

# Zoonotic schistosomiasis in Africa: the need for a One Health approach for research and control



Photo credit: Dr Elsa Léger

Professor Joanne P. Webster

# Schistosomiasis

## A Neglected Tropical Disease



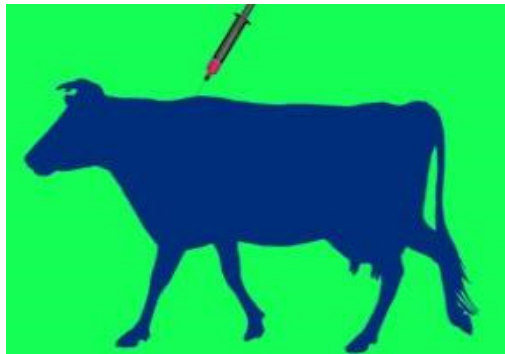
Blood-borne fluke

Indirectly transmitted involving a mammalian definitive and a molluscan intermediate host.

>240 million infected humans



# Changing environments for schistosomes





# Control and ‘Elimination’ of Schistosomiasis

## 2013: World Health Organization (WHO) Strategic Plan:



Vision	A world free of schistosomiasis
Goals	<p>To control morbidity due to schistosomiasis by <b>2020</b></p> <p>To eliminate schistosomiasis as a public health problem by <b>2025</b></p> <p>To interrupt transmission of schistosomiasis in endemic member states, and in selected African countries by <b>2025</b></p>



*“ We have committed to continuing our efforts in Africa, in cooperation with WHO, until schistosomiasis is eliminated.”*

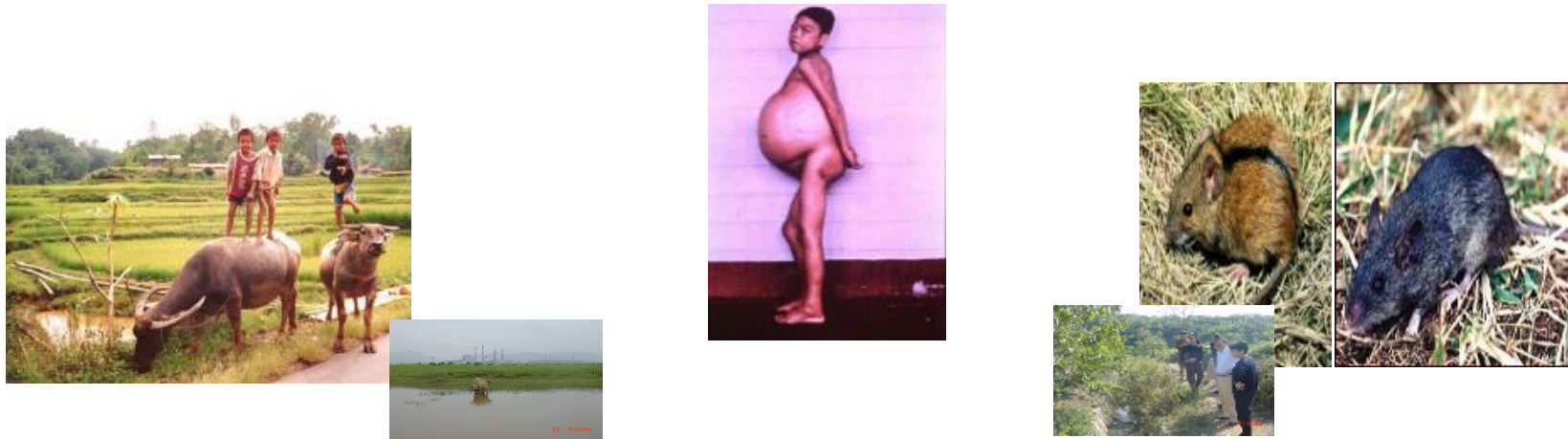
2016: Donation jump from 25 million to 250 million PZQ tablets a year.

## Lessons learned:

### *S. japonicum* in Asia ongoing transmission via animal reservoirs

**Within China**, despite major control efforts >50 years: PZQ, health education, mollusciciding, environmental modification, behavioural change etc)

*S. japonicum* remains **endemic in seven** (out of 12) provinces and **re-emerging** in some areas.



‘*S. japonicum* is **zoonotic** — transmission between animals and humans.’



Webster, J.P., Gower, C.M., Knowles, S., Molyneux, D.M. & Fenton, A. (2016) *Evolutionary Applications*  
Rudge, J.W., Webster, J.P., Lu, D-B., Wang, T-P., Fang, G-R., Basanez, M-G (2013) *Proc. Natl. Acad. Sci. USA*  
Rudge, J.W., Lu, D-B, Feng, G-W, Wang, T-P, & Webster, J.P. (2009). *Molecular Ecology*

# Lessons to be learned: *S. mansoni* & *S. haematobium* in Africa



*'S. haematobium* a uniquely human schistosome'



The Journal of  
Infectious Diseases

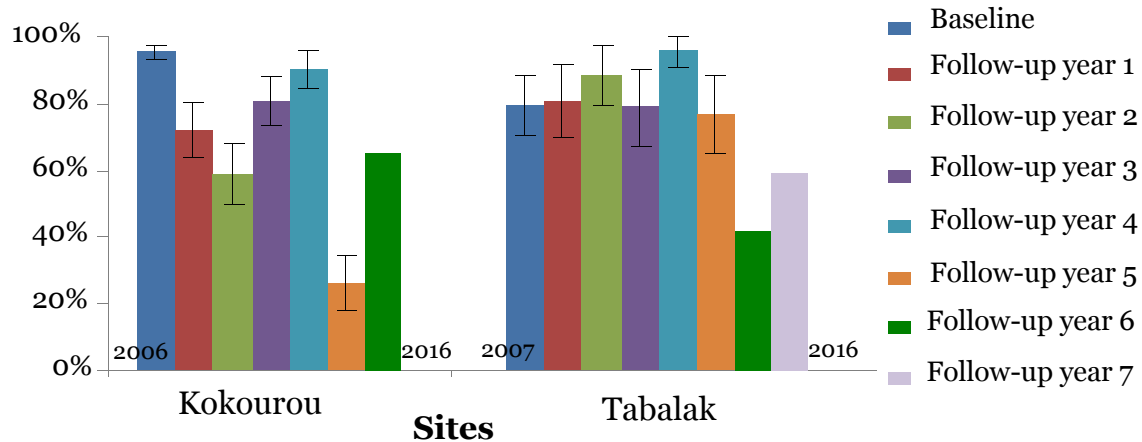
THE ROYAL SOCIETY  
PUBLISHING  
PHILOSOPHICAL  
TRANSACTIONS B  
ABOUT  
BROWSE BY SUBJECT  
ALERTS  
FREE TRIAL

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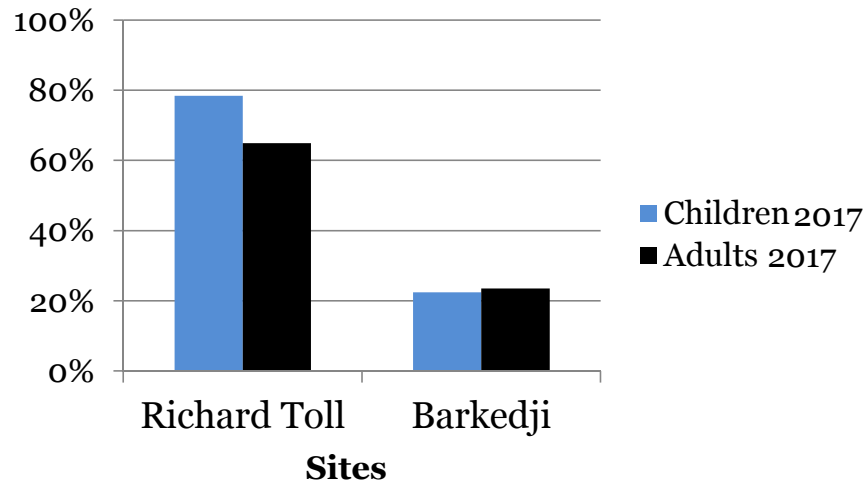
Catalano, S., Sene, M., Diouf, N.D., Fall, C.B., Borlase, A., Leger, E., Ba, K., & Webster, J.P. (2018). *The Journal of Infectious Diseases*  
Webster, J.P., Borlase, A.M. & Rudge, J.W. (2017). *Phil. Trans. Roy. Soc., B (Lond)*  
King, K.C., Stelkens, R.B., Webster, J.P.. (2015) *PLoS Pathogens*  
Webster, J.P., Molyneux, D., Hotez, P.J. & Fenwick, A. (2014). *Phil. Trans. Roy. Soc., B (Lond)*

# Schistosomiasis in West Africa

## Urogenital schistosomiasis prevalence in Niger



## Urogenital schistosomiasis prevalence in Senegal



68 % ⊕



19% ⊕

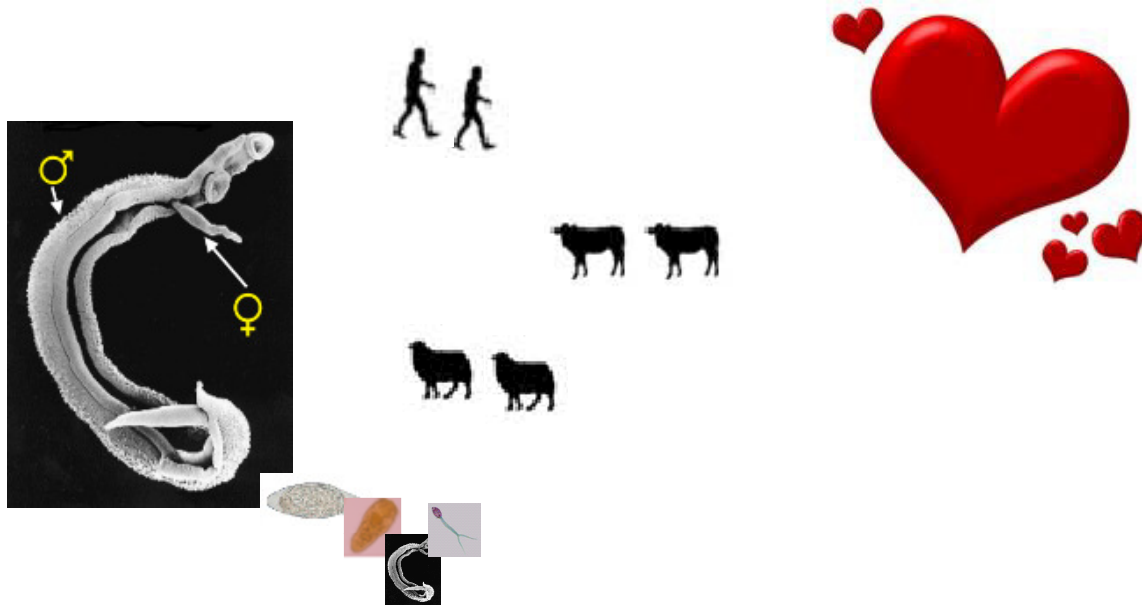


33% ⊕

in  
Senegal












60% to 100% of the children and adults are infected with viable zoonotic hybrid schistosomes

Schistosome pairings:  
the conventional wisdom = **within-species** monogamy



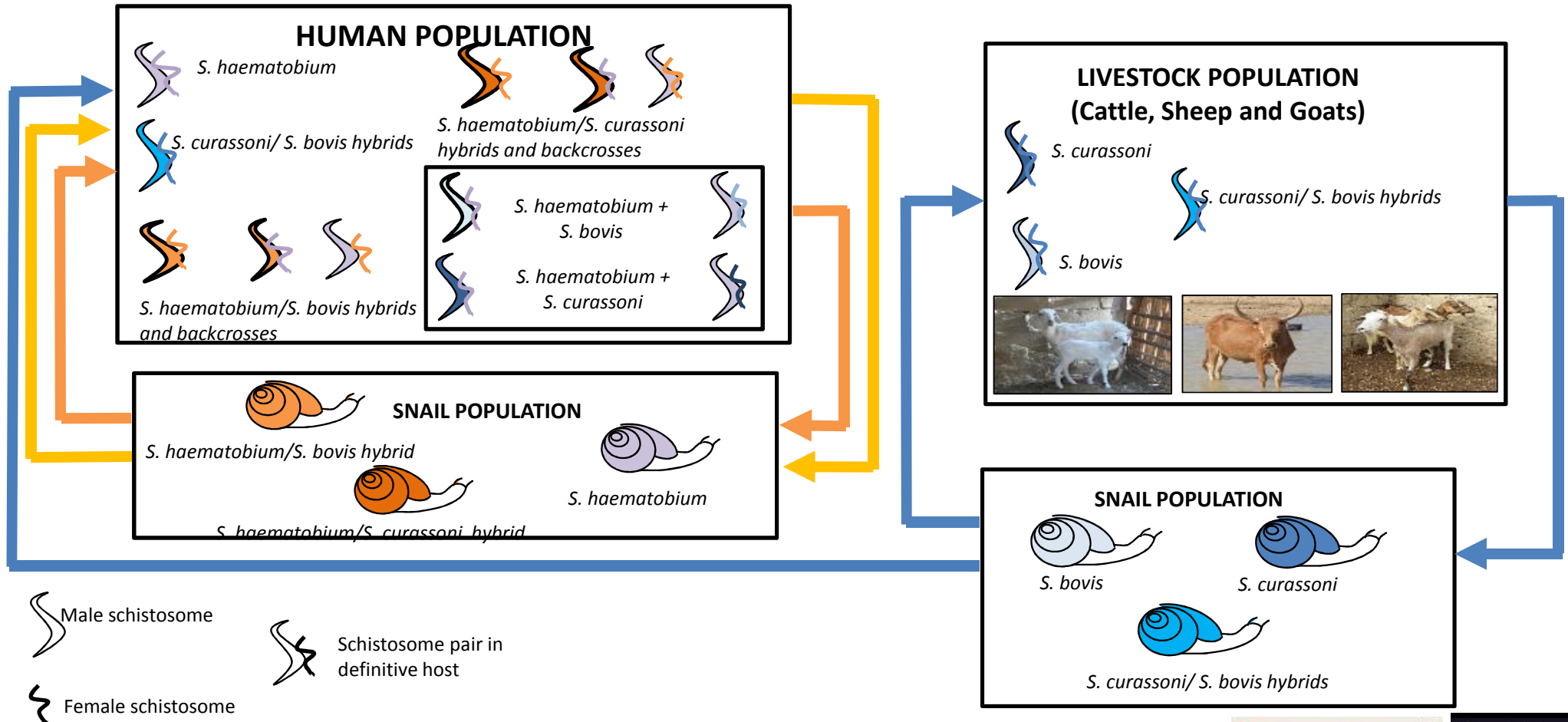


# A plethora of human and livestock schistosome combinations

<b><i>S. haematobium</i></b> 	 cox1 mtDNA fragment: <i>S. haematobium</i> ITS rRNA fragment: <i>S. haematobium</i>	
<b><i>S. bovis</i> x <i>S. haematobium</i></b> 	 cox1 mtDNA fragment: <i>S. bovis</i> ITS rRNA fragment: <i>S. haematobium</i>	
<b><i>S. bovis</i> x <i>S. haematobium</i> x <i>S. curassoni</i></b> 	 cox1 mtDNA fragment: <i>S. bovis</i> ITS rRNA fragment: Mixed, <i>S. haematobium</i> x <i>S. bovis</i> / <i>S. curassoni</i>	
<b><i>S. bovis</i> x <i>S. curassoni</i></b> 	 cox1 mtDNA fragment: <i>S. bovis</i> ITS rRNA fragment: <i>S. bovis</i> x <i>S. curassoni</i>	
<b><i>S. haematobium</i> x <i>S. bovis</i>/<i>S. curassoni</i></b> 	 cox1 mtDNA fragment: <i>S. haematobium</i> ITS rRNA fragment: <i>S. bovis</i> / <i>S. curassoni</i>	 cox1 mtDNA fragment: <i>S. haematobium</i> ITS rRNA fragment: Mixed, <i>S. haematobium</i> x <i>S. bovis</i> / <i>S. curassoni</i>

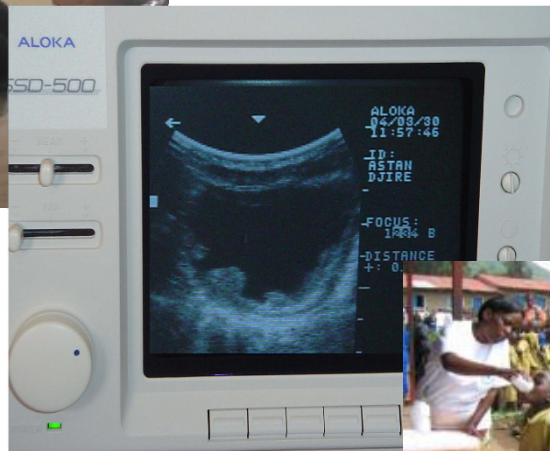
“species” !.....

# Novel mathematical hybrid models illustrate role of livestock for ongoing human transmission



Borlase, A.M., Webster, J.P. & Rudge, J.W. (2017). *Evolutionary Applications*  
 Webster, J.P., Borlase, A.M. & Rudge, J.W. (2017). *Phil. Trans. Roy. Soc., B (Lond)*

# Clinical and Economic studies: High 'costs' for both human and animal schistosomiasis



**GCRF**  
Global Challenges Research Fund

**BBSRC**  
bioscience for the future

Vince, L., Gower, C.M., Binetou-Fall, C., Chatribarti, B., Sene-Wade, M., Diouf, N.D., Jackson, E., & Webster, J.P. (2018/in prep).  
Gower, C.M., Vince, L. & Webster, J.P. (2017) *Trans Roy Soc Trop Med Hyg.*

So Research to Policy ???:  
should we treat both human and animal schistosomiasis in Africa?



Animal reservoirs: for and against evolution of PZQ-resistance



# Ethnographic studies: Current use and Misuse of PZQ for animal schistosomiasis



This one for animals costs 7500 CFA. The (*human form*) praziquantel cost 100 CFA the unit. The box of benzimidazole costs 8000 CFA and the box of praziquantel costs 6000 CFA

Focus Group Farmer, Linguere region.

For "yarguítel" it is medicine is not the same (*from the market or from the vets*). The one who comes from France (*Translation Europe*) is more efficient.

Focus Group Farmer, Linguere region.

The price, the quality because there are fraudulent drugs that sometimes come from The Gambia. The directions for use of the medication are also important.

Interview Linguere Region, Veterinary Technician.

The problem is that there was no medication proper to animals, so, generally, we would use praziquantel for people to treat animals and in that case, we did not know the dosage, which can cause resistance.

Interview Linguere Region, Veterinary Technician.

# Drug Access and Efficacy Evaluation for Livestock Schistosomiasis



**Brutel**



Praziquantel  
+  
Levamisole  
(tapeworm  
dosage)

Human  
Policy  
assists  
Livestock  
Policy

MINISTRY OF HEALTH



## Lessons **to be** learned

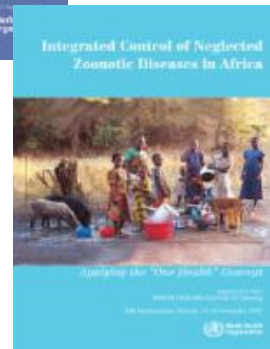
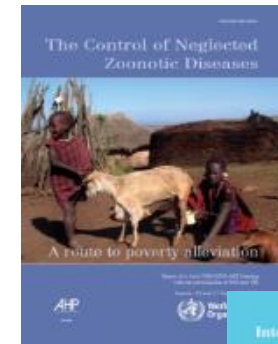
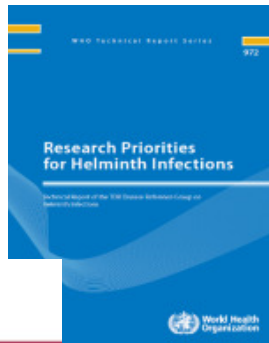


*Schistosoma* spp. in Africa can also be **zoonotic**  
= ongoing transmission  
A demand for human **and** animal treatment

Research: Elucidation of the biology and impact of this both ancient and emerging infectious disease.

Influence and Implement: Policy & Practice – National & International

Ultimately help improve human and animal health





# Thank you

## Royal Veterinary College

Dr Elsa Leger  
Anna M. Borlase  
Stefano Catalano  
Louise Vince  
Sara Laskowski  
Lucy Rupkus  
Alice Morrell

## Senegal

Cheikh B. Fall  
Cheikh Thiam  
Alassane Ndiaye  
Samba D. Diop  
Dr. Nicolas D. Diouf  
Dr. Mariama Sene-Wade

## Natural History Museum

Dr. David Rollinson  
Dr. Aidan Emery  
Muriel Rabone  
Dr. Fiona Allan  
Dr. Bonnie Webster  
Tom Pennance

## Niger (RISEAL)

Dr. Amina H. Hamidou  
Dr. Amadou Garba  
Dr. Rabiou Labbo

## SCI team in Niger

Mousumi Rahman

