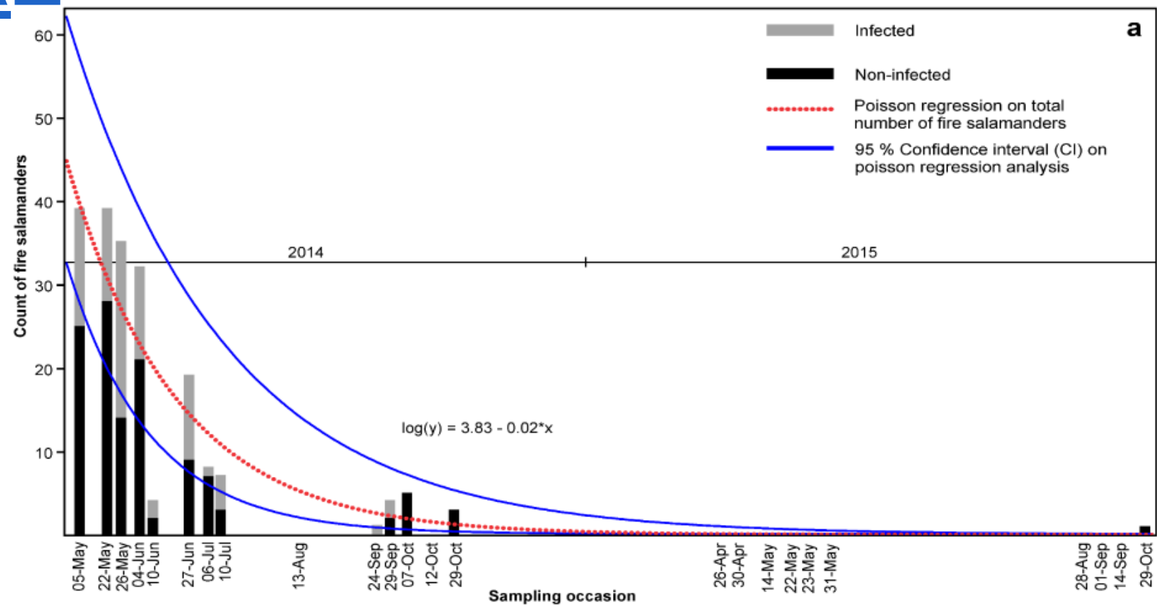
Mitigating amphibian chytridiomycoses in nature

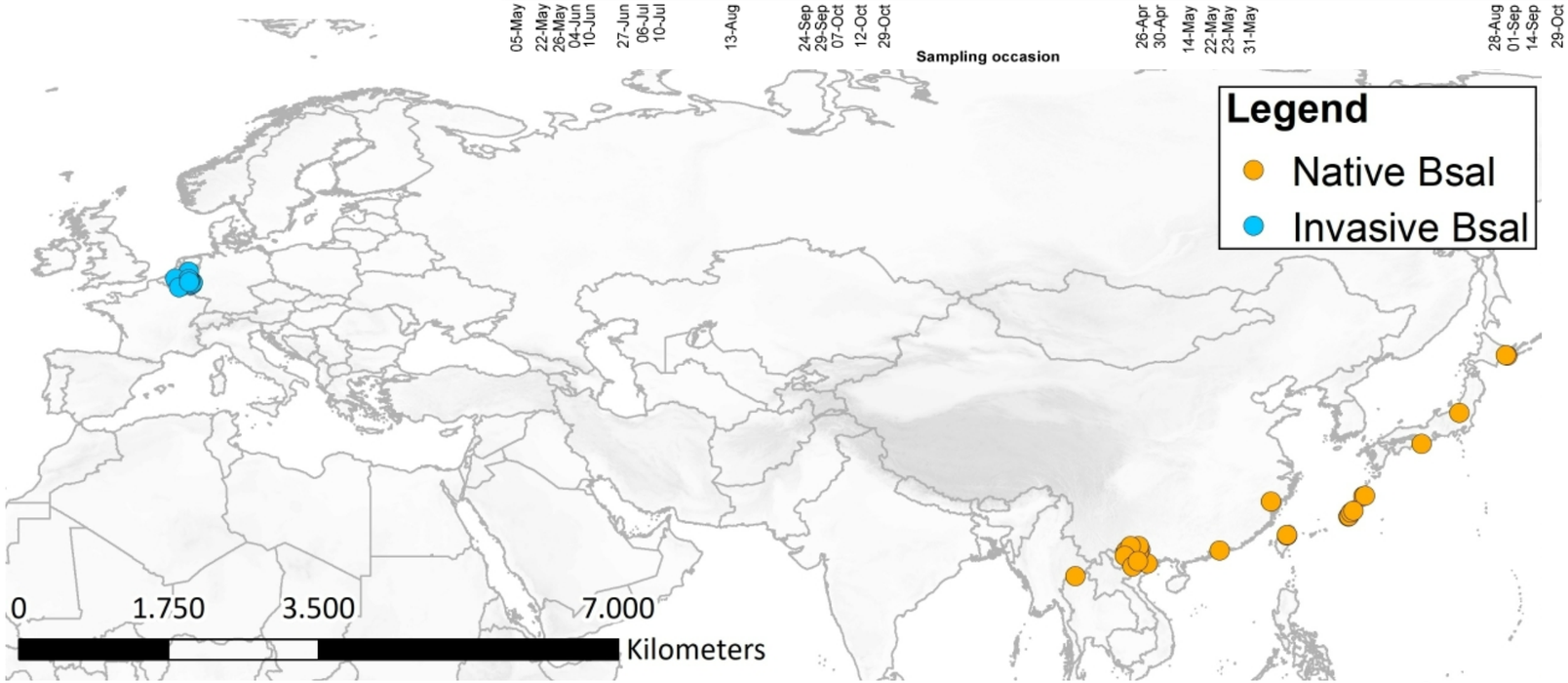
Trenton W. J. Garner[1,2], Benedikt R. Schmidt[3,4], An Martel[5], Frank Pasmans[5], Erin Muths[6], Andrew A. Cunningham[1], Che Weldon[2], Matthew C. Fisher[7] and Jaime Bosch[8]

CHYTRIDIOMYCOSIS: BSAL

> 90% decline in 6 months

- Fungal disease
- Origin Asia
- Infects Urodela + Anura
- Extirpation events





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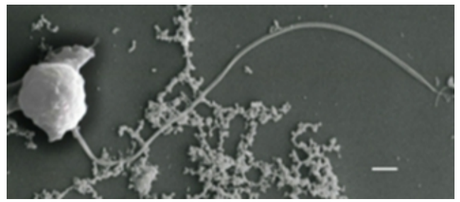
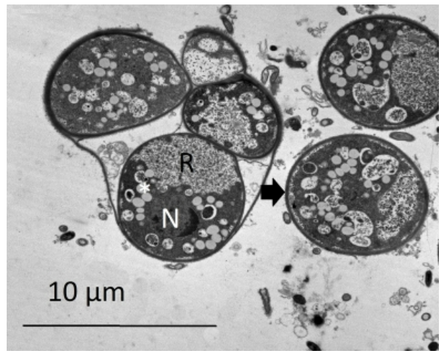
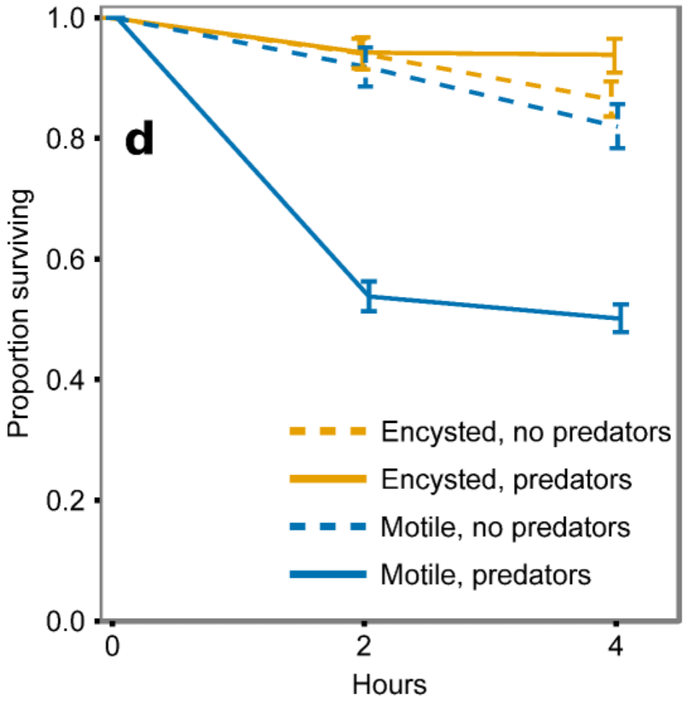
ENVIRONMENTAL PERSISTENCE

Motile spores



Encysted spores





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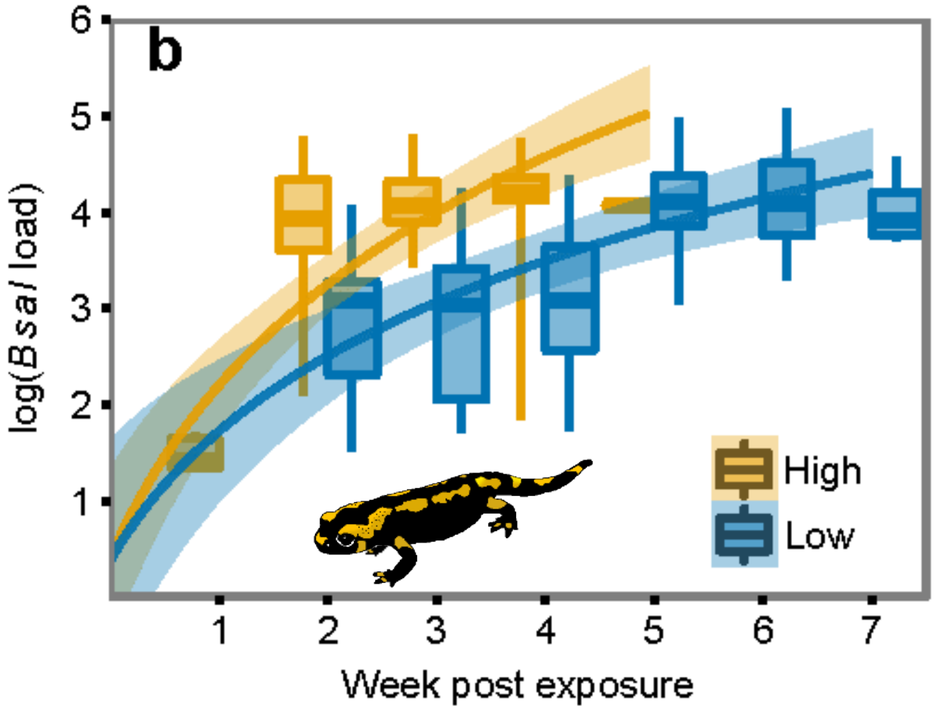
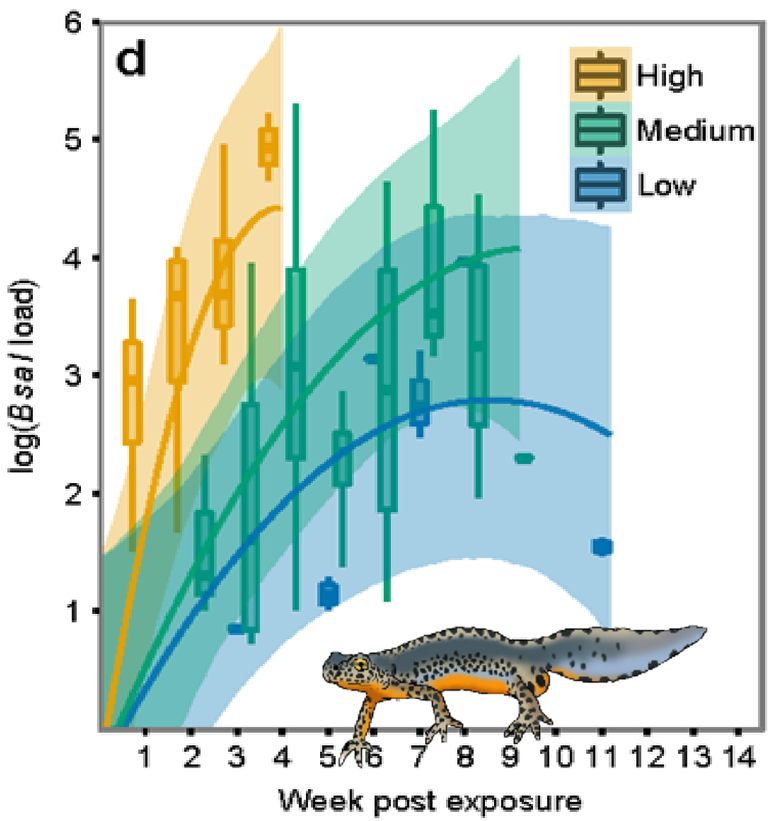
DOSE (IN)DEPENDENT COURSE OF DISEASE

DOSE INDEPENDENT COURSE OF DISEASE



DOSE DEPENDENT COURSE OF DISEASE



RESERVOIR

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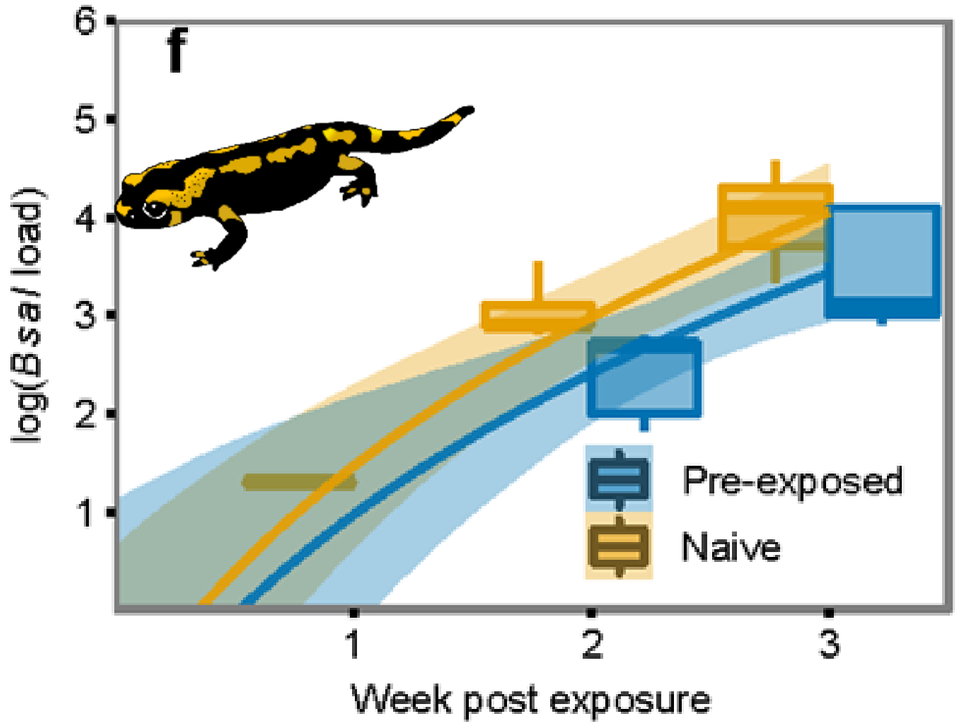
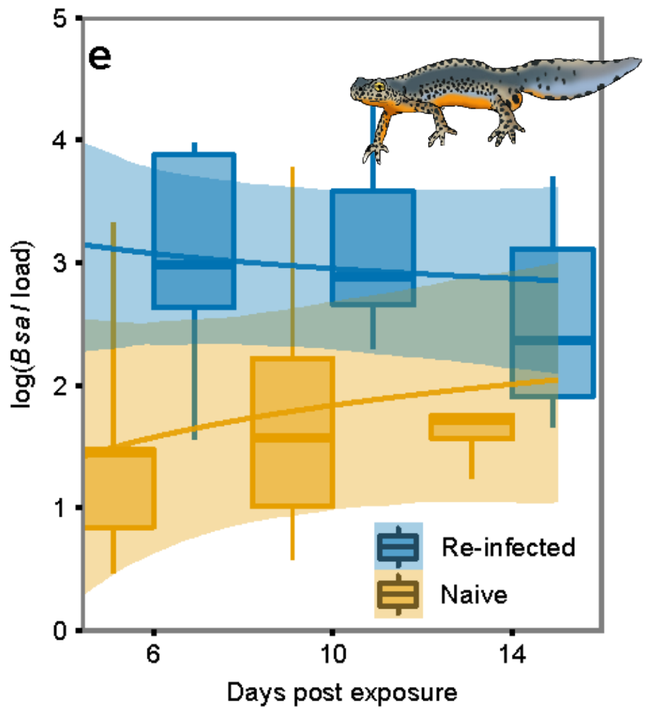
NO IMMUNITY BUILD UP





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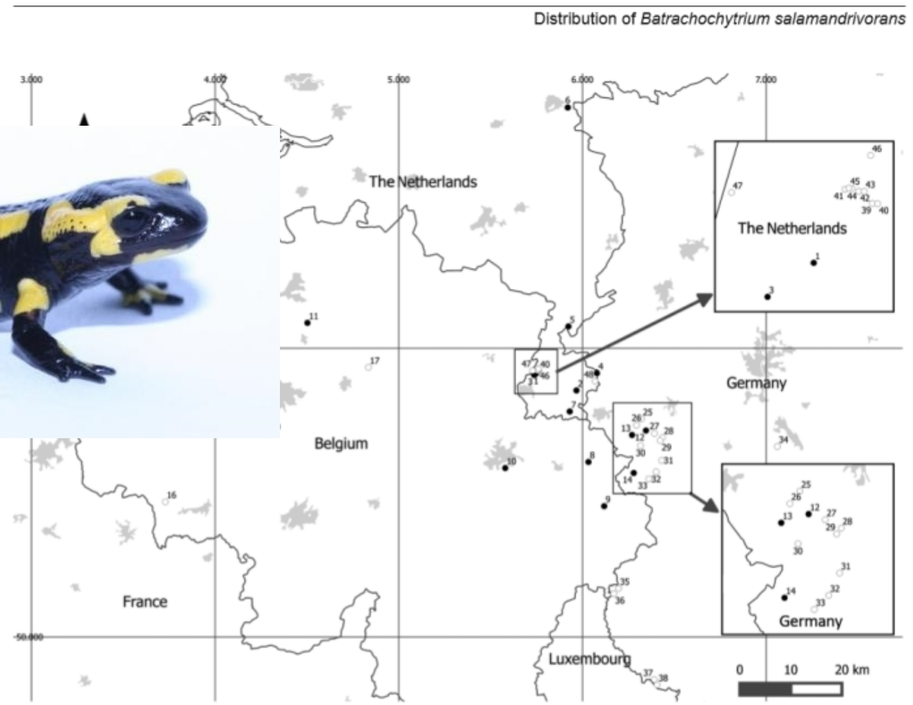
BSAL IN EUROPE

– Captive vs wild



Spitzen et al 2016

Amphibia-Reptilia (2015) DOI:10.1163/15685381-00003008

First detection of the emerging fungal pathogen *Batrachochytrium salamandrivorans* in Germany

Joana Sabino-Pinto[1,*], Molly Bletz[1], Ralf Hendrix[1], R.G. Bina Perl[1], An Martel[2], Frank Pasmans[2], Stefan Lötters[3], Frank Mutschmann[4], Dirk S. Schmeller[5], Benedikt R. Schmidt[6,7], Michael Veith[3],

Veterinary Record

Emerging disease in UK amphibians

Andrew A. Cunningham, Katie Beckmann, Matthew Perkins, Liam Fitzpatrick, Ruth Cromie, Jay Redbond, Michelle F. O'Brien, Pria Ghosh, Jennifer Shelton and Matthew C. Fisher

Veterinary Record 2015 176: 468
doi: 10.1136/vr.h2264

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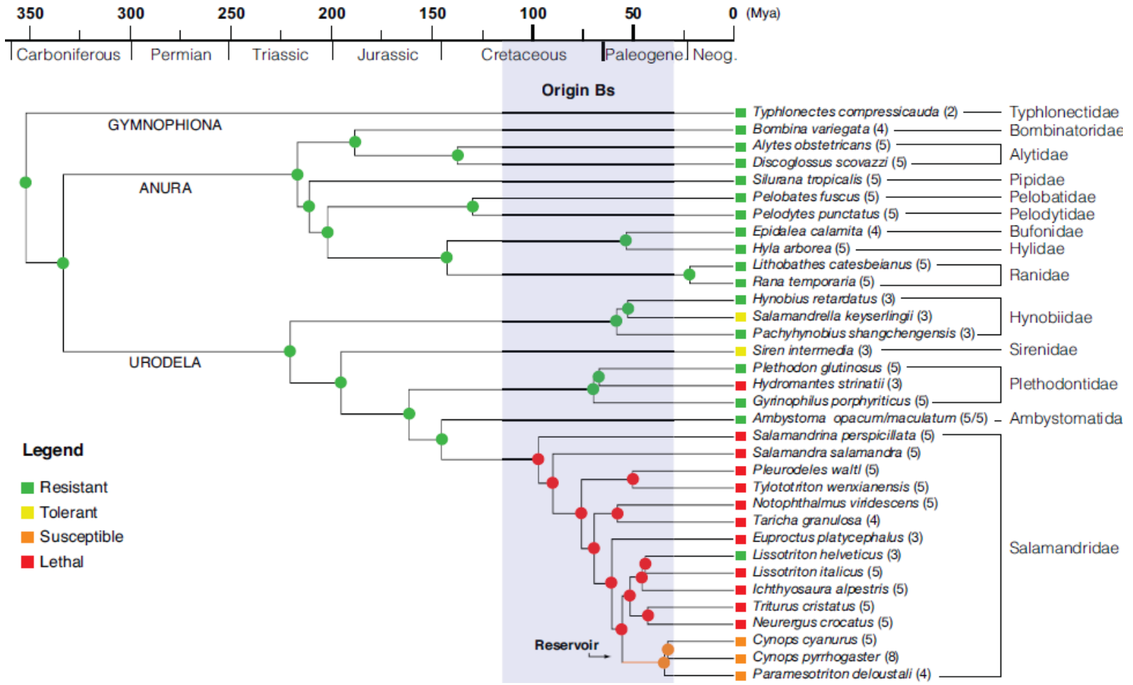
BSAL IN EUROPE

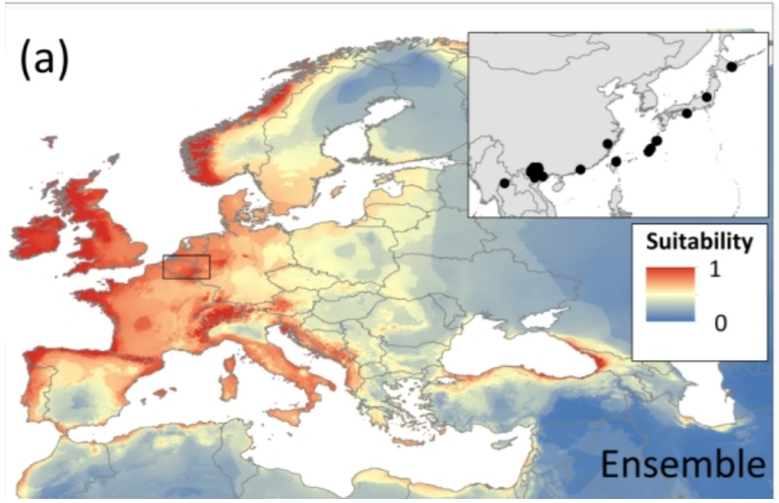
- Introduction linked to trade
- Potential impact in Europe

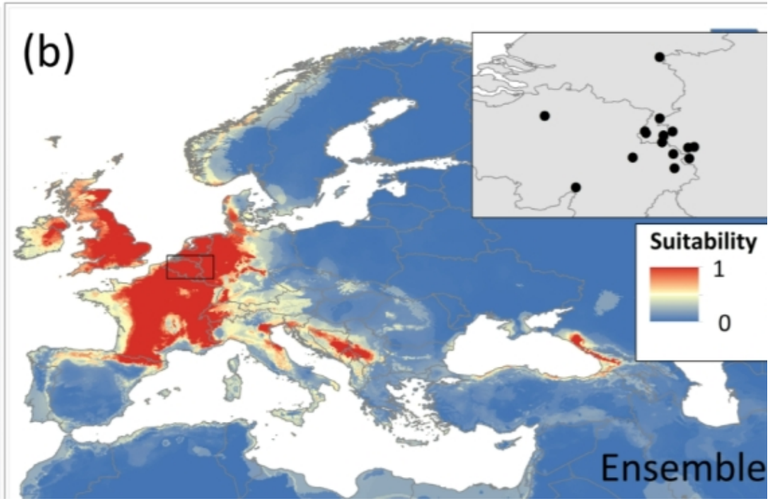


Amphibia-Reptilia (2017) DOI:10.1163/15685381-00003125

Trade in wild anurans vectors the urodelan pathogen *Batrachochytrium salamandrivorans* into Europe

Tao Thien Nguyen[1,2], Thinh Van Nguyen[2], Thomas Ziegler[3,4], Frank Pasmans[5], An Martel[5,*]





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UNCERTAINTIES

- Aquatic environment
- Role of carriers
- Susceptibility?
- Spread?

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DIAGNOSTICS / MITIGATION

PREVENTION!

EX SITU?

- qPCR / necropsy / histopathology
- Mitigation:
  - OIE listed
  - Captivity: eradication possible
  - Natural populations: ?

Marion Jouffroy

LETTER

doi:10.1038/nature22059

Drivers of salamander extirpation mediated by *Batrachochytrium salamandrivorans*

Gwij Stegen[1]*, Frank Pasmans[1]*, Benedikt R. Schmidt[2,3], Lieze O. Rouffaer[1], Sarah Van Praet[1], Michael Schaub[4], Stefano Canessa[1], Arnaud Laudelout[5], Thierry Kinet[5], Connie Adriaensen[1], Freddy Haesebrouck[1], Wim Bert[6], Franky Bossuyt[7] & An Martel[1]

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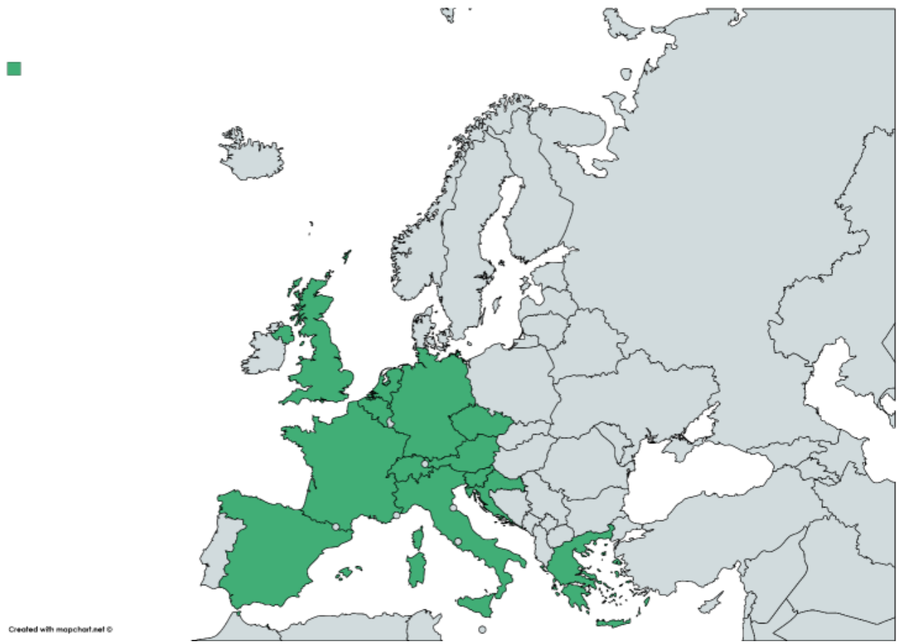
TENDER

- Delineation of current Bsal range
- European early warning system
- Emergency action plans
- Sustainable mitigation



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EARLY WARNING SYSTEM

https://bsalinfoeurope.wixsite.com/eubsalmitigation2017/

Passive surveillance ⟸ Regional hotlines 

UK, the Netherlands, Spain, Germany, Belgium, Italy, France

Information to public and stakeholders

+

SOPs for sampling of animals and hygiene procedures

Diagnostic centres 

Reference lab

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European Commission

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EMERGENCY ACTION PLANS

- Species prioritization
- Species specific and general protocols

https://bsalinfoeurope.wixsite.com/eubsalmitigation2017/

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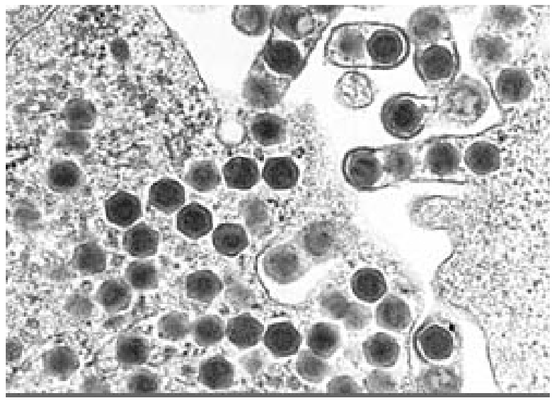
European Commission

RANAVIRUSES

- Large, ds DNA viruses: 6 species (Major Capsid Protein)
- Globally distributed
- Amphibians, reptiles, fish (?)
- All life stages



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Pictures: © D Willems

RANAVIRUSES IN EUROPE

Since 1968 at least (Croatia)…

Recent: Nl, Fr, Po, E

The Veterinary Journal xxx (2011) xxx–xxx

Contents lists available at SciVerse ScienceDirect

The Veterinary Journal

journal homepage: www.elsevier.com/locate/tvjl

Short Communication

Ranavirus-associated mass mortality in wild amphibians, The Netherlands, 2010: A first report

Marja Kik[a,*], An Martel[b], Annemarieke Spitzen-van der Sluijs[c], Frank Pasmans[b], Peter Wohlsein[d], Andrea Gröne[a], Jolianne M. Rijks[a]

DOI: 10.7589/2015-05-113

Journal of Wildlife Diseases, 52(2), 2016, pp. 242–252

***RANAVIRUS* CAUSES MASS DIE-OFFS OF ALPINE AMPHIBIANS IN THE SOUTHWESTERN ALPS, FRANCE**

Claude Miaud,[1,6] Françoise Pozet,[2] Nadine Curt Grand Gaudin,[3] An Martel,[4] Frank Pasmans,[4] and Sophie Labrut[5]

Current Biology 24, 2586–2591, November 3, 2014 ©2014 The Authors http://dx.doi.org/10.1016/j.cub.2014.09.028

Report

Collapse of Amphibian Communities Due to an Introduced *Ranavirus*

Stephen J. Price,[1,2,7,*] Trenton W.J. Garner,[1] Richard A. Nichols,[2] François Balloux,[2] César Ayres,[4] Amparo Mora-Cabello de Alba,[5] and Jaime Bosch[6]
[1]Institute of Zoology, Zoological Society of London, Regents Park, London NW1 4RY, UK
[2]The School of Biological and Chemical Sciences, Queen Mary University of London, London E1 4NS, UK
[3]UCL Genetics Institute, University College London, Gower Street, London, WC1E 6BT, UK
[4]Asociación Herpetológica Española, José Gutiérrez Abascal 2, 28006 Madrid, Spain
[5]Parque Nacional Picos de Europa, Avenida Covadonga 43, 33550 Cangas de Onís, Asturias, Spain
[6]Museo Nacional de Ciencias Naturales, CSIC, José Gutiérrez Abascal 2, 28006 Madrid, Spain

ranges. They infect and cause disease in fish and reptiles but are noted for their ability to cause lethal disease in amphibians in the Americas, Europe, Asia, and Australia [5, 7–17]. Despite *Ranavirus*'s broad geographic distribution and documented multihost epizootics in amphibian communities [18], quantitative evidence for amphibian demographic decline due to ranavirosis has previously been reported for only a single amphibian host species [19].

Disease and Mass Mortality

We have continued to record mass mortality events consistent with ranavirosis affecting amphibian communities at four locations in the PNPE (Áliva, Ercina, Lloroza, and Mofetas [ALIVA, ERC, LLOR, and MON], Figure 1). During annual field surveys, we encountered numerous dead and dying adult, juvenile, and larval caudate and anuran amphibians, including all six com-

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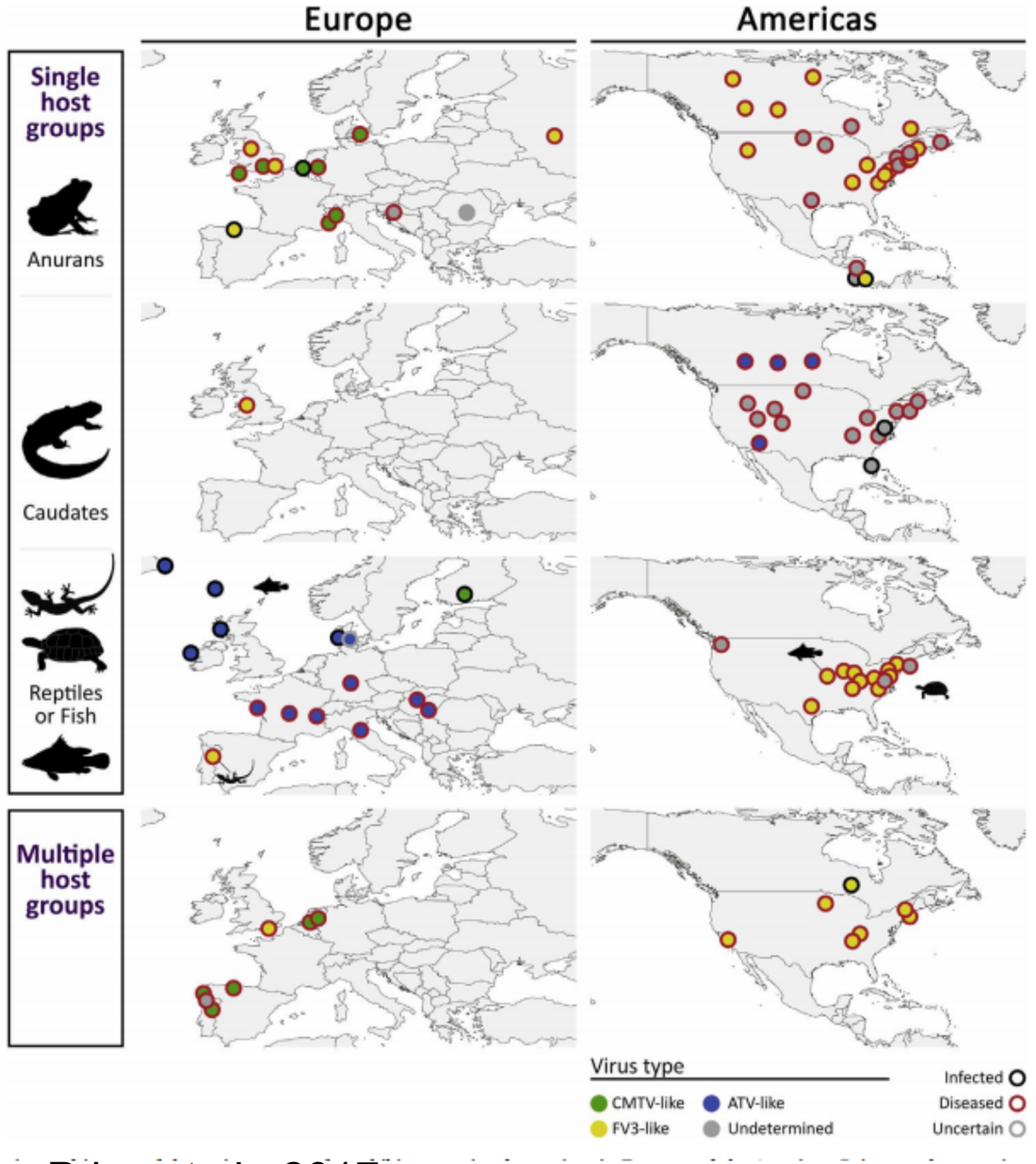
SCIENTIFIC REPORTS

OPEN

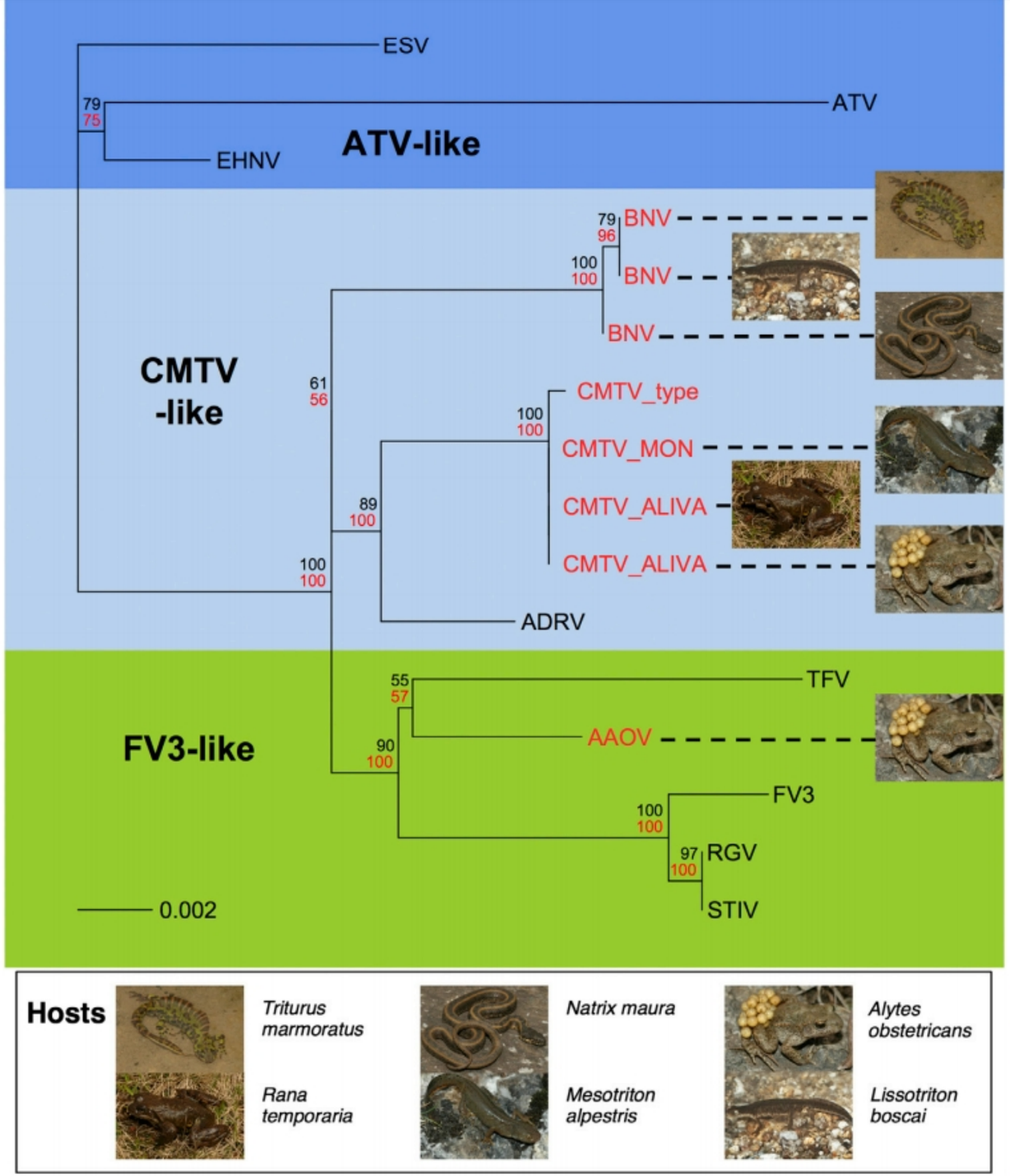
Impact of asynchronous emergence of two lethal pathogens on amphibian assemblages

Received: 23 September 2016
Accepted: 17 January 2017
Published: 27 February 2017

Gonçalo M. Rosa[1,2,3,4], Joana Sabino-Pinto[5], Telma G. Laurentino[6,7], An Martel[8], Frank Pasmans[8], Rui Rebelo[3], Richard A. Griffiths[1], Anke C. Stöhr[9], Rachel E. Marschang[9,10], Stephen J. Price[2,11], Trenton W. J. Garner[2] & Jaime Bosch[12]



Price et al., 2017



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RANAVIRUSES IN EUROPE

- Recent introductions?
- ~ trade
- Impact:
  - Local variation
  - Extinction?
  - Poorly understood
- 15 species / 10 genera

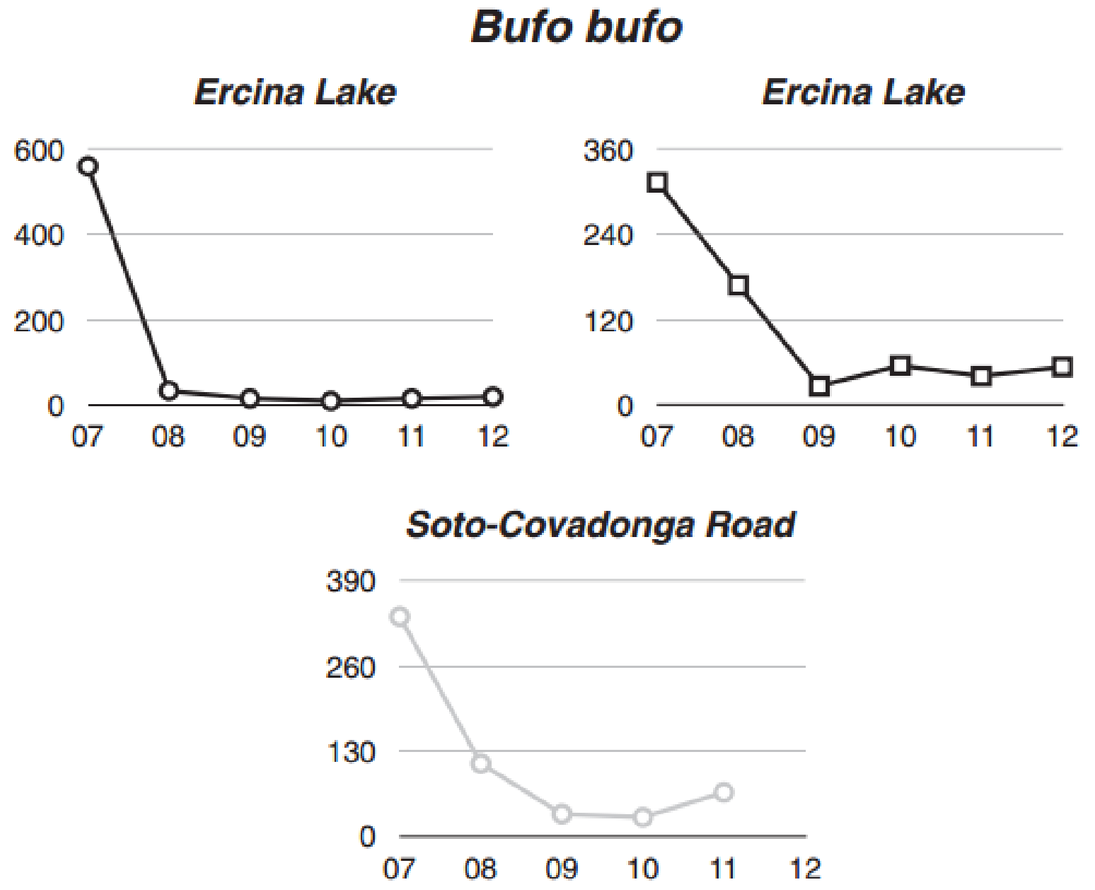

Figure 3. Population Trends for Declining Species in the Picos de Europa National Park

Common midwife toad ranavirus (CMTV) infections have been confirmed within amphibian communities at Moñetas, Lloroza, and Ercina Lake (black

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RESERVOIRS

- Aquatic & terrestrial amphibians!
- Fish (?), reptiles?
- Environment

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DIAGNOSTICS AND MITIGATION

- (q)PCR / necropsy / histopathology / virology
- BUT: live animals / carriers!
- Mitigation:
  - OIE listed
  - Captivity: ?
  - Natural populations: ?

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OTHER DISEASES, UNKNOWN IMPACT

- Herpesviruses
- Chlamydiales
- Mesomycetozoans (*Amphibiocystidium*)
- Oomycetes

© J. Helder

TAKE HOME MESSAGE

- Bd, Bsal, ranaviruses: negative impact
- Several potentially virulent pathogens
- Mitigation in natural populations?
  - Sustainable control measures
- Prevention is key:
  - Trade: quarantine, entry control
  - Hygiene measures
  - Monitoring

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THANK YOU FOR YOUR ATTENTION

Marion Jouffroy

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