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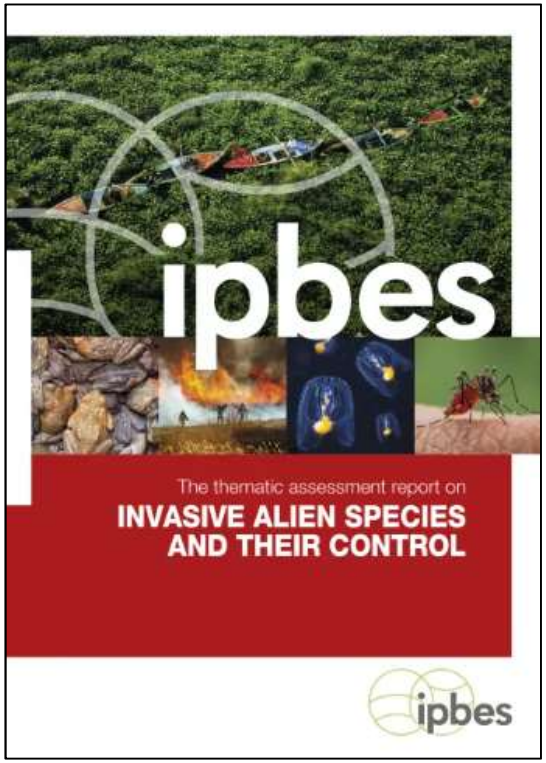
Parasitic monogenean flatworms as tags for invasive aquatic vertebrates in Africa

using mitochondrial markers and historical collections

Maarten Vanhove, Nikol Kmentová, Nicolas Antoine-Moussiaux, Tom Artois, Louis Du Preez, Milan Gelnar, Mare Geraerts, Michiel Jorissen, Antoine Pariselle, Anneke Schoeman, Miriam Shigoley, Jos Snoeks & Tine Huyse

Invasive alien species as vectors/hosts



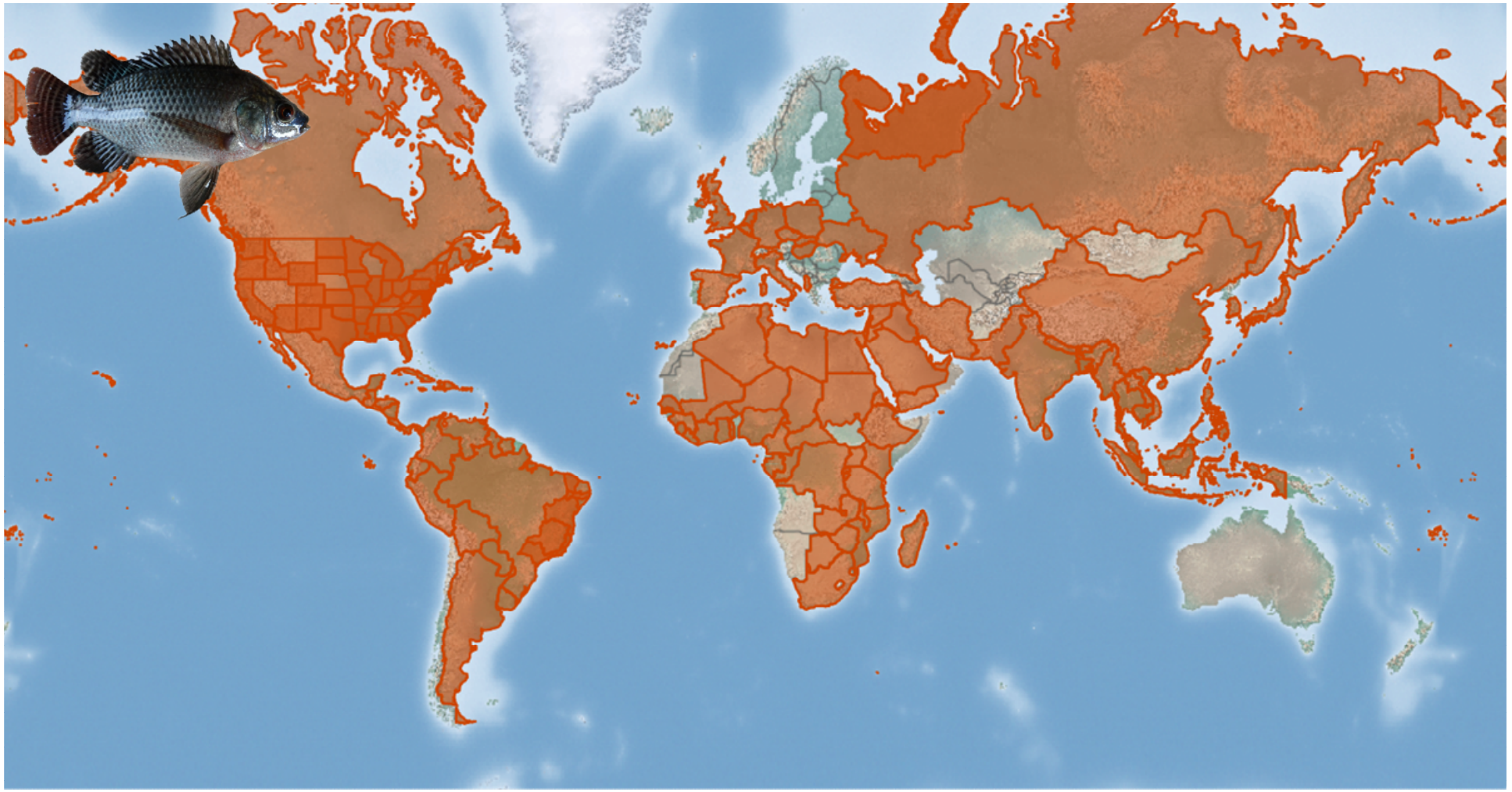
Box 4 16 **Invasive alien species as disease vectors or reservoir hosts.**

Beyond the health impacts discussed in **Box 4.15**, many invasive alien species can act as disease vectors (i.e., introducing parasites and pathogens to new regions along with their host, passing diseases directly to humans), reservoir hosts (where a disease can survive before a vector passes it onward), or facilitators (i.e., helping the occurrence of pathogen or vector).

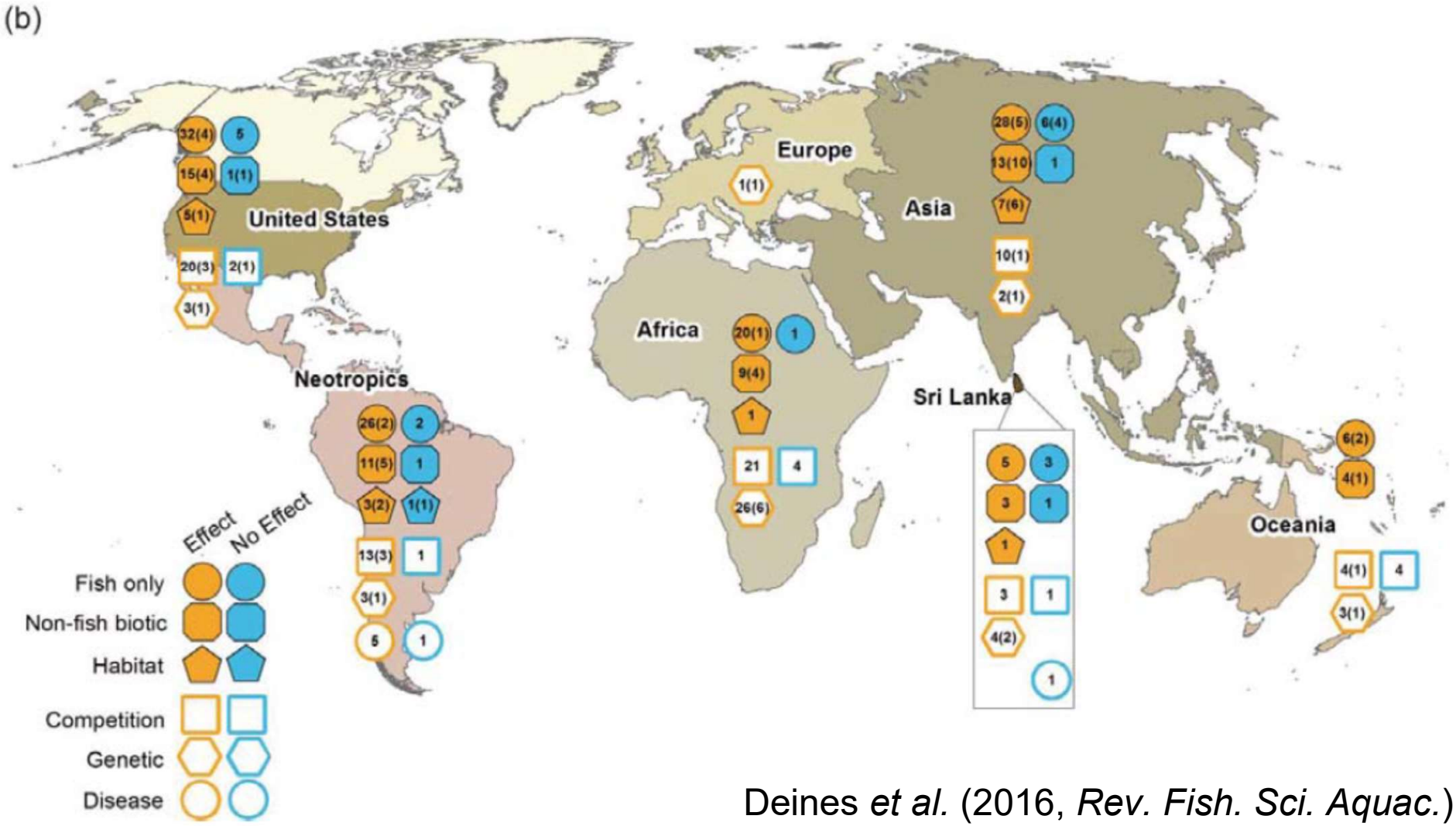
Global trade in livestock, wildlife and plants is a key driver facilitating both intended and unintended introductions of pathogens, hosts, and vectors to new land areas, increasing the rate of disease emergence and health impacts on human populations (Bezerra-Santos *et al.*, 2021; Chinchio *et al.*, 2020; Fèvre *et al.*, 2006; Lounibos, 2002; Vilà *et al.*, 2021).

Diseases such as the bubonic plague, caused by the flea- and rat-borne bacterium *Yersinia pestis* (black death), have caused traumatic social and political upheavals (Athni *et al.*, 2021; Kosoy & Bai, 2019; Wells *et al.*, 2015). Mosquito species such as *Aedes aegypti* (yellow fever mosquito) and *Aedes albopictus* (Asian tiger mosquito) have spread since the fifteenth century, largely due to shipping, air and road transport and trade (Lounibos, 2002). These species have exacerbated the spread of the lethal yellow fever, dengue fever, chikungunya and Zika viruses, and other infectious diseases, throughout the Americas, Asia and, more recently Europe (Juliano & Lounibos, 2005; LaPointe, 2021; Romi *et al.*, 2018). *Culex quinquefasciatus* (southern house mosquito), a vector for lymphatic filariasis, St. Louis Encephalitis virus, and West Nile virus, has spread from West Africa, killing over a million people a year (LaPointe, 2021; Lounibos, 2002; Romi *et al.*, 2018). Invasive mammals and birds can alter the epidemiology of resident pathogens and become reservoir hosts, increasing disease risk for humans (Capizzi *et al.*, 2018). Most zoonotic human diseases are known to originate from mammals: rodents and bats are vectors for a high number of pathogens (Han *et al.*, 2016), and so are *Nyctereutes procyonoides* (raccoon dog), implicated in rabies and tapeworm transmission, and *Procyon lotor* (raccoon), implicated in roundworm transmission (Lojkić *et al.*, 2021; Page *et al.*, 2016). Introduced bird species, in particular psittaciform (parrots), columbiform (pigeons) and anseriform (duck) species, represent a hazard to good quality of life. Main zoonoses include psittacosis, cryptococcosis, listeriosis and salmonellosis, transmitted by direct contact or *via* insect vectors (fleas, lice, ticks and mites). Some galliform species, introduced for hunting, can cause salmonellosis and other gastroenteric diseases (Mori *et al.*, 2018).

The magnitude of risks and impacts arising from co-invasive pathogens is difficult to discern because few data exist on the links among invasive alien species, their parasites or pathogen load and zoonotic diseases (Hulme, 2014). Robust documentation of the prevalence and abundance of parasites, pathogens, and vectors of human diseases associated with high-risk alien hosts would be needed to initiate effective management.

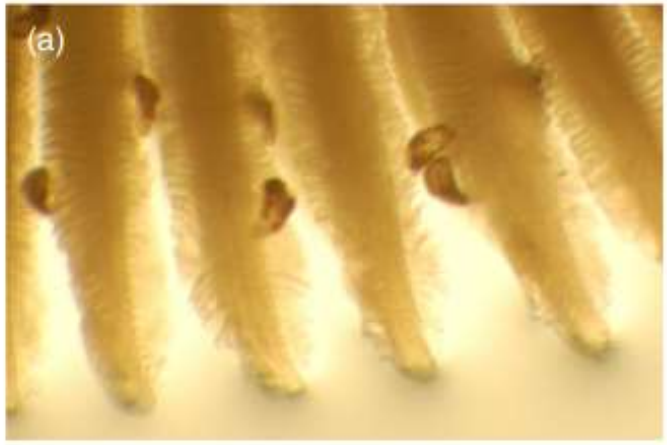


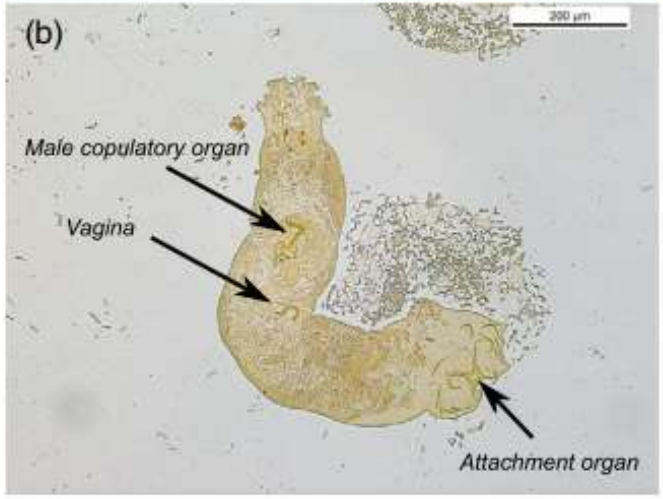
SOURCE: CABI 2022. *Oreochromis niloticus*. In: Invasive Species Compendium. Wallingford, UK: CAB International. https://www.cabi.org/isc

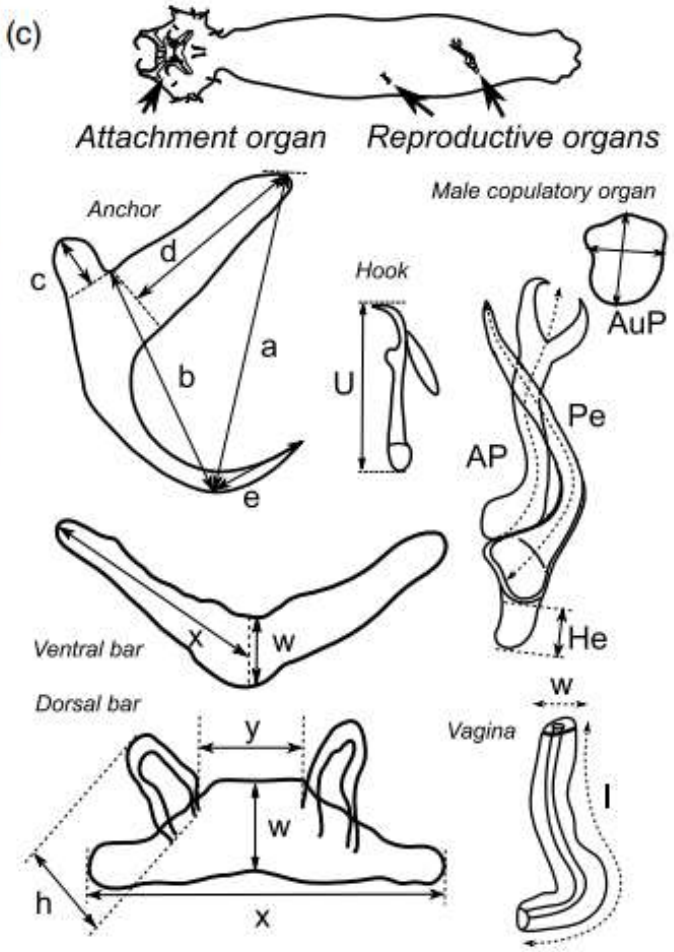


Deines *et al.* (2016, *Rev. Fish. Sci. Aquac.*)

The first day of the rest of your lives: meet monogenean flatworms!

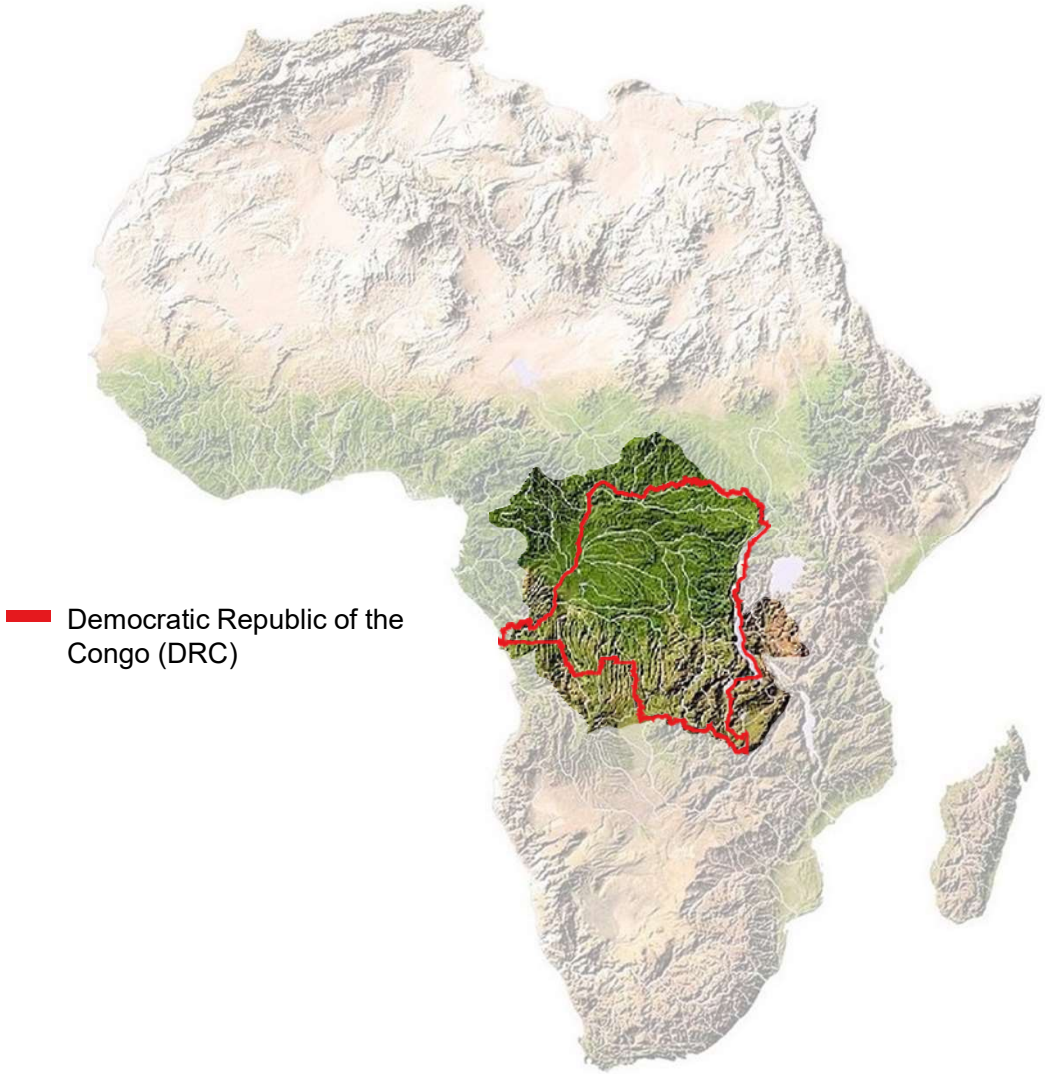


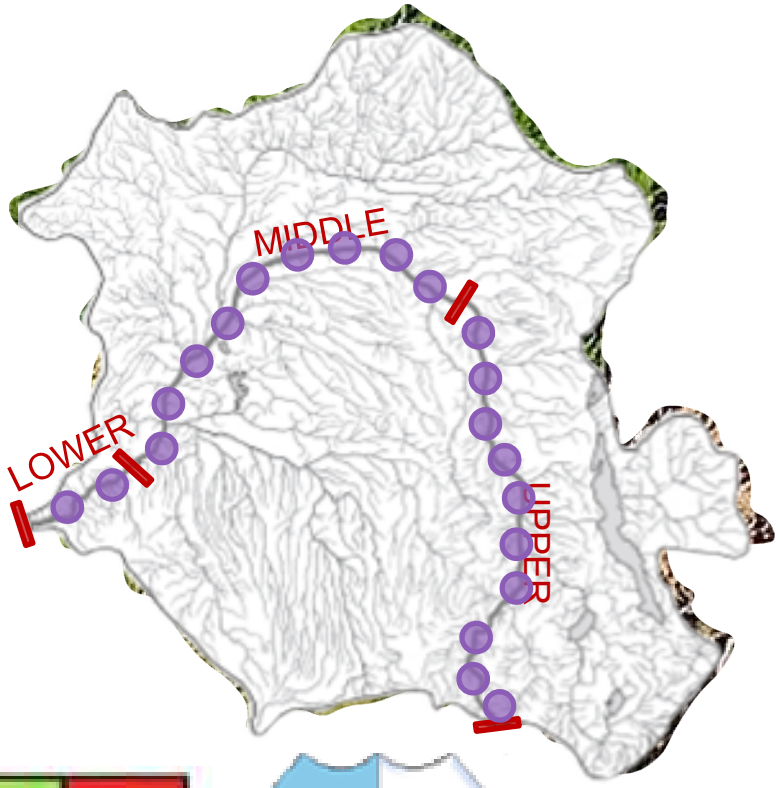




Cruz-Laufer *et al.* (2022, *Cladistics*)

Scholz *et al.* (eds.) (2018, *AbcTaxa*)


Democratic Republic of the Congo (DRC)



Journal of Helminthology, Page 1 of 21
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Diversity and host specificity of monogenean gill parasites (Platyhelminthes) of cichlid fishes in the Bangweulu-Mweru ecoregion

M.W.P. Jorissen[1,2*], A. Pariselle[3], T. Huyse[1,4], E.J. Vreven[1], J. Snoeks[1,4], F.A.M. Volckaert[4], A. Chocha Manda[5], G. Kapepula Kasembele[5], T. Artois[2] and M.P.M. Vanhove[1,2,4,6,7]

Parasite 25, 64 (2018)

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urn:lsid:zoobank.org:pub:EEFEB392-86FC-40ED-B8C3-01936A04C892

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RESEARCH ARTICLE OPEN ACCESS

Six new dactylogyrid species (Platyhelminthes, Monogenea) from the gills of cichlids (Teleostei, Cichliformes) from the Lower Congo Basin

Michiel W.P. Jorissen[1,2,*], Antoine Pariselle[3], Tine Huyse[2,4], Emmanuel J. Vreven[2,4], Jos Snoeks[2,4], Eva Decru[2,4], Thomas Kusters[1], Soleil Wamuini Lunkayilakio[5], Fidel Muterezi Bukinga[6], Tom Artois[1], and Maarten P.M. Vanhove[1,4,7,8]

Geraerts *et al. Parasites Vectors* (2020) 13:187
https://doi.org/10.1186/s13071-020-3927-4

Parasites & Vectors

RESEARCH Open Access

Six new species of *Cichlidogyrus* Paperna, 1960 (Platyhelminthes: Monogenea) from the gills of cichlids (Teleostei: Cichliformes) from the Lomami River Basin (DRC: Middle Congo)

Mare Geraerts[1†], Fidel Muterezi Bukinga[2*†], Maarten P. M. Vanhove[1,3,4,5], Antoine Pariselle[6,7], Auguste Chocha Manda[8], Emmanuel Vreven[5,9], Tine Huyse[10] and Tom Artois[1]

Monogeneans as threats

Oreochromis mweruensis
Upper Congo

Coptodon tholloni
Lower Congo

	Recent		Recent	
C. cirratus	**T?**		**NO**	
C. halli	**T?**		**NO**	
C. rognoni	**NO**		**NO**	
C. sclerosus	**T?**		**NO**	
C. thurstonae	**NO**		**NO**	
C. tilapiae	**T?**		**T?**	
S. longicornis	**NO**		**NO**	

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Jorissen *et al.* (2020, *Biological Invasions*)

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C. thurstonae	**NO**	**NO**	**NO**	**NO**
C. tilapiae	**T?**	**YES**	**T?**	
S. longicornis	**NO**	**NO**	**NO**	**NO**

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C. thurstonae	NO	NO	NO	NO
C. tilapiae	T?	YES	T!	NO
S. longicornis	NO	NO	NO	NO

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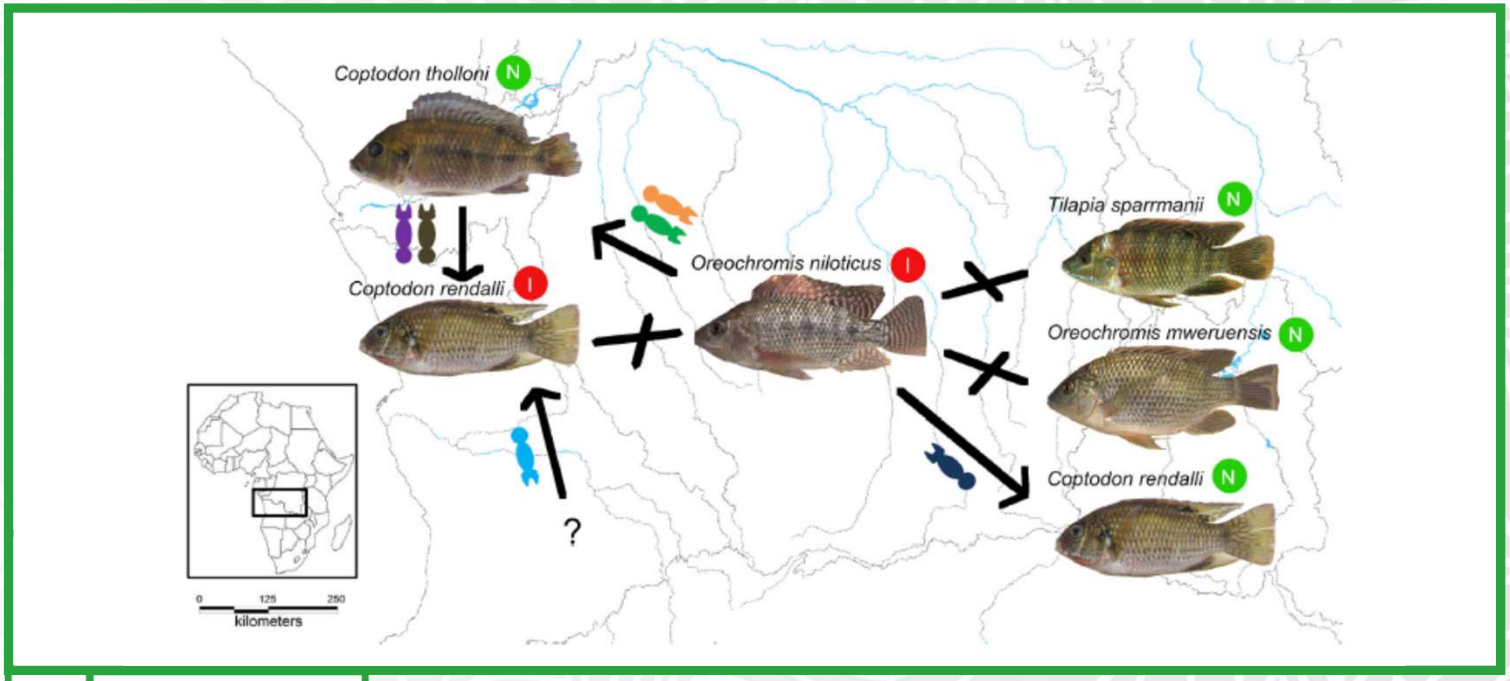
Co-introduction? Transmission?



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The historical ecology of parasitism

UNIVERSITY of WASHINGTON

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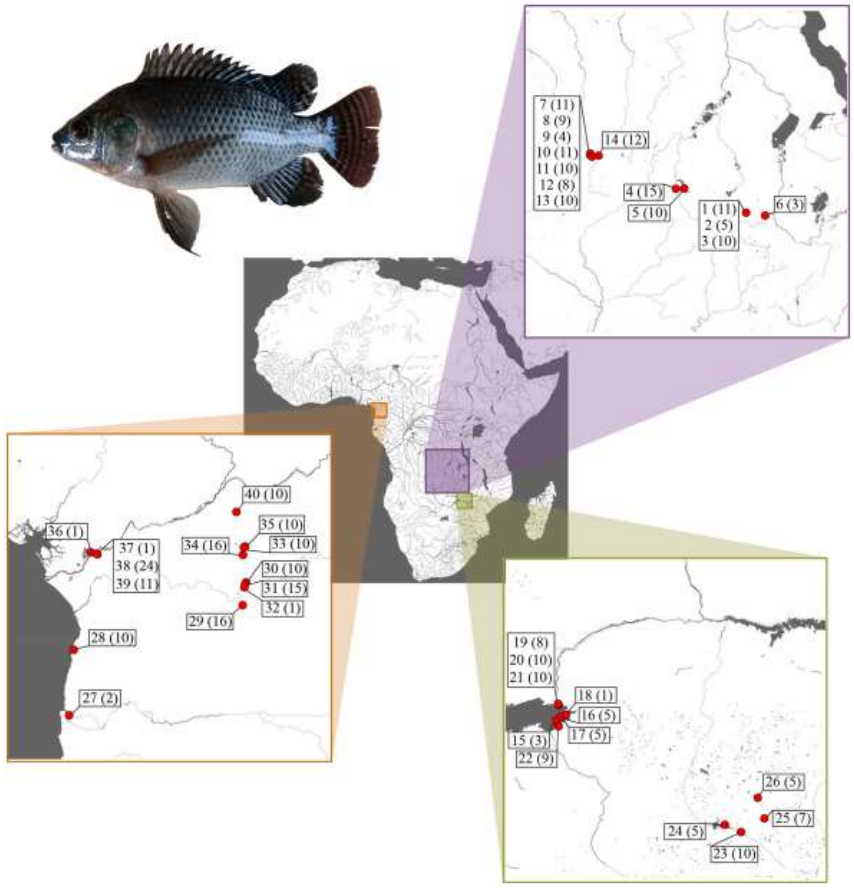
Wood *et al.* (2023, *Journal of Helminthology*)
Wood & Vanhove (2023, *Journal of Animal Ecology*)

Monogeneans as tools



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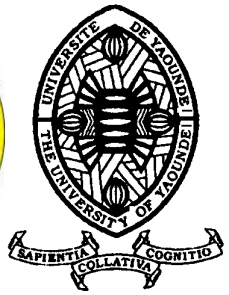

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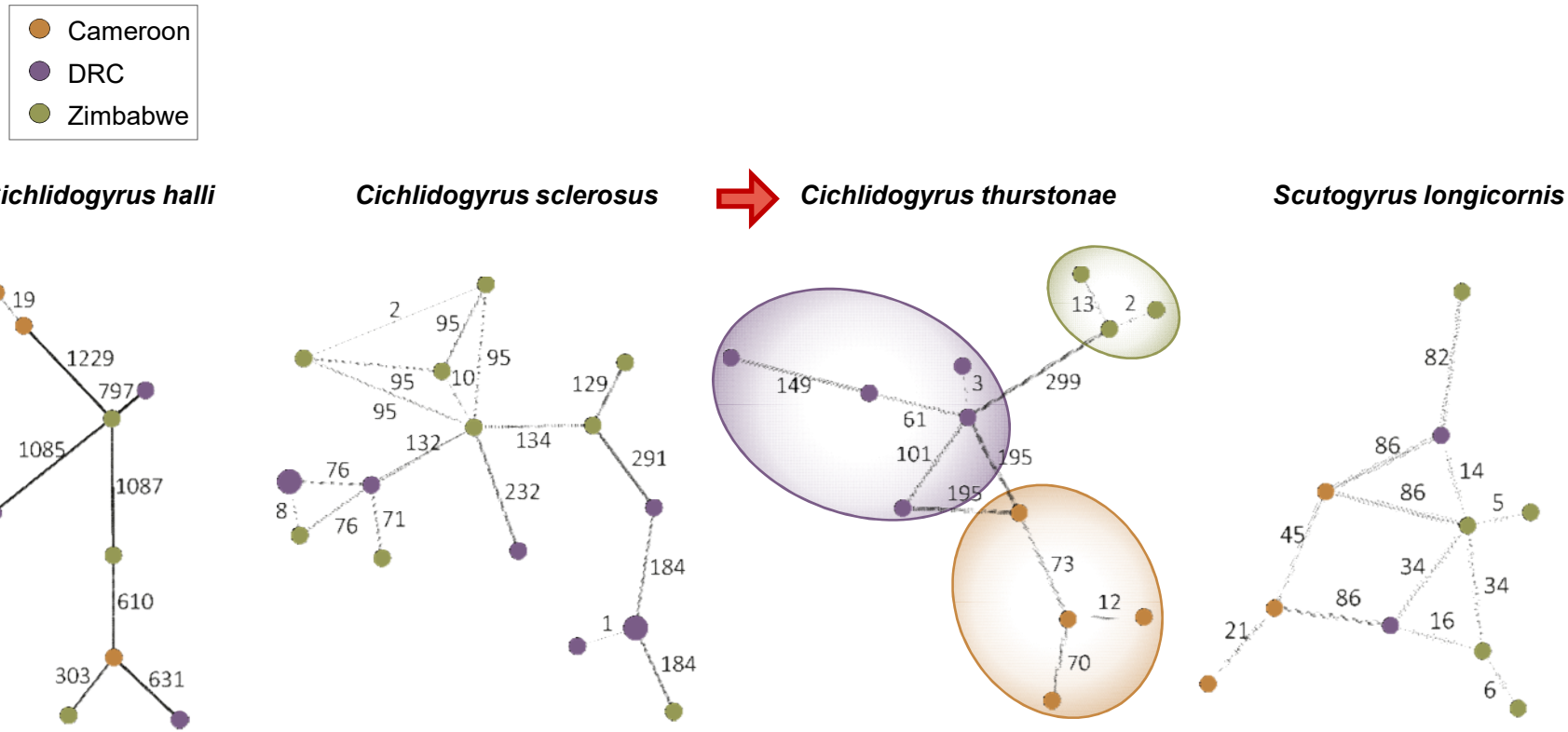
Geraerts *et al.* (2022, *Genomics*)

Monogeneans as tools

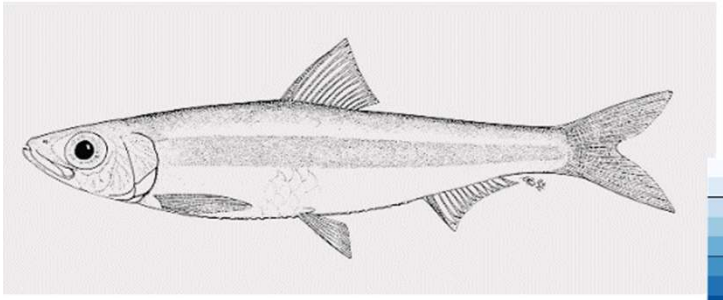


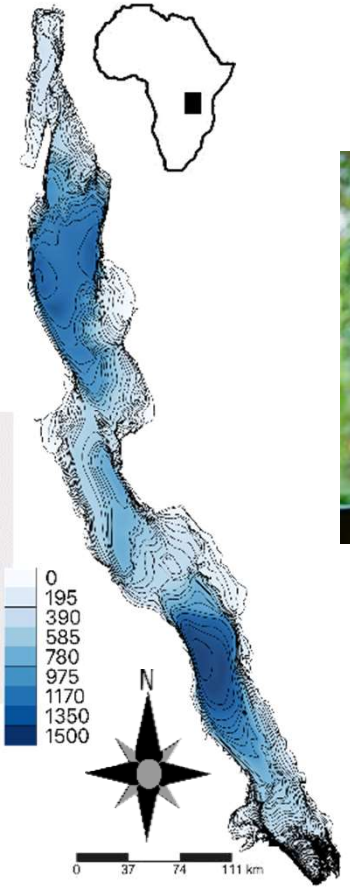
Geraerts *et al.* (2022, *Genomics*)

Monogeneans as tools

Monogenean parasite fauna of:

Limnothrissa miodon





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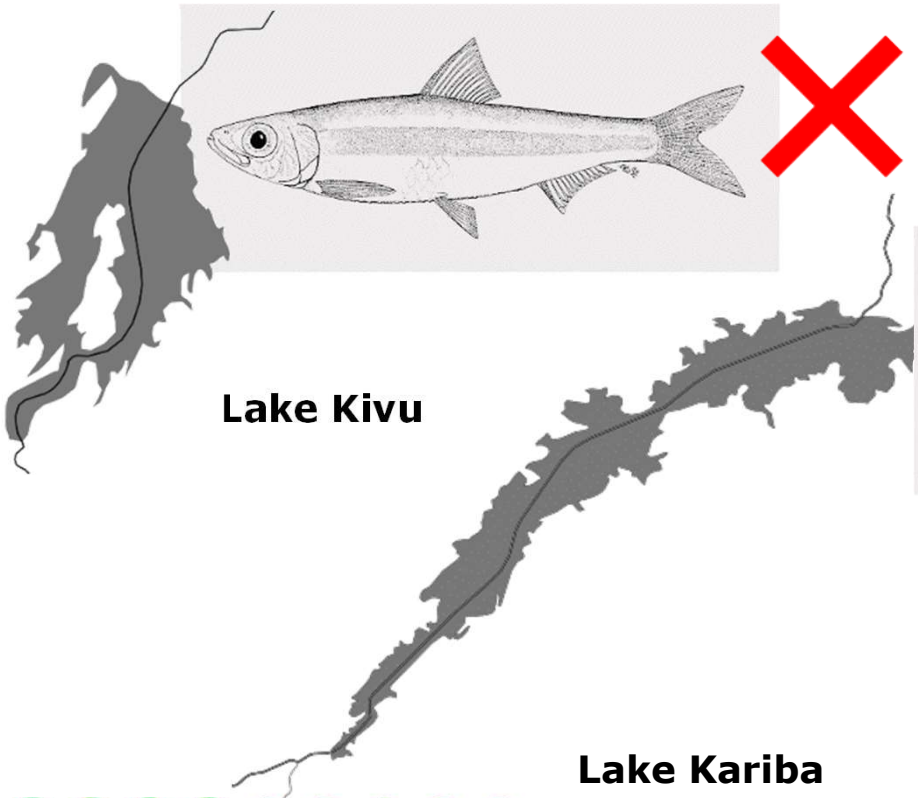
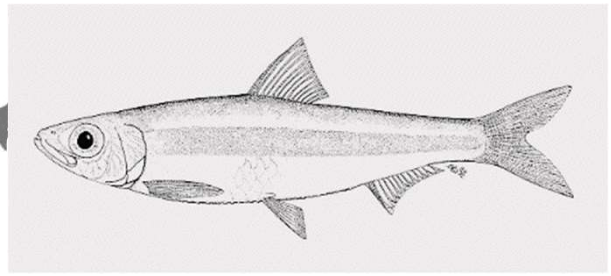




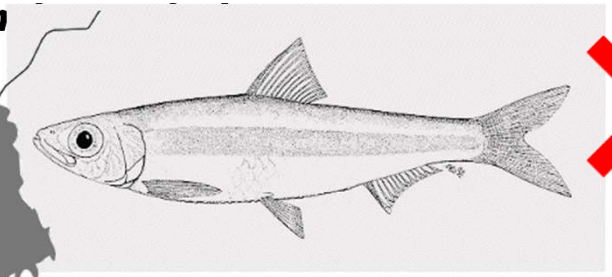
Kapentagyrus limnotrissae

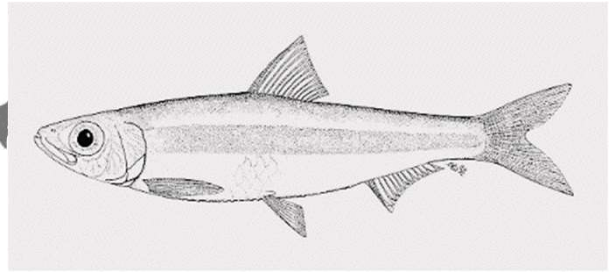
Kmentová *et al.* (2019, *Biological Invasions*)

Monogeneans as tools

Monogenean parasite fauna of:

Limnoth





Kapentagyrus limnotrissae

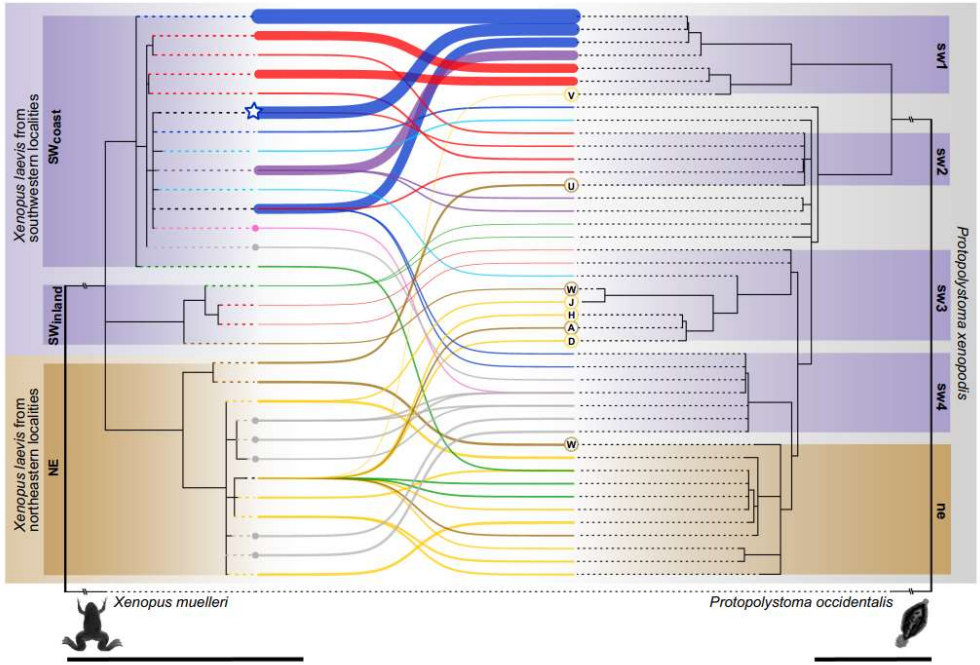
Lake Kivu

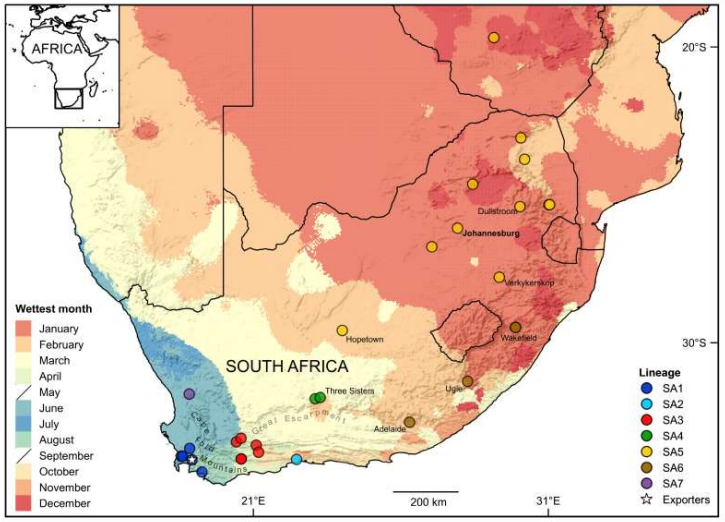
Lake Kariba

"… some larger specimens did find their way into the containers."
(Bell-Cross & Bell-Cross, 1971, Fish. Res. Bull. Zambia)

Kmentová *et al.* (2019, *Biological Invasions*)

Monogeneans as tools





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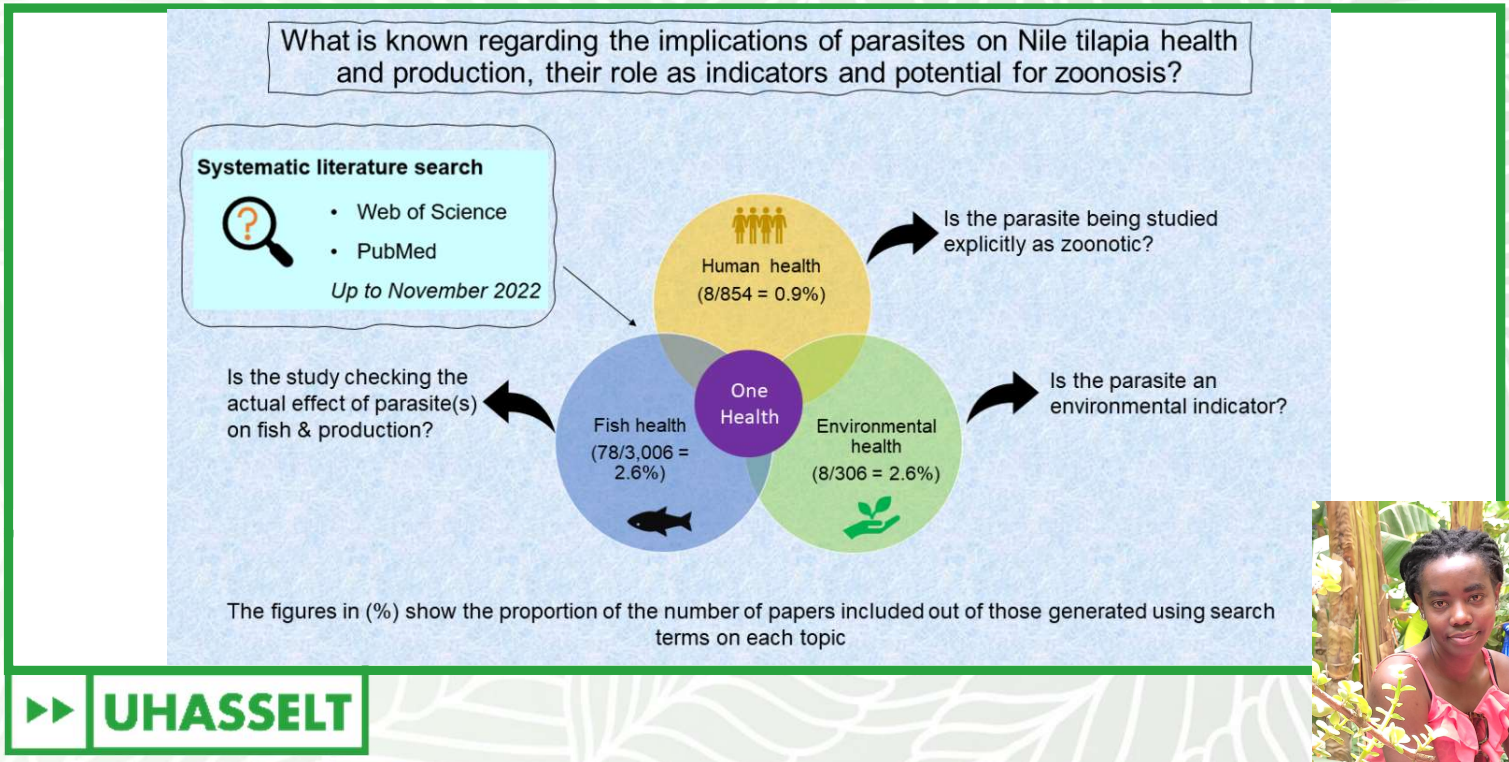
Schoeman *et al.* (2022, *Journal of Applied Ecology*)

One Health in Nile tilapia parasitology?



Shigoley *et al.* (in press, *Hydrobiologia*)

Conclusions and perspectives

- parasitology of major IAS requires a more integrative approach (overlooks co-introduction & (zoonotic) transmission, bio-indication…)
- potential of historical collections for baseline infection data
- importance of morphology-based parasite taxonomy
- potential of parasites as tags for IAS

MPM_Vanhove
maarten.vanhove@uhasselt.be
mpm_vanhove
linkedin.com/in/maarten-vanhove-68317b1b4

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Technical report

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WASP: the World Archives of Species Perception

Tuan Nguyen[1,2,*], Robert Malina[1], Ilias Mokas[1], Antonis Papakonstantinou[3], Orestes Polyzos[3] and Maarten P.M. Vanhove[2]

http://www.wasp-project.net/