

# *Décrypter l'émergence de Bilharziose en Corse, une approche One Health*

**Jérôme Boissier**

**RIVOC 23 juin 2022**

# Schistosomiasis

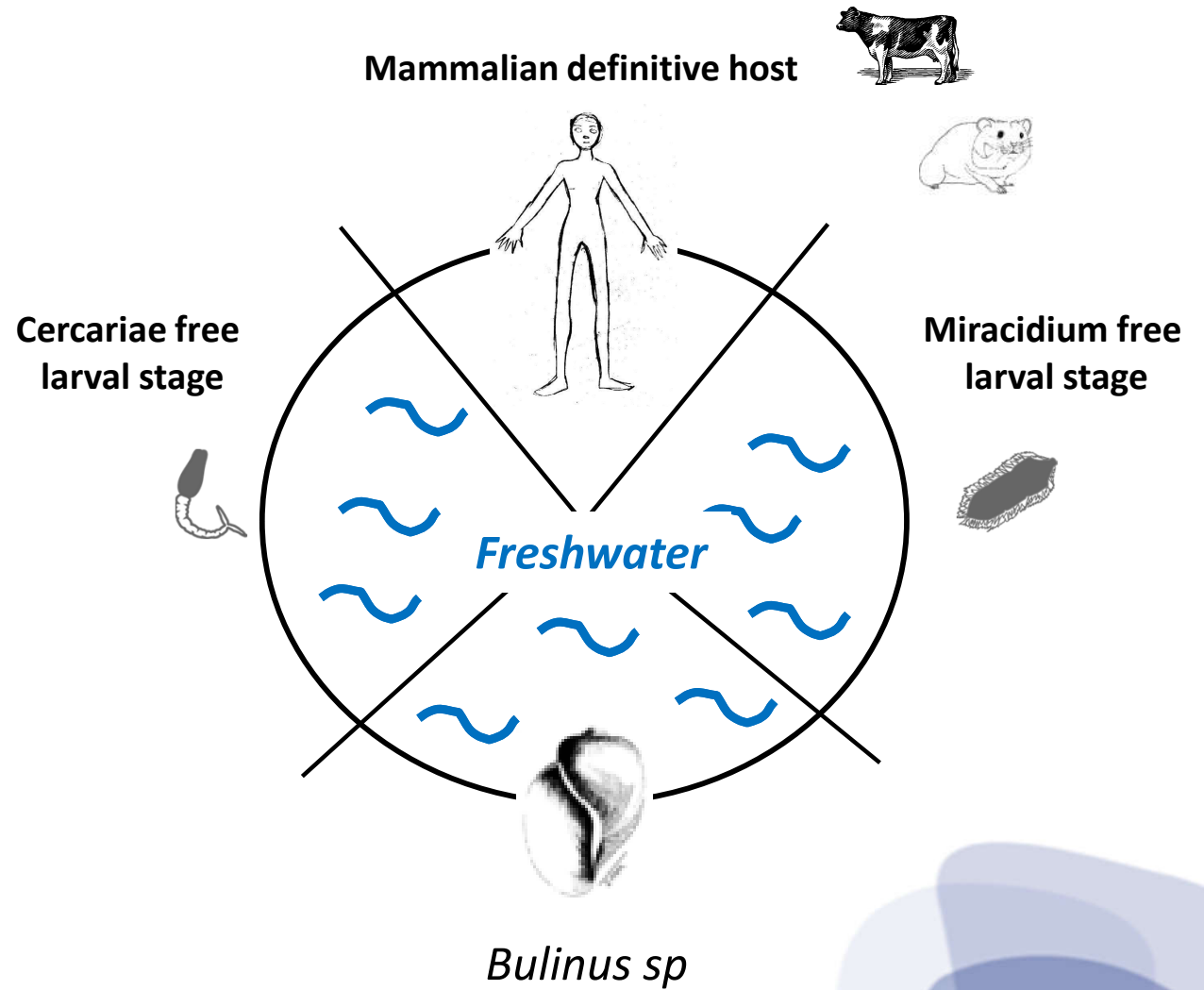
**600-800 millions exposed people**

**78 countries**

**85% in Africa**


**230 millions infected people**




**230 000 dead/years**



	Cavu River		Cavu River				Solenzara River	Cavu River Solenzara	
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cases	2	River closed	1	2	5	2	1	2	3


*Berry et al 2014 (EID)*  
*Richter et al 2014 (Eurosurveillance)*

  
 Autochthonous Schistosomiasis is a notifiable disease in France

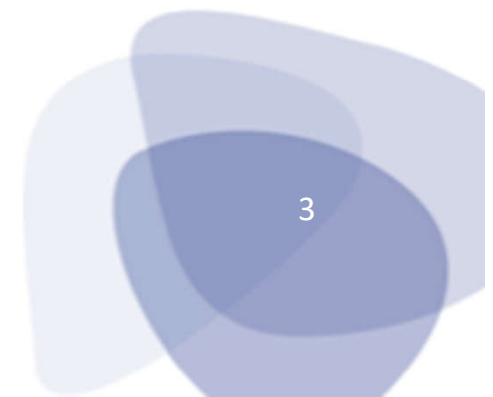
  
 French nationwide screening  
  
 38,310 individuals serologically tested  
  
**106 cases**

Modeling estimation: 338 [166-510]<sup>IC95</sup>

*Noel et al. 2018 (Clin Microbiol Infect)*

*Brunet et al. 2015 Int J Inf Dis*

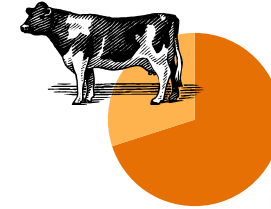
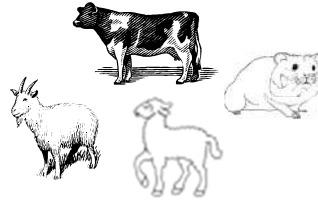
*Patard et al. 2015 Archive de Pédiatrie*





**Hybrid parasite**  
**(Human infecting x Animal infecting parasite)**  
**(*S. haematobium* x *S. bovis*)**

**Genomic characterisation**



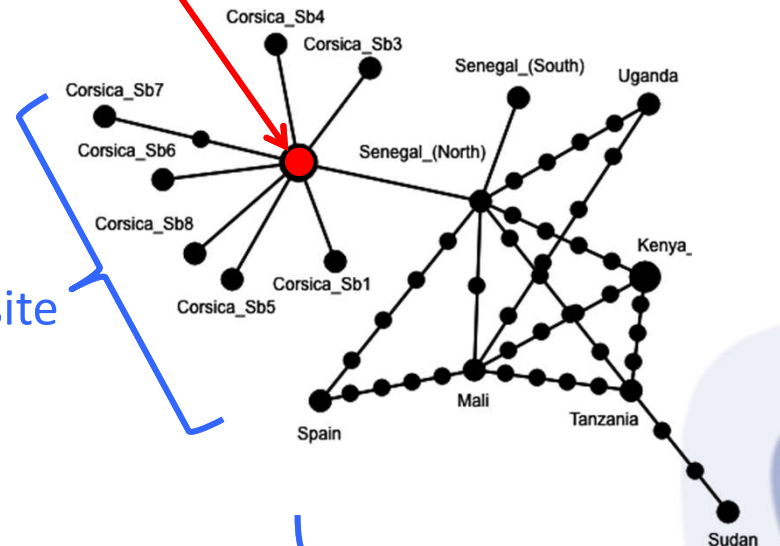
*Rey et al Plos Path 2021*  
*Kincaid-smith et al. Plos NTD 2022*



**West African Origin**

Most common haplotype in Corsica + Senegal

Human Parasite

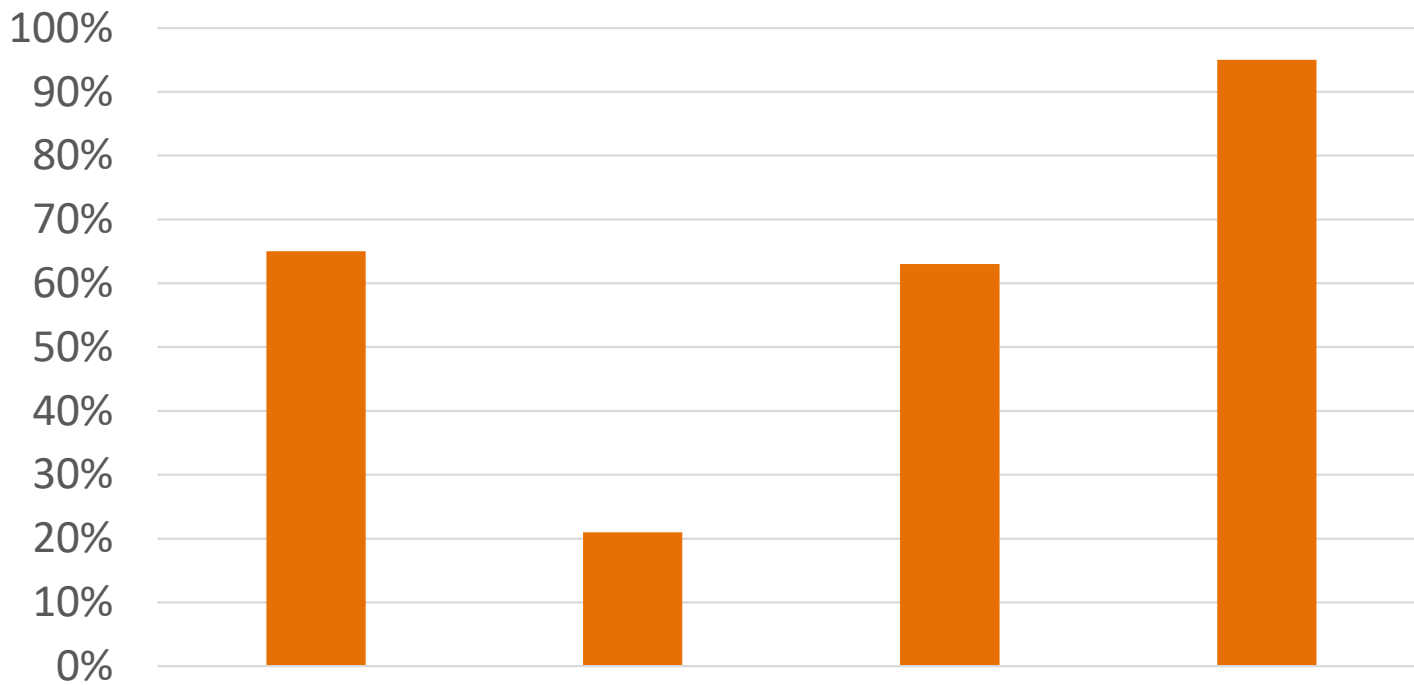


Cattle Parasite

*Boissier et al Lancet ID, 2015*  
*Boissier et al Lancet ID, 2016*

**In Africa...**

*Hybrid prevalence in West Africa*



Senegal

Cameroon

Côte d'Ivoire

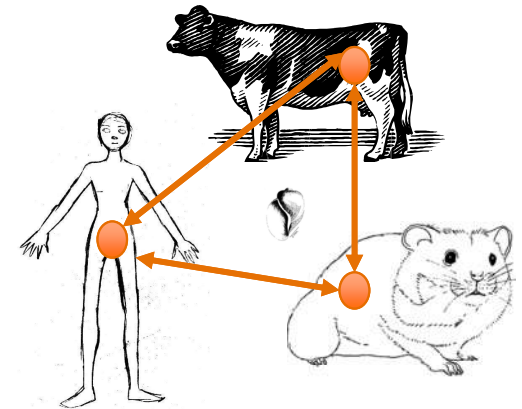
Nigéria

n=1,300 parasites  
82% of patients  
(56 patients)

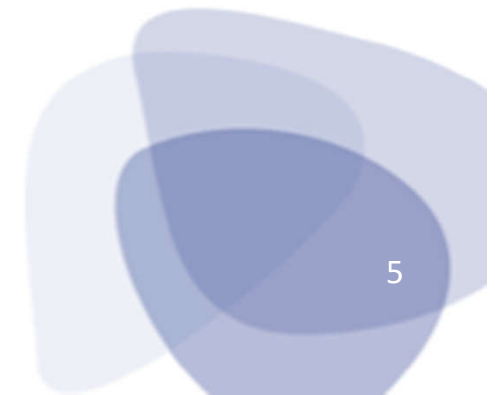
n=2,200 parasites  
100% of patients  
(90 patients)

n=1,300 parasites  
100% of patients  
(72 patients)

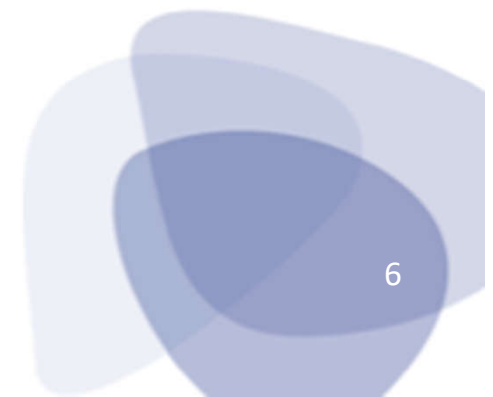
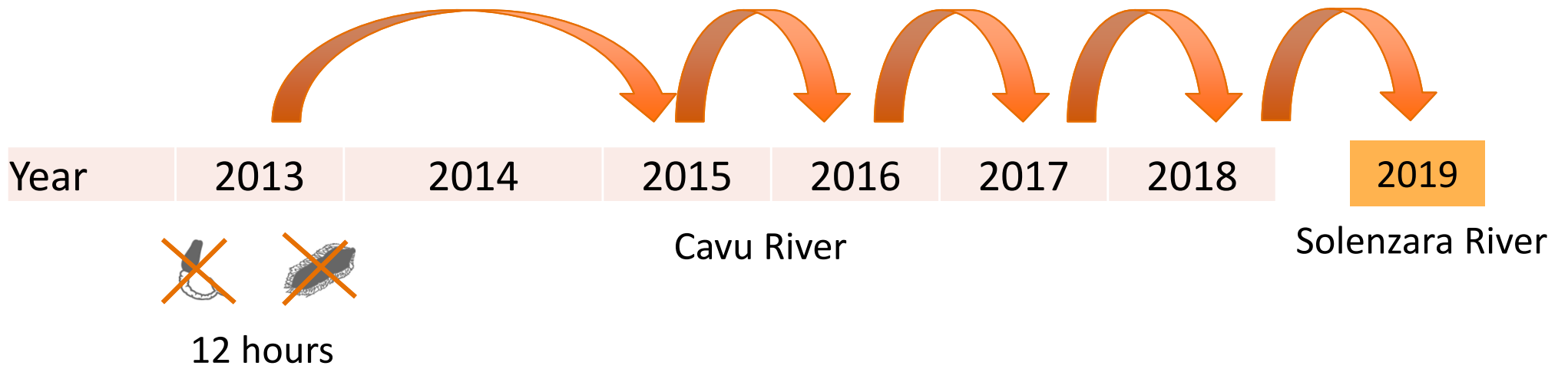
**Bénin**



*Savassi et al. P Res 2021*  
*Savassi et al. P Res 2020*

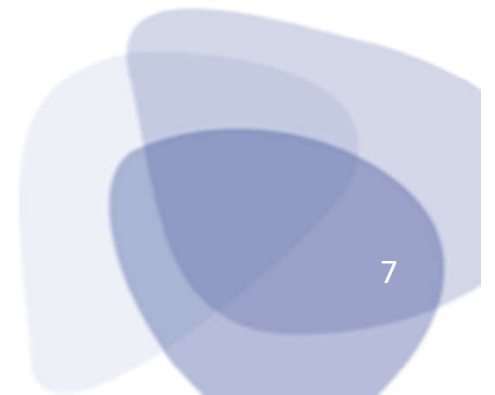


# How to explain this year to year transmission ?





**Human**



## Site 8



## Site 9



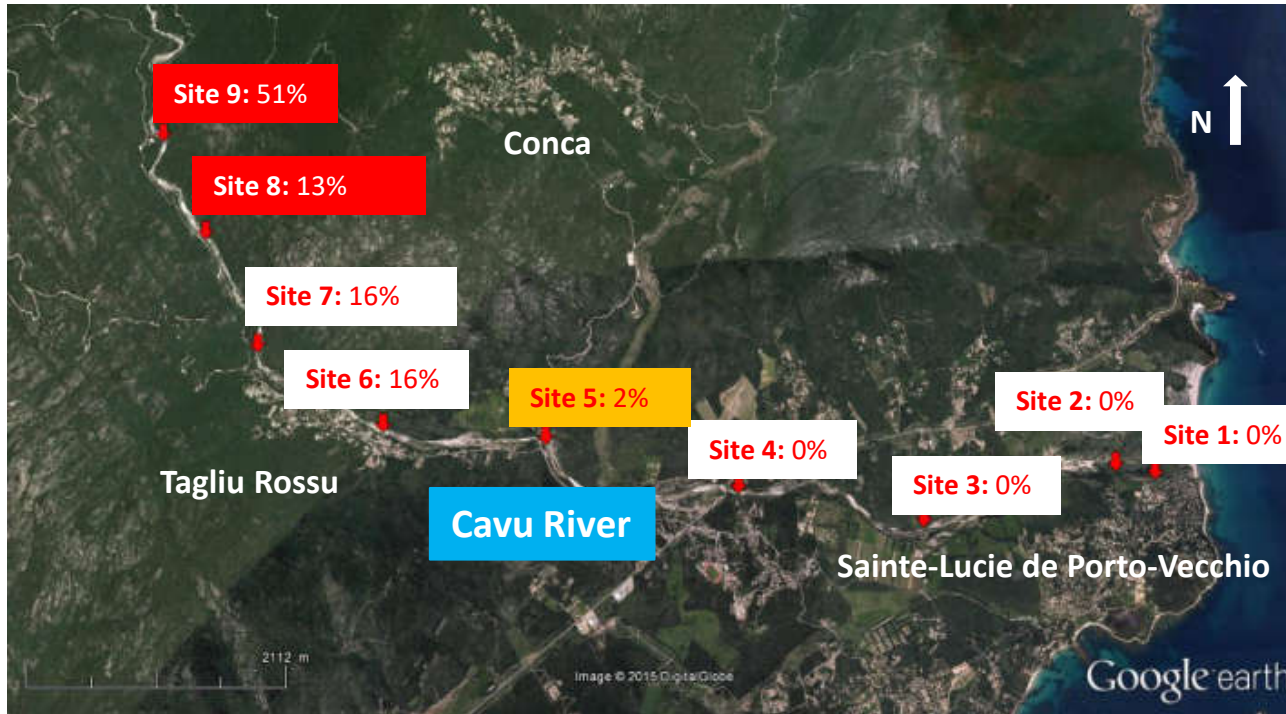
	site 5	site 6	site 7	site 8	site 9
Tourist Family 1					1
Tourist Family 2					1
Tourist Family 3					1
Tourist Family 4					1
Local 1					1
Local 2					1
Local 3				1	
Local 4		1	1	1	
Local 5		1	1	1	
Local 6		1			1
Local 7			1		
Local 8			1		1
Local 9			1		1
Local 10	1	1			1
Local 11				1	
Local 12					1
Local 13				1	
Local 14				1	
Local 15					1
Local 16		1	1		1
Local 17					1
Local 18					1
Local 19					1
Local 20					1
Local 21					1
Local 22	1	1	1		1
Local 23		1			1
Local 24					1
Local 25					1
Local 26					1

2	7	7	6	23
4%	16%	16%	13%	51%



**The CAVU river, the most frequented river in South Corsica**

In touristic season 3.000 to 5.000 / day



**Developing Endemicity of Schistosomiasis, Corsica, France**

Camilla Rothe, Thorbjörn Zimmer, Mirjam Schunk, Claudia Wallrauch, Kerstin Helfrich, Fatih Gültekin, Gisela Bretzel, Jean-François Allienne, Jérôme Boissier



Boissier et al Lancet ID 2016

Rothe et al EID 2020  
Wellinghausen et al P. Res 2022

➔ **Problem of diagnostic**

ELISA + IHA => Western Blot

66% asymptomatic in Corsica (33% in general)

Median of diagnostic: 7 month after exposition

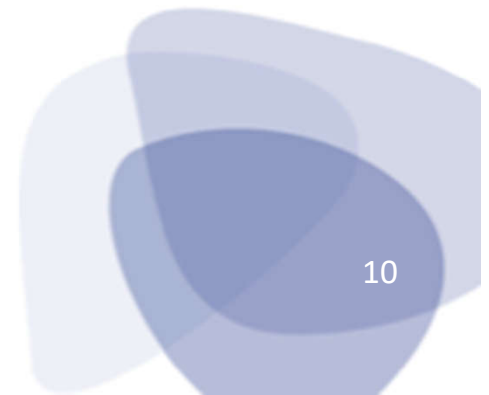
Only 30% of the patient with eggs (gold standard)

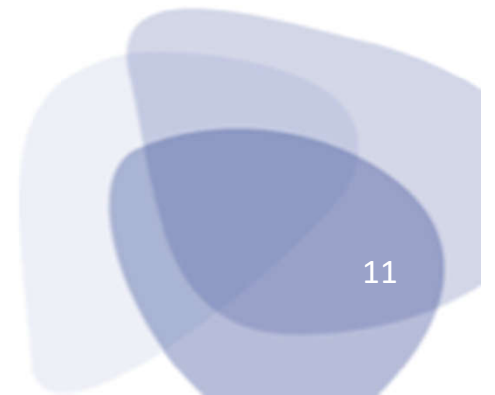
*Moné et al EID 2016; Beltrame et al EID 2015*

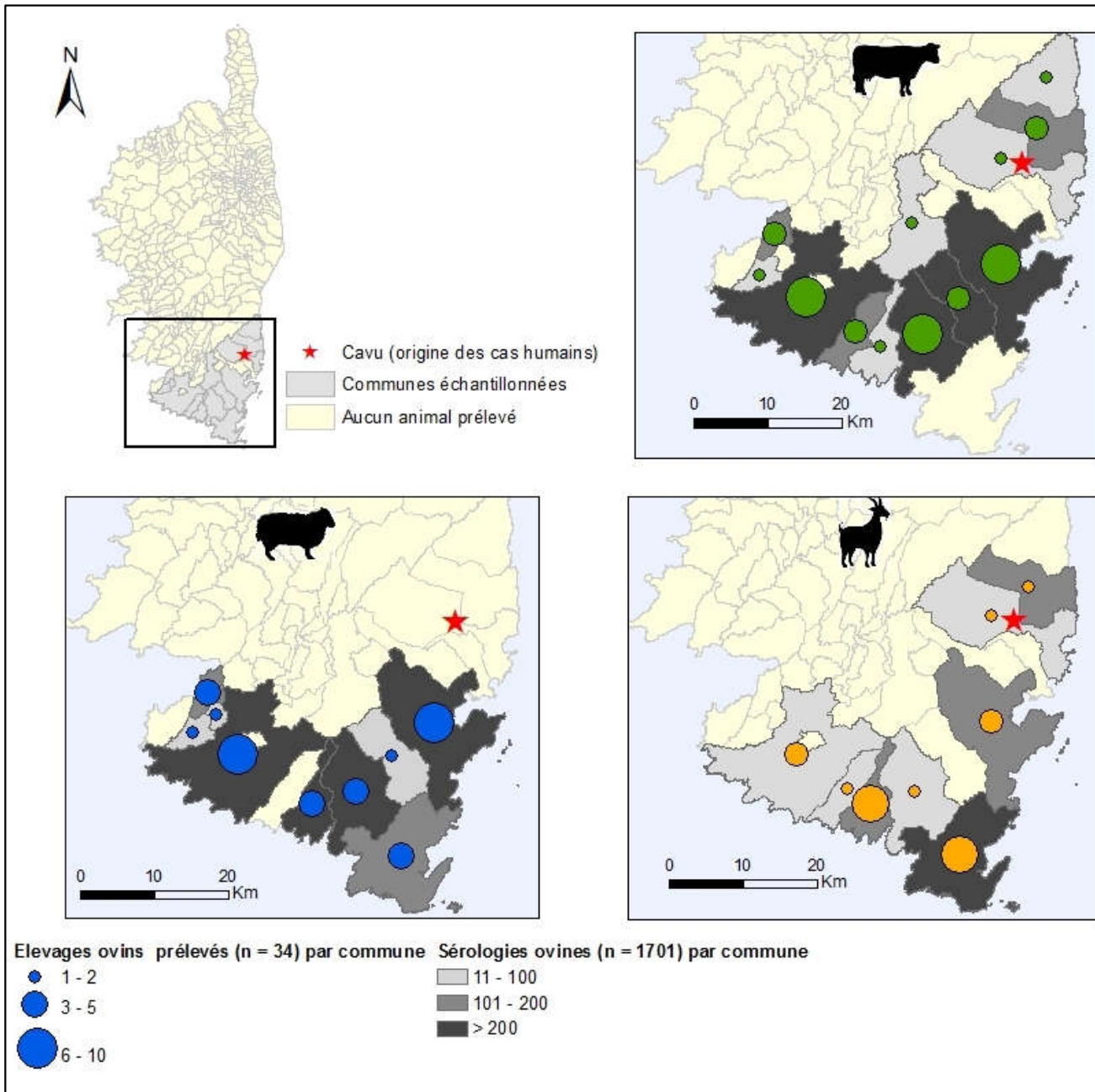
*Gautret et al EID 2015; Berry et al EID 2016*

*Gautret et al EID 2016*

➔ **Long lived parasite...but efficient treatment**







X Animal (farm)



X 1157 (108)



X 671 (18)



X 1651 (34)

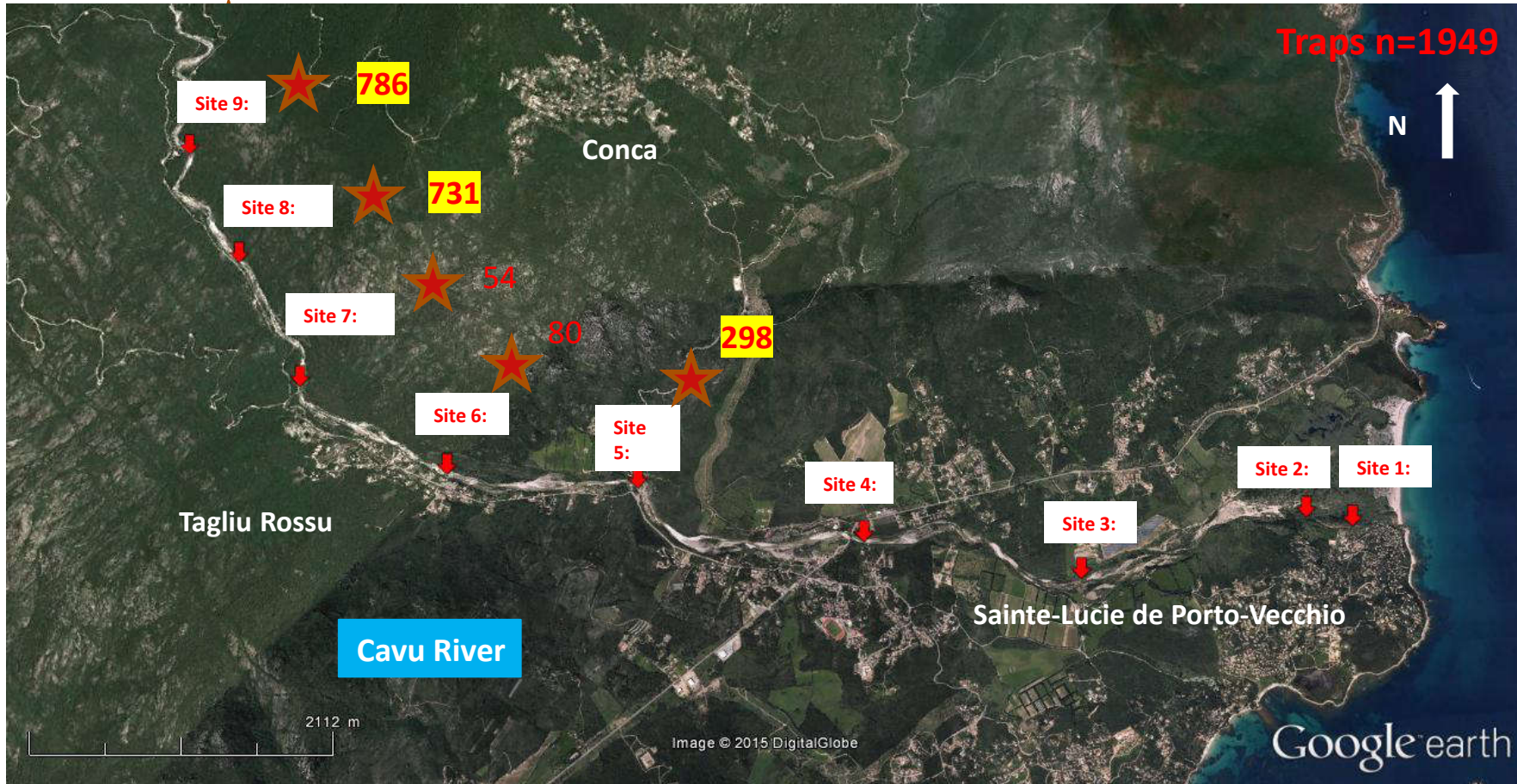


No Corsican livestock tested positive for schistosomiasis

*Oleaga et al Plos NTD 2019*

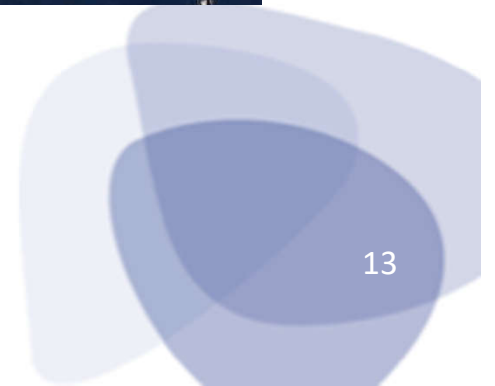
Animal diagnostic  
fiability ?  
(ELISA)

### Are rodents reservoir host for hybrid Schistosome in Corsica ?



2 positive rats

24/06/2022



## Other mammals .....?

*In Africa :*

Sheep, Cows, Camels, Buffaloes, Horses, Rats...  
(~21 species)

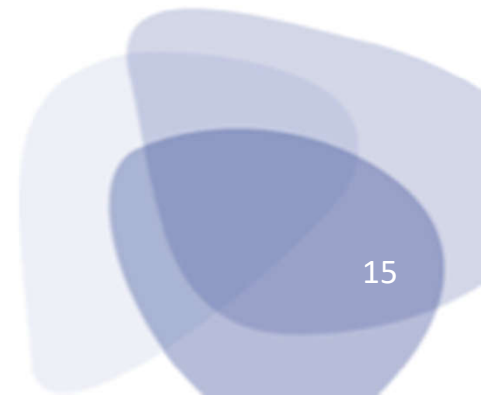
*In Europe ?*



Mouflon (*Ovis gmelini musimon*)



**Environnement**



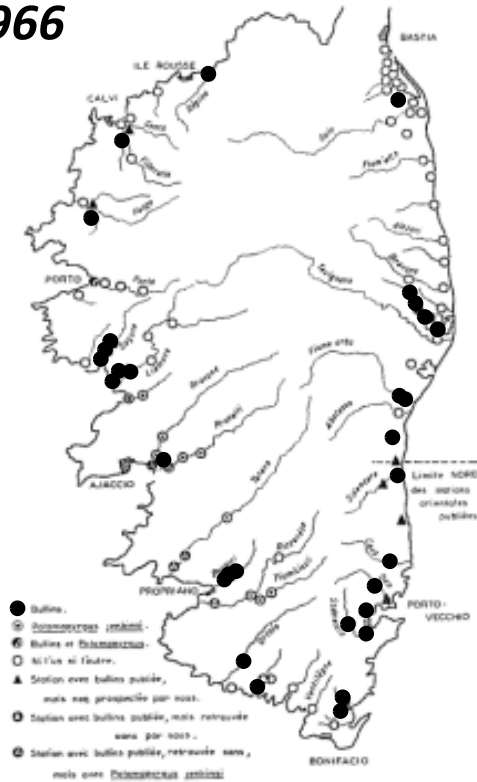
## Is the intermediate mollusc host present in Corsica ?

Bullins et bilharzioses en Corse

Répartition, fréquence et biologie de « *Bulinus truncatus* »

Par J.-M. DOBY, B. RAULT, S. DEBLOCK et A. CHABAUD (1)

1966



## Is the mollusc currently present in the CAVU river?

2014



## How to detect the presence of the mollusc ?

2019

Environmental DNA



*Mulero et al. eDNA 2019*  
*Mulero et al. Global Ecol Cons 2021*

+ Mediterranean coasts (IT, FR, ESP, PT, GR)  
 + All mediterranean islands



How to detect the presence of the mollusc ?



Targeted Approach (qPCR or ddPCR)

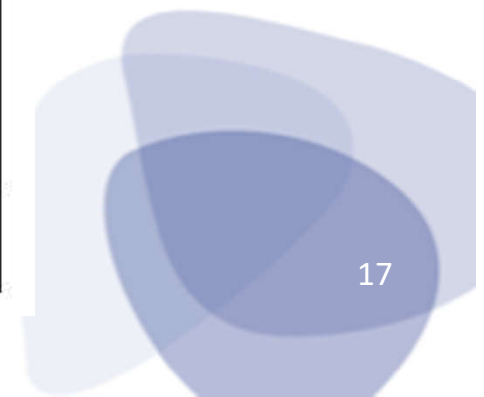
*Mulero et al. eDNA 2019*

Shore

(a)	Water sampled on the river shore						
Site	Water intake	Mulinu Bridge	A Tyroliana park	3 Pool	Solenzara river	University	
1L	Red	Green	Green	Green	Green	Green	Red
3L	Red	Green	Green	Green	Green	Green	Red
5L	Red	Green	Green	Green	Green	Green	
control	Red	Red		Red		Red	Red

Streambed

(b)	Water sampled on the river streambed						
Site	Water intake	Mulinu Bridge	A Tyroliana park	3 Pool	Solenzara river	University	
1L	Red	Green	Red	Green	Green	Green	Red
3L	Red	Green	Green	Green	Green	Green	Red
5L	Red	Green	Green	Green	Green	Green	
control	Red	Red		Red		Red	Red

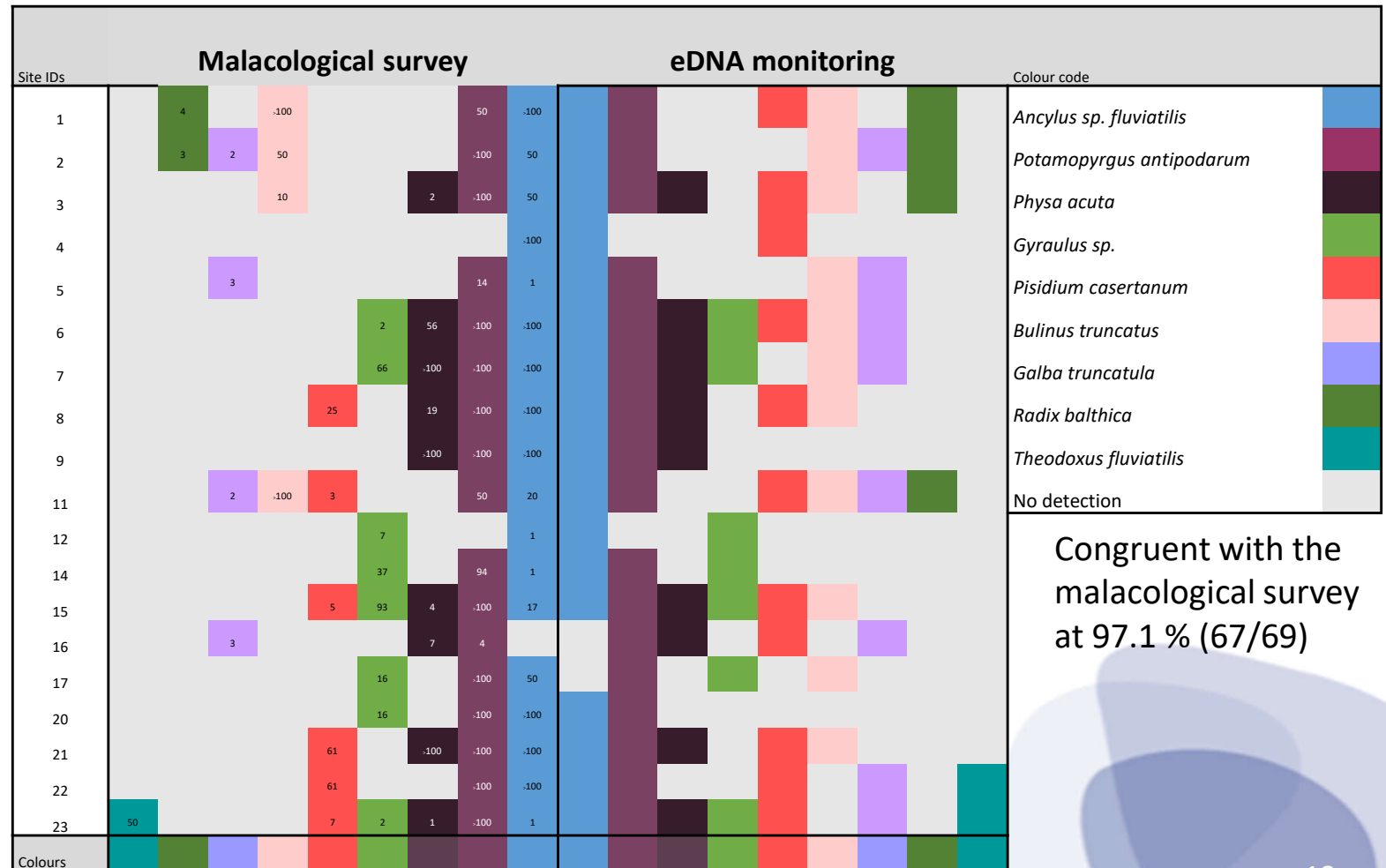
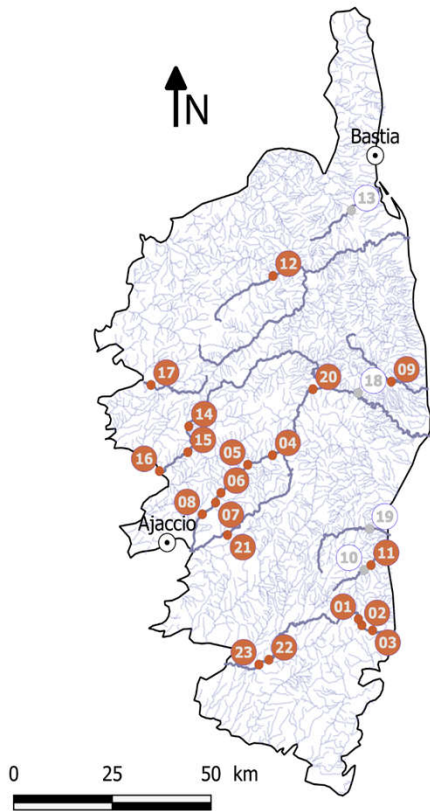


How to detect the presence of the mollusc ?



Metabarcoding

*Mulero et al. Global Ecol Cons 2021*



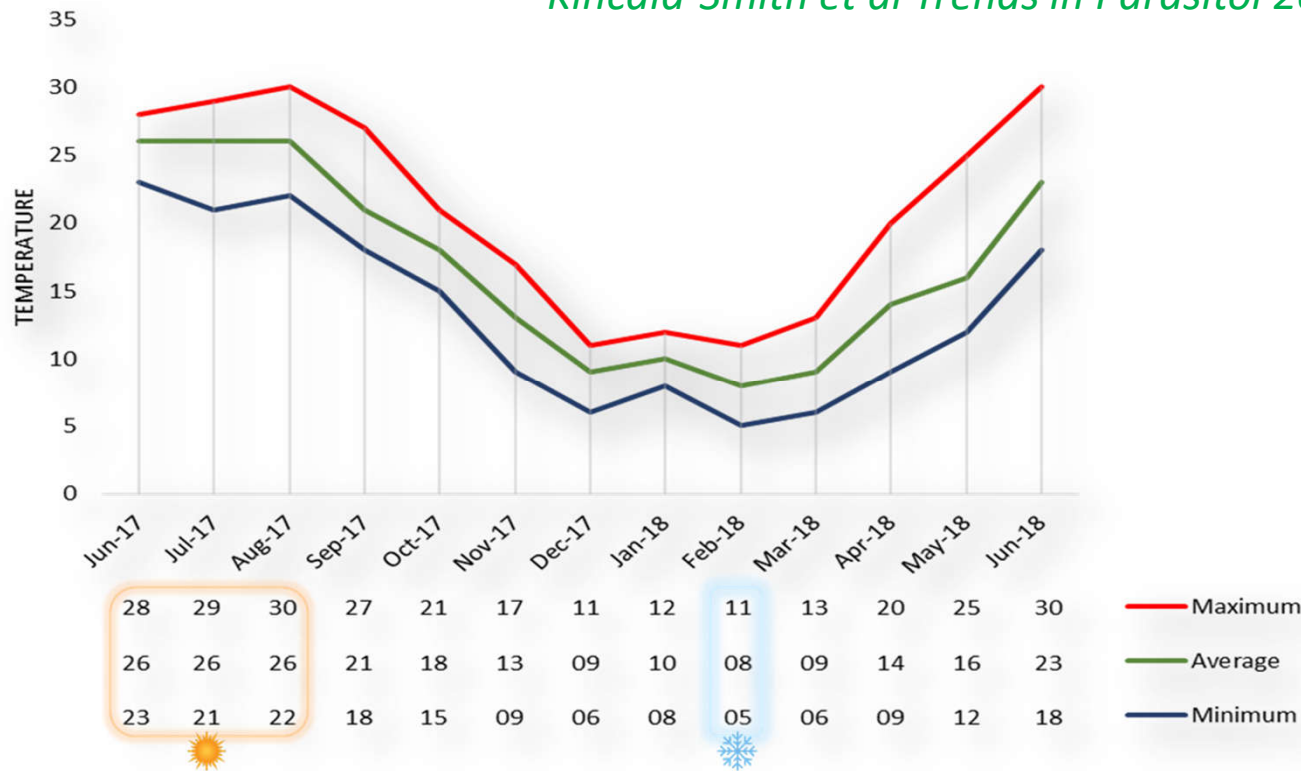
**Opinion**

**Trends in Parasitology**

**Emerging Schistosomiasis in Europe: A Need to Quantify the Risks**

Julien Kincaid-Smith,<sup>1,†</sup> Olivier Rey,<sup>1,†</sup> Eve Toulza,<sup>1</sup> Antoine Berry,<sup>2</sup> and Jérôme Boissier<sup>1,\*</sup>

*Kincaid-Smith et al Trends in Parasitol 2019*

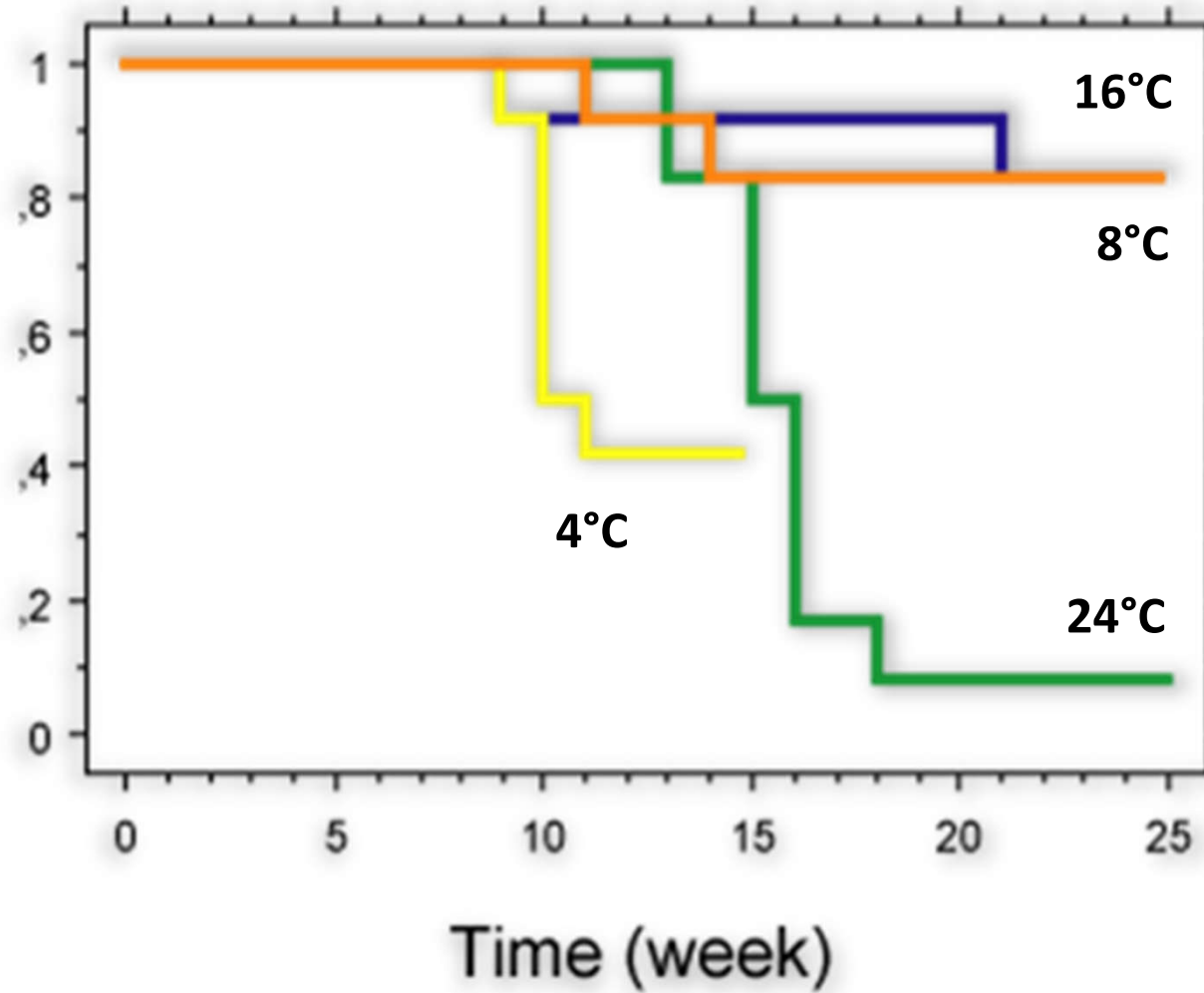


**Temperatures recorded in the Cavu River from June 2017 to May 2018.**

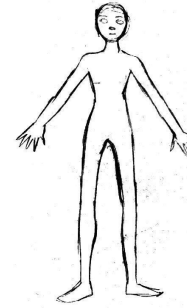
*Mulero et al Parasite & vector 2019*



Survival of infected molluscs



# How the parasite is maintained ?



**Corse infos**  
CORSICA INFORMAZIONE

Lundi 18 juillet 2016

**corse-matin** 12

## La vallée de San Martinu plus forte que la bilharziose

En 2014, un parasite sème la crainte dans la rivière Cavu, sur la commune de Zonza. Depuis, du chemin a été fait pour endiguer le fléau et rassurer la population. Retour et bilan sur une épidémie qui a joué les gros bras



PHOTOS ALAIN PISTORESI

### Les dates clefs

**Printemps 2014** : 118 cas pathologiques sont relevés. Les personnes atteintes se sont baignées dans le Cavu entre 2011 et 2013.

**Juin 2014** : par arrêté préfectoral, la baignade dans le Cavu devient interdite. Un point info relié à l'office de tourisme est ouvert à destination de la population locale et touristique.

**10 juillet 2014** : Le sous-préfet Jean Salomon valide le principe de la cellule de veille. Celle-ci est constituée pour optimiser la communication.

**3 juin 2015** : un arrêté préfectoral lève l'interdiction de baignade dans le cours d'eau. Néanmoins, la maladie est décelée chez deux personnes qui se sont baignées le même jour au même endroit.

**7 juin 2016** : un arrêté préfectoral réintègre l'autorisation de baignade dans le Cavu, sous réserve d'un suivi par les autorités compétentes afin de limiter la résurgence de cas humains contaminés par la bilharziose.

**August 2016**



### Lesson 1

One health approach



### Lesson 2

Global change and emergence

#### Climate change



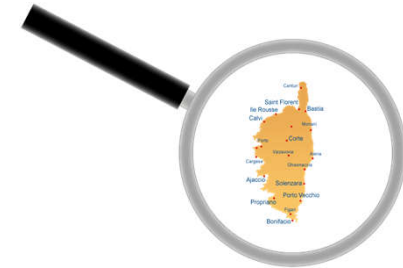
**Tourism**



**Migration**

### Lesson 3

Parasite elimination



#### *WHO 2030 Roadmap*

“Number of countries where interruption of transmission has been verified”....for 5 years