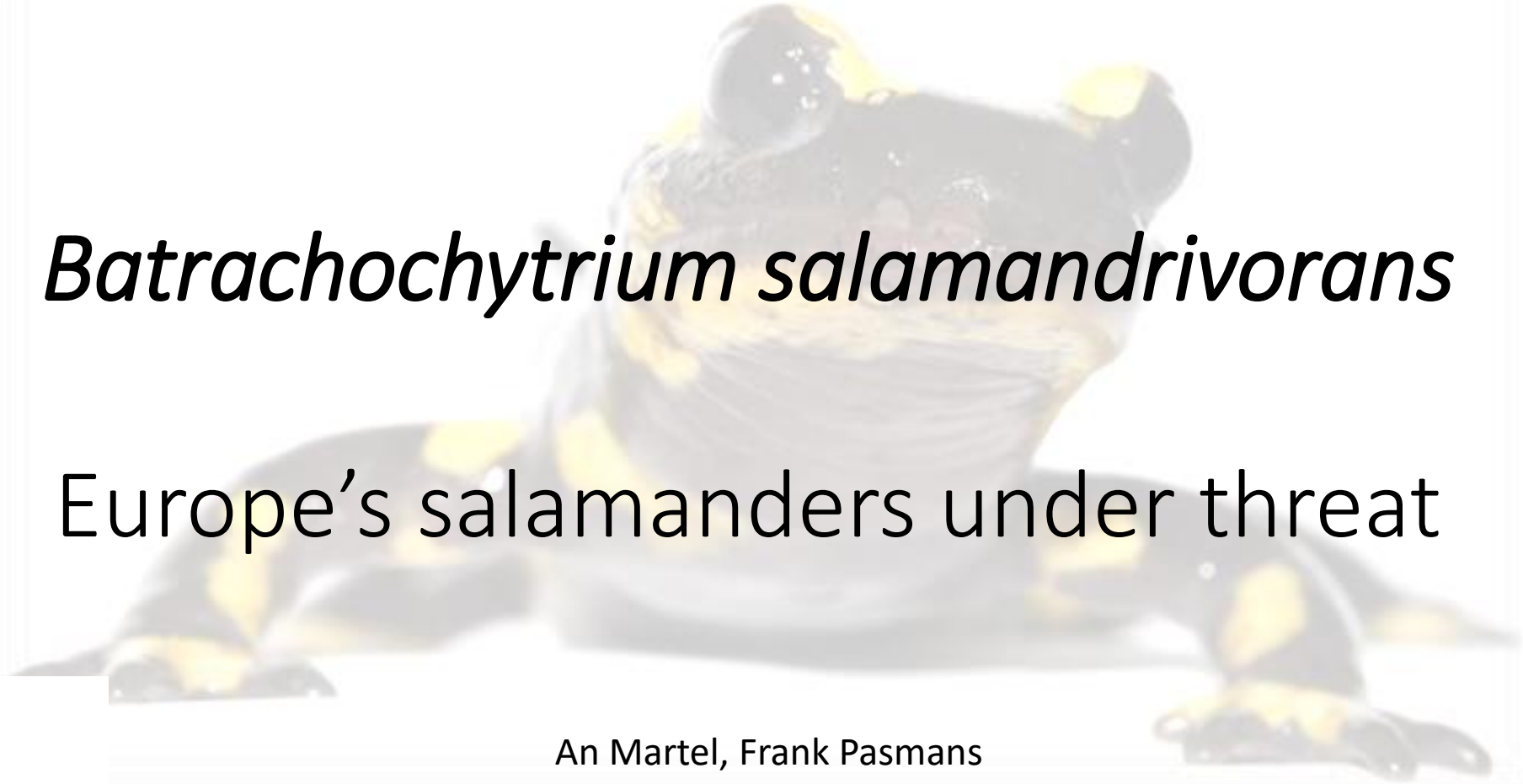


Batrachochytrium salamandrivorans

Europe's salamanders under threat

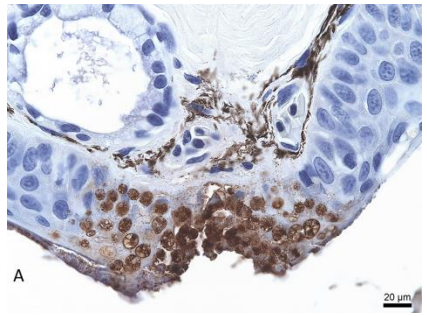
An Martel, Frank Pasmans
An.Martel@ugent.be

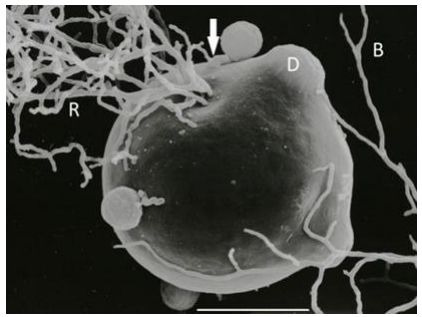
Batrachochytrium salamandrivorans (Bsal)

Chytrid fungus

Sporangium – spores: motile and non motile

Lethal skin disease





Martel et al., 2013

Amphibia-Reptilia 34 (2013): 233-239

Rapid enigmatic decline drives the fire salamander (*Salamandra salamandra*) to the edge of extinction in the Netherlands

Annemarieke Spitzen-van der Sluijs[1,4,*], Frank Spikmans[1], Wilbert Bosman[1], Marnix de Zeeuw[2], Tom van der Meij[2], Edo Goverse[1], Marja Kik[3], Frank Pasmans[4], An Martel[4]

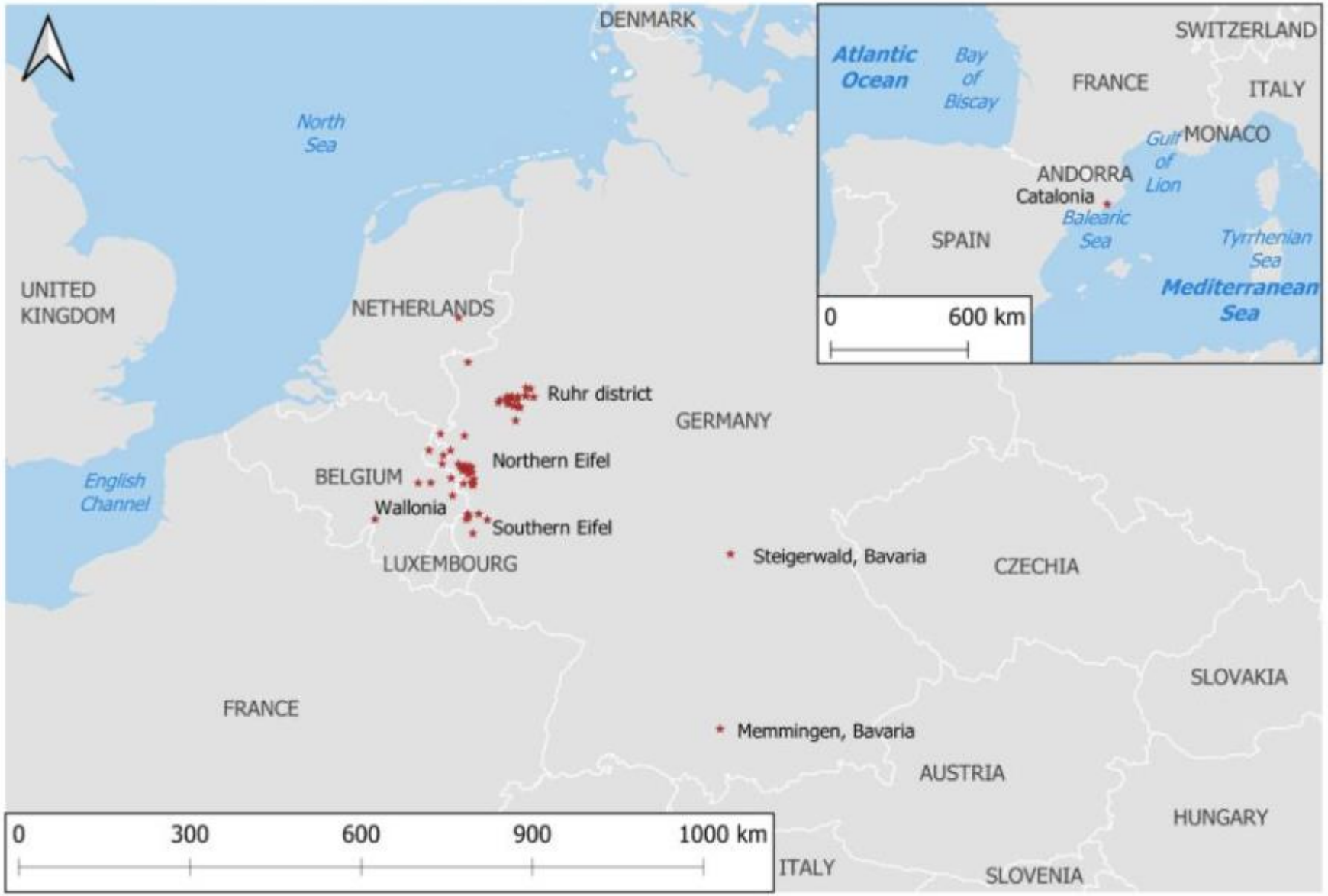
SALAMANDRA **56**(3): 239–242
15 August 2020 | ISSN 0036–3375

SALAMANDRA
German Journal of Herpetology

Correspondence

***Bsal*-driven salamander mortality pre-dates the European index outbreak**

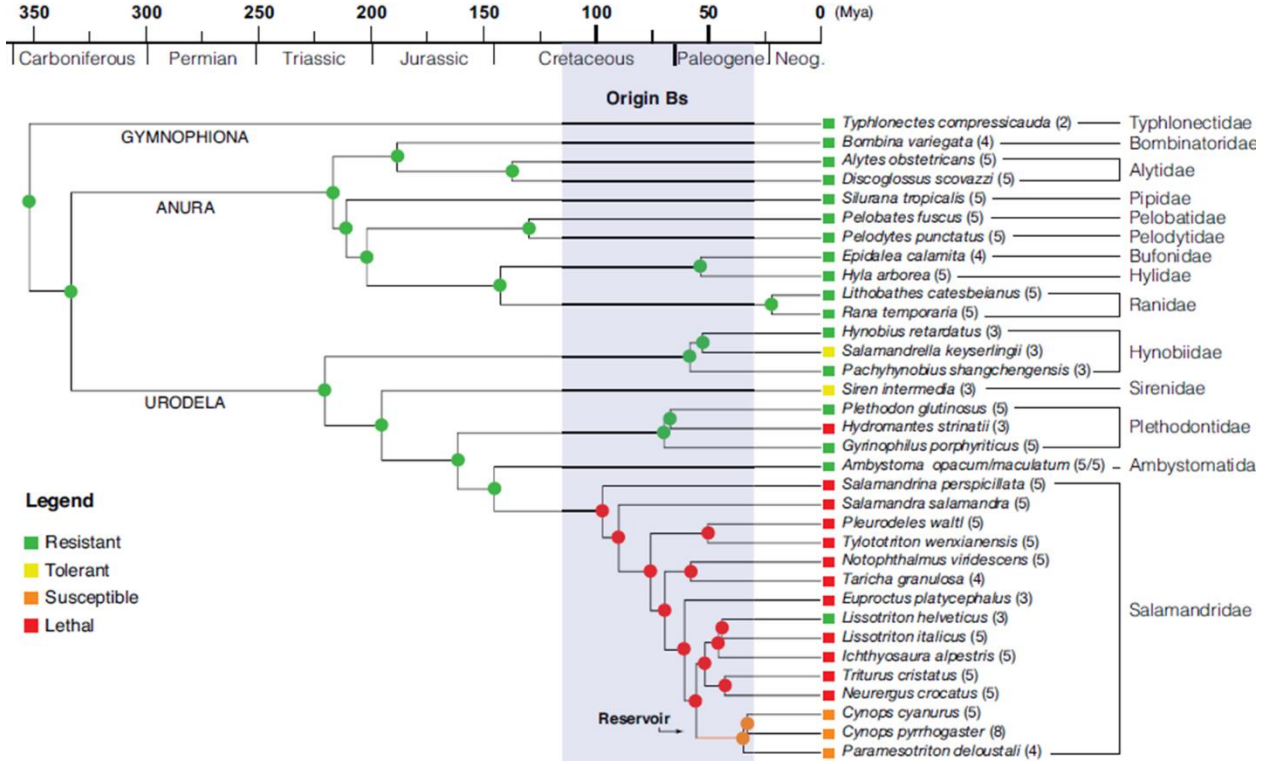
Stefan Lötters[1], Michael Veith[1], Norman Wagner[1], An Martel[2] & Frank Pasmans[2]



HOTLINES
Passive surveillance

Bsaleurope.com

Host susceptibility



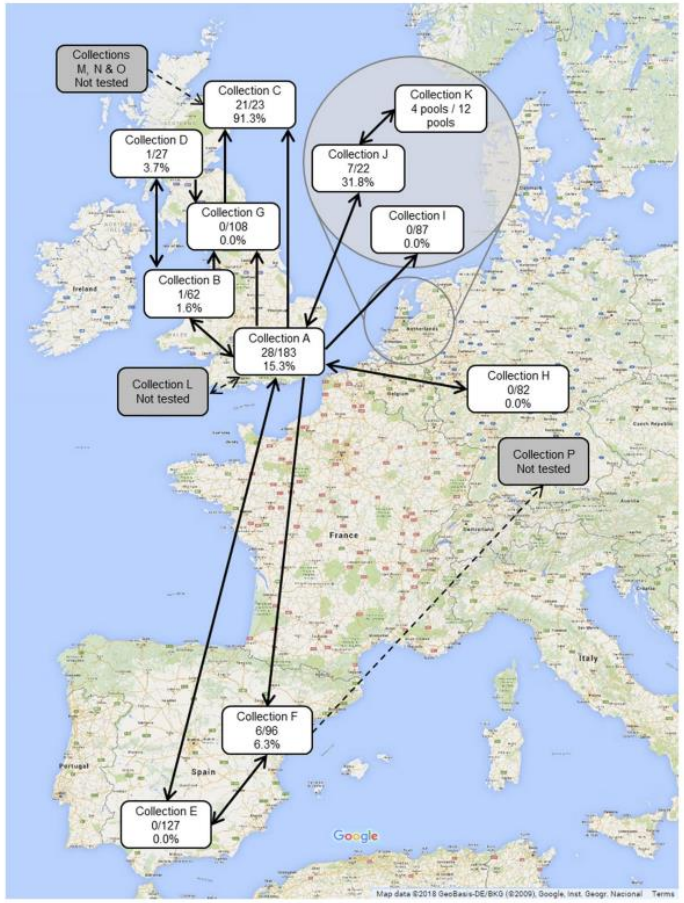
Martel et al., 2014

Skin glycosylation pattern

Wang et al., in press

Field mortality

Mortality in captive Urodela



Sci Rep. 2018; 8: 13845.
Published online 2018 Sep 14. doi: 10.1038/s41598-018-31800-z
PMCID: PMC6138723
PMID: 30218076

Epidemiological tracing of *Batrachochytrium salamandrivorans* identifies widespread infection and associated mortalities in private amphibian collections

Liam D. Fitzpatrick,[1] Frank Pasmans,[2] An Martel,[2] and Andrew A. Cunningham[1]

Coinfections

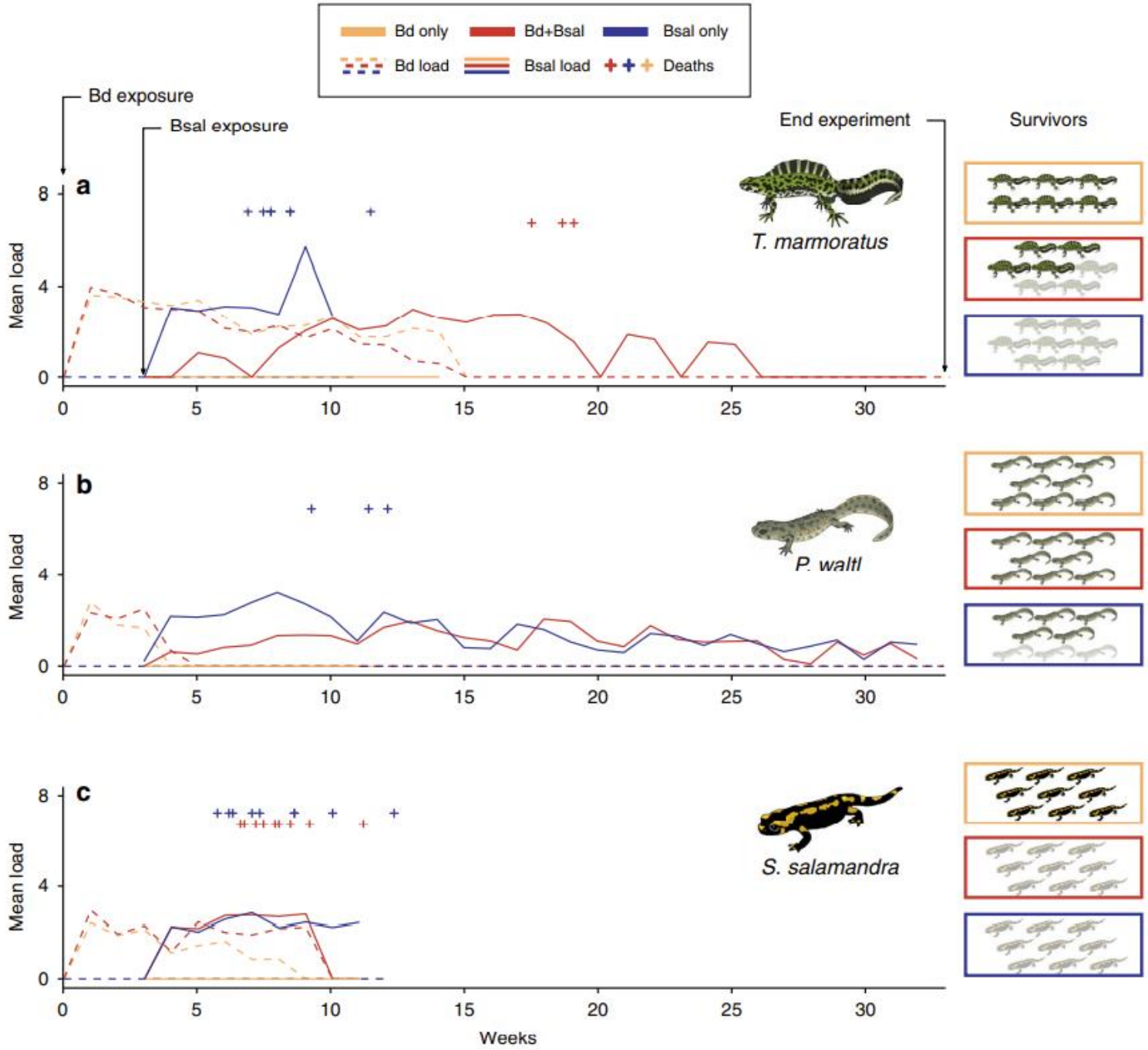
nature COMMUNICATIONS

ARTICLE

https://doi.org/10.1038/s41467-020-19241-7 OPEN

Presence of low virulence chytrid fungi could protect European amphibians from more deadly strains

Mark S. Greener[1], Elin Verbrugghe[1], Moira Kelly[1], Mark Blooi[1], Wouter Beukema[1], Stefano Canessa[1], Salvador Carranza[2], Siska Croubels[3], Niels De Troyer[4], Daniel Fernandez-Giberteau[5], Peter Goethals[4], Luc Lens[6], Zhimin Li[1], Gwij Stegen[1], Diederik Strubbe[6], Robby van Leeuwenberg[1], Sarah Van Praet[1], Mireia Vila-Escale[7], Muriel Vervaeke[8], Frank Pasmans[1] & An Martel[1]✉



Estimating threat, action plan development

Mitigating *Batrachochytrium salamandrivorans* in Europe

Batrachochytrium salamandrivorans Action Plan for European urodeles

Family	Species/subspecies	Estimated susceptibility to Bsal				Population level risk of extinction	Confidence	Taxon level risk of extinction			Range size*	IUCN Red List Category**	Listed in Annex IV Habitats Directive
		Laboratory trial	Field outbreak	Captivity	Inferred from phylogeny			10 years	100 years	Confidence			
Salamandridae	*Lissotriton vulgaris vulgaris*	Moderate[10]	No[8,9]	NA	NA	Medium	High	Low	Low	High	>25	NA	No
Salamandridae	*Lyciasalamandra helverseni*	High[2]	NA	NA	NA	High	Low	High	High	Low	1-5	VU	Yes
Salamandridae	*Lyciasalamandra luschani***	NA	NA	NA	High	High	Low	High	High	Low	1-5	VU	Yes
Salamandridae	*Lyciasalamandra luschani basoglui*	NA	NA	NA	High	High	Low	High	High	Low	1-5	NA	Yes
Salamandridae	*Pleurodeles waltl*	High[1,3]	NA	NA	NA	High	Low	Low	Medium	Low	>25	NT	No
Salamandridae	*Salamandra atra*	NA	NA	Yes[6]	NA	High	Low	Low	Medium	Low	>25	LC	Yes
Salamandridae	*Salamandra atra atra*	NA	NA	NA	High	High	Low	Low	Medium	Low	>25	NA	Yes
Salamandridae	*Salamandra atra aurorae*	NA	NA	NA	High	High	Low	High	High	Low	1-5	NA	Yes
Salamandridae	*Salamandra atra pasubiensis*	NA	NA	NA	High	High	Low	High	High	Low	1-5	NA	Yes
Salamandridae	*Salamandra atra prenjensis*	NA	NA	NA	High	High	Low	Medium	High	Low	6-25	NA	Yes
Salamandridae	*Salamandra corsica*	NA	NA	Yes[6,11]	NA	High	Low	Medium	High	Low	6-25	LC	No
Salamandridae	*Salamandra lanzai*	NA	NA	NA	High	High	Low	High	High	Low	1-5	VU	Yes

European Commission

http://bsaleurope.com/wp-content/uploads/2021/03/Bsal-Action-Plan.pdf

Risk assessment European urodeles

10/40 (25%): high risk

6/40 (15%): medium risk

} 81% annex IV Habitats Directive

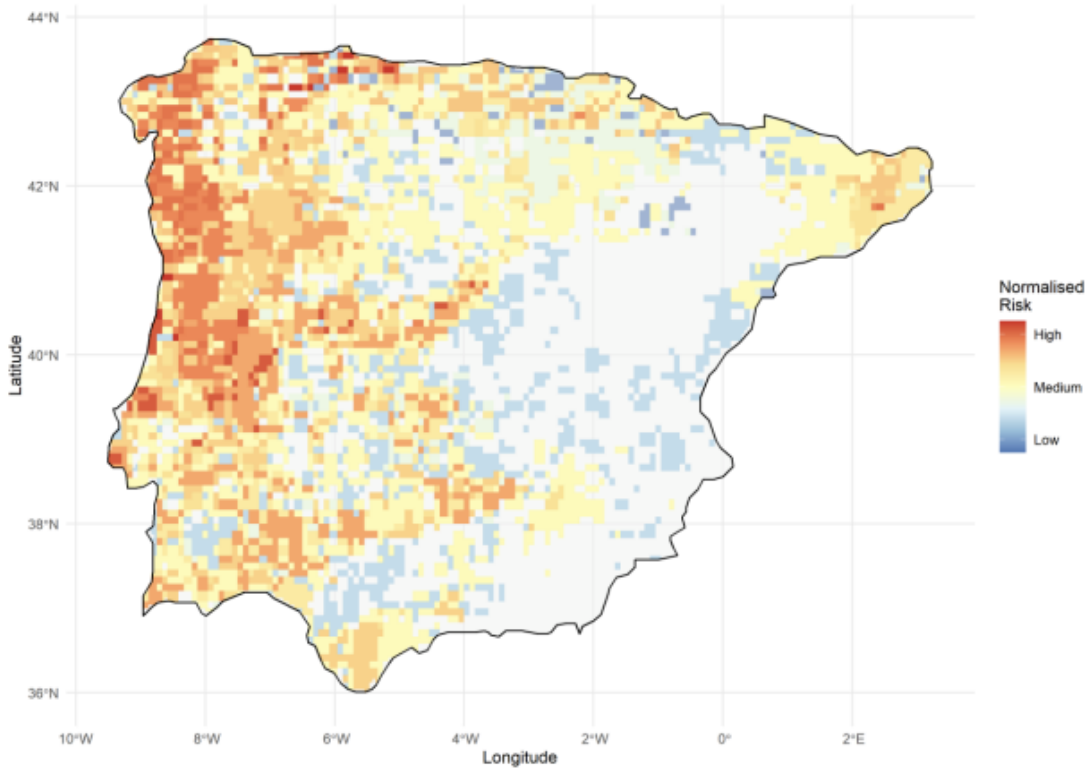


Figure 3. Spatial prediction of risk to Iberian urodeles from *Bsal* introduction. Each cell (10 km × 10 km) represents the normalized risk to biodiversity loss, given both species richness and the predicted susceptibility of inhabitants to *Bsal* infection. Darker red cells, as in the northwest/west regions of the peninsula, indicate areas likely to be most at risk should *Bsal* be introduced. Transparent gray cells are those with no salamander inhabitants.

Six conservation units

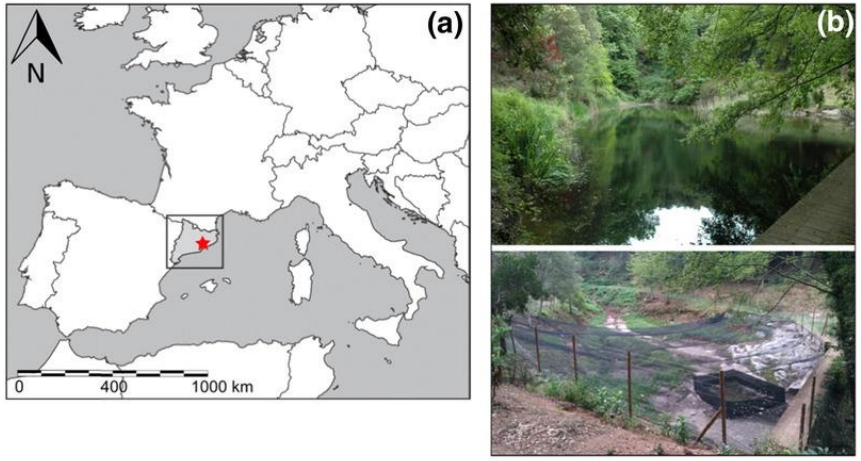
Chioglossa l. lusitanica
Calotriton arnoldi
S. s. longirostris
S. s. crespoi
S. s. bernardezi
S. s. almanzoris

Open Access Article

Batrachochytrium salamandrivorans Threat to the Iberian Urodele Hotspot

by Jaime Bosch [1,2,*], An Martel [3], Jarrod Sopniewski [4], Barbora Thumsová [1,2,5], Cesar Ayres [5], Ben C. Scheele [4,†], Guillermo Velo-Antón [6,7,†] and Frank Pasmans [3,†]

Mitigation



1. Preventing further spread of Bsal
    1. Fencing
    2. Host removal

2. Reducing fungal load in environment
    1. Habitat management and disinfection
    2. Biosecurity protocols

3. Surveillance

Fast and drastic approach resulted in containment of Bsal in a two year time frame

Triturus marmoratus (picture: courtesy Daniel Fernandez Guiberteau)

POLICY PERSPECTIVE

Conservation Letters
A journal of the Society for Conservation Biology
Open Access
WILEY

Integral chain management of wildlife diseases

An Martel[1] | Mireia Vila-Escale[2] | Daniel Fernández-Giberteau[3] | Albert Martinez-Silvestre[4] | Stefano Canessa[1] | Sarah Van Praet[1] | Pep Pannon[2] | Koen Chiers[1] | Albert Ferran[2] | Moira Kelly[1] | Mariona Picart[2] | Dolors Piulats[5] | Zhimin Li[1] | Viviana Pagone[5] | Laia Pérez-Sorribes[3] | Carolina Molina[3] | Aïda Tarragó-Guarro[6] | Roser Velarde-Nieto[7] | Francesc Carbonell[8] | Elena Obon[8] | Diego Martínez-Martínez[9] | Daniel Guinart[2] | Ricard Casanovas[6] | Salvador Carranza[5] | Frank Pasmans[1]

Proc Biol Sci. 2018 Aug 29; 285(1885): 20180758.
Published online 2018 Aug 22. doi: 10.1098/rspb.2018.0758

PMCID: PMC6125908
PMID: 30135150

Disruption of skin microbiota contributes to salamander disease

Molly C. Bletz,[1,2] Moira Kelly,[3] Joana Sabino-Pinto,[2] Emma Bales,[2] Sarah Van Praet,[3] Wim Bert,[4] Filip Boyen,[3] Miguel Vences,[2] Sebastian Steinfartz,[2] Frank Pasmans,[3] and An Martel[3]

ECOLOGY LETTERS

Letter | Full Access

Microclimate limits thermal behaviour favourable to disease control in a nocturnal amphibian

Correction(s) for this article

Wouter Beukema, Frank Pasmans, Sarah Van Praet, Francisco Ferri-Yáñez, Moira Kelly, Alexandra E. Laking, Jesse Erens, Jeroen Speybroeck, Kris Verheyen, Luc Lens, An Martel

First published: 06 October 2020 | https://doi.org/10.1111/ele.13616 | Citations: 2

Further needs for action

- Spontaneous elimination : highly unlikely
  - Avert further establishment and future loss of European urodelan diversity
  - Disease eradication should be envisaged (at least attempted!)

- Early Warning system
- National action plans
- Clean trade
- Coordination at European level
- Developing novel mitigation strategies