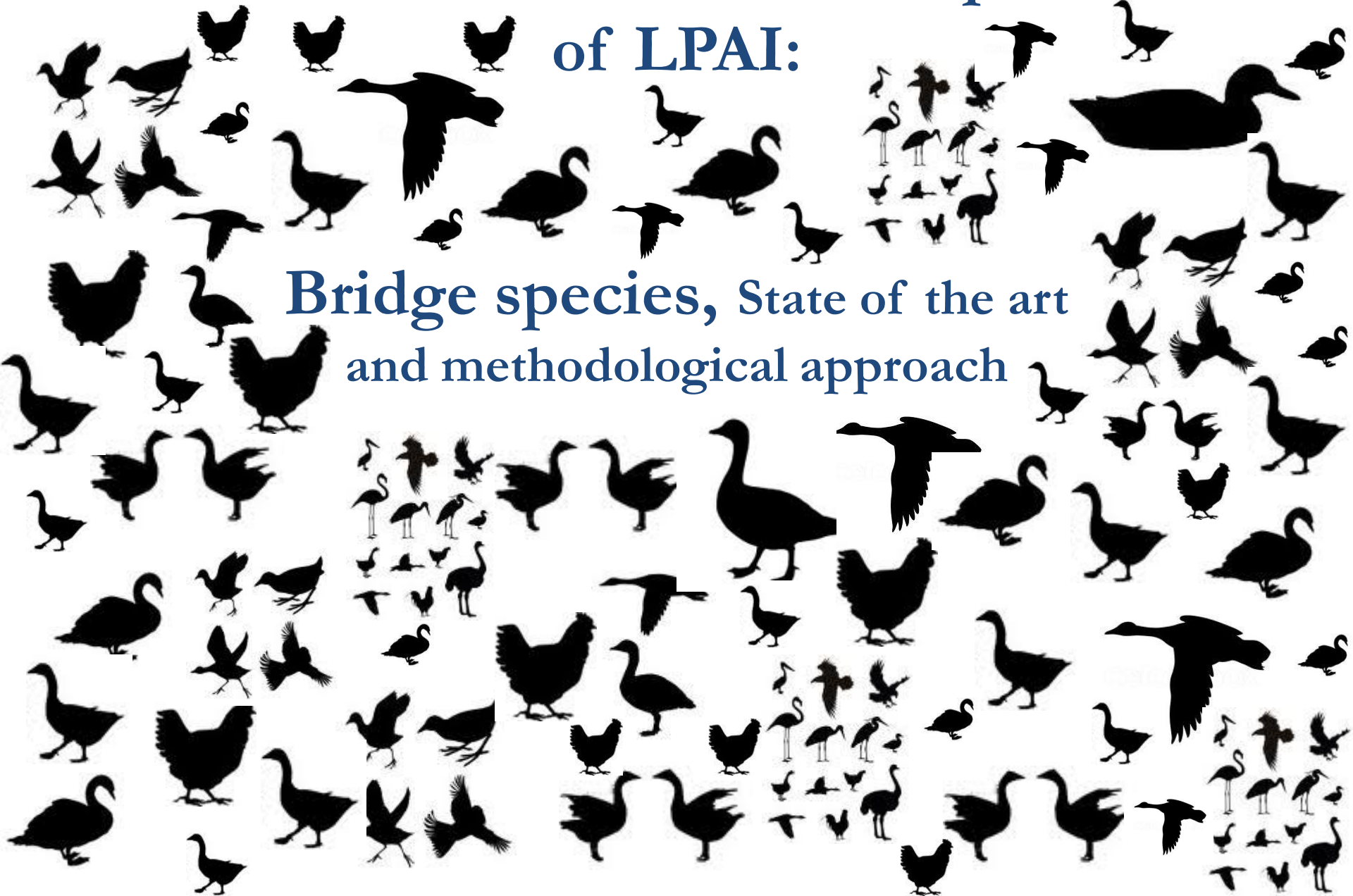


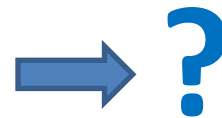
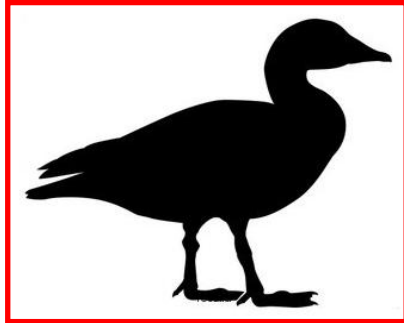
Roles of Wild Birds in the Eco-epidemiology of LPAI:

Bridge species, State of the art
and methodological approach



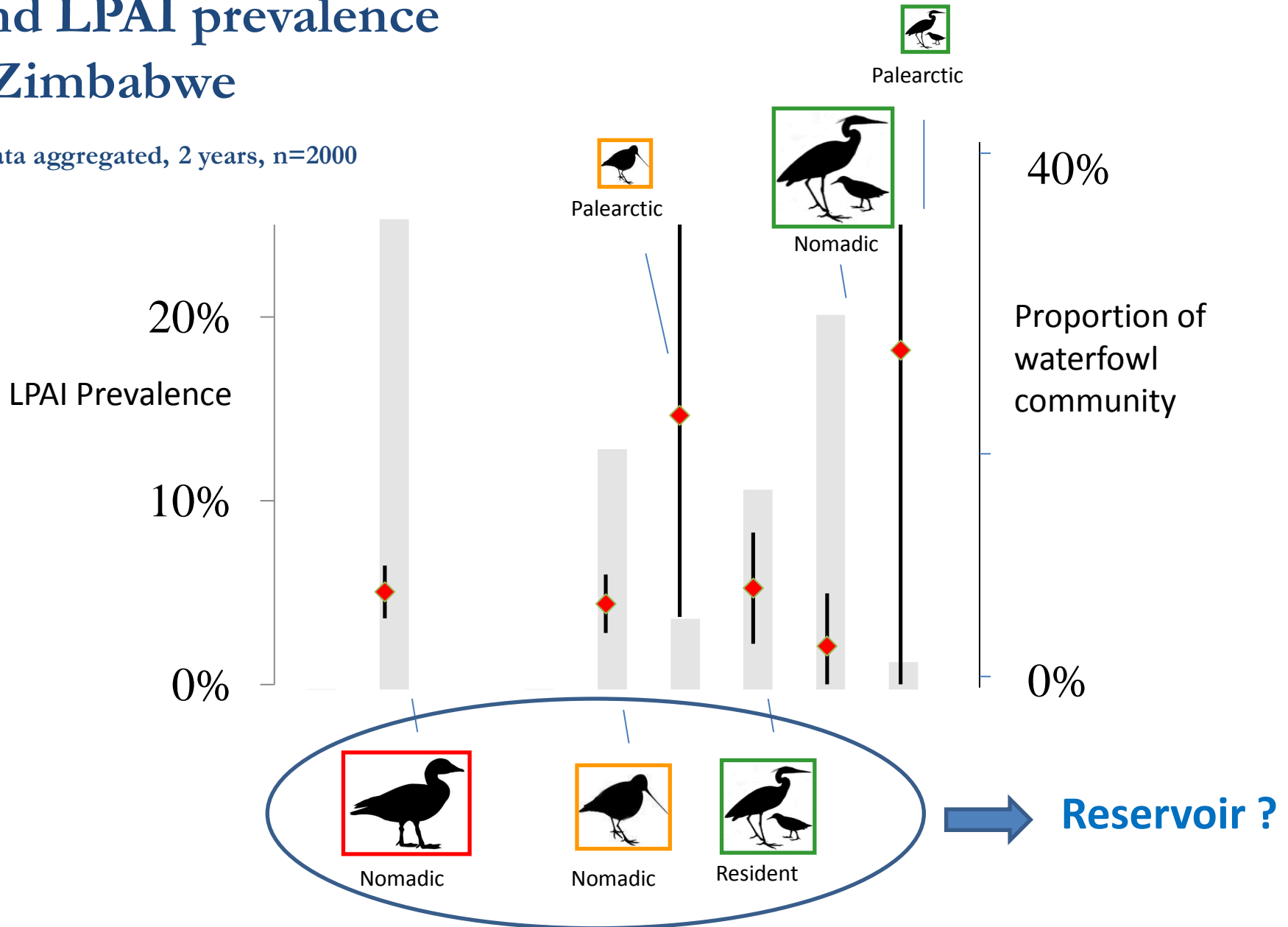
Anseriforms and Charadriiforms

are the reservoir
of LPAI
In Wild birds



Waterfowl community and LPAI prevalence - Zimbabwe

Data aggregated, 2 years, n=2000



Rough literature review on non-Anseriformes and non-Charadriiformes wild birds

- >150 articles and reports included
- Globally
- All PCR results in non-Anseriformes and non-charadriiformes, excluding HPAI H5N1 results

Literature review: results, per bird families

ORDERS	n	p	prev
apodiformes	9	2	22,22
culculiformes	11	1	9,09
gaviformes	34	3	8,82
cuculiformes	18	1	5,56
podicipediformes	791	37	4,68
pelecaniformes	14196	334	2,35
psittaciformes	205	4	1,95
passeriformes	29545	507	1,72
strigiformes	313	5	1,60
coraciiformes	493	7	1,42
gruiformes	14764	208	1,41
phoenicopteriformes	2063	29	1,41
columbiformes	4268	46	1,08
Total général	97391	1313	1,35

Anseriformes = 7,7%

Charadriiformes = 1,2%
(Olsen 2006)

Are we not blinded by
some epidemiological
receipes deduced
from particular
context?

Bridge species

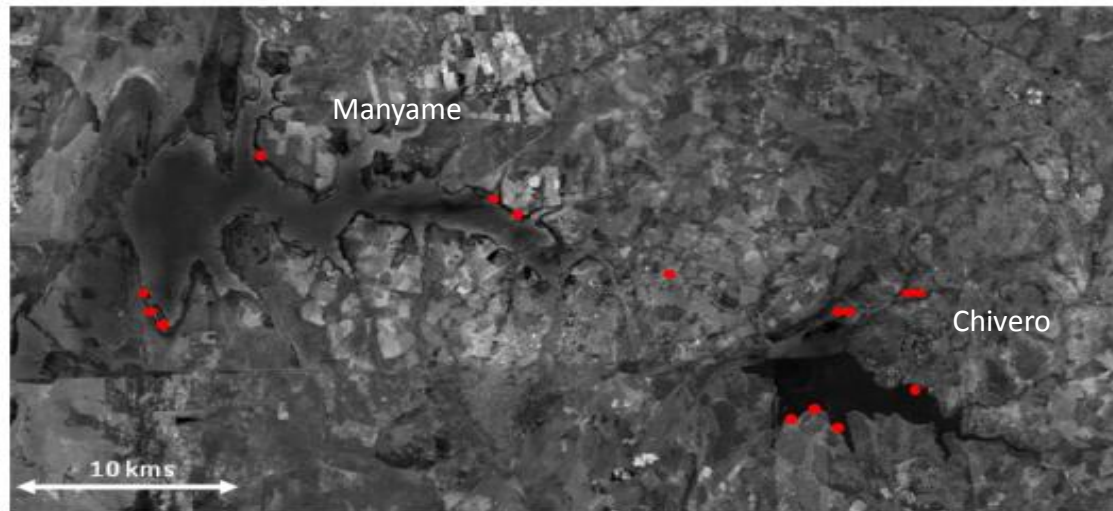
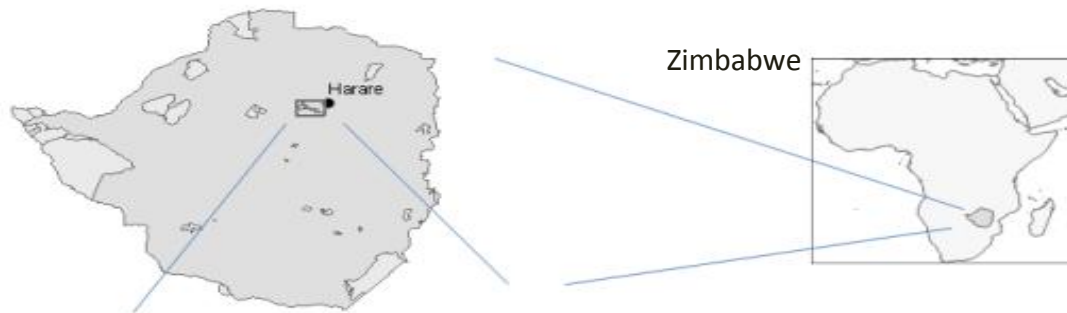
- Little studies available
- Proposed definition:
 - *“A species transmitting a pathogen between an infected population and a naïve population”*
- Linked to Haydon et al. 2002
- A bridge species need to be:
 - In contact with the infected population
 - In contact with the naive population
 - Susceptible to the disease

Problem

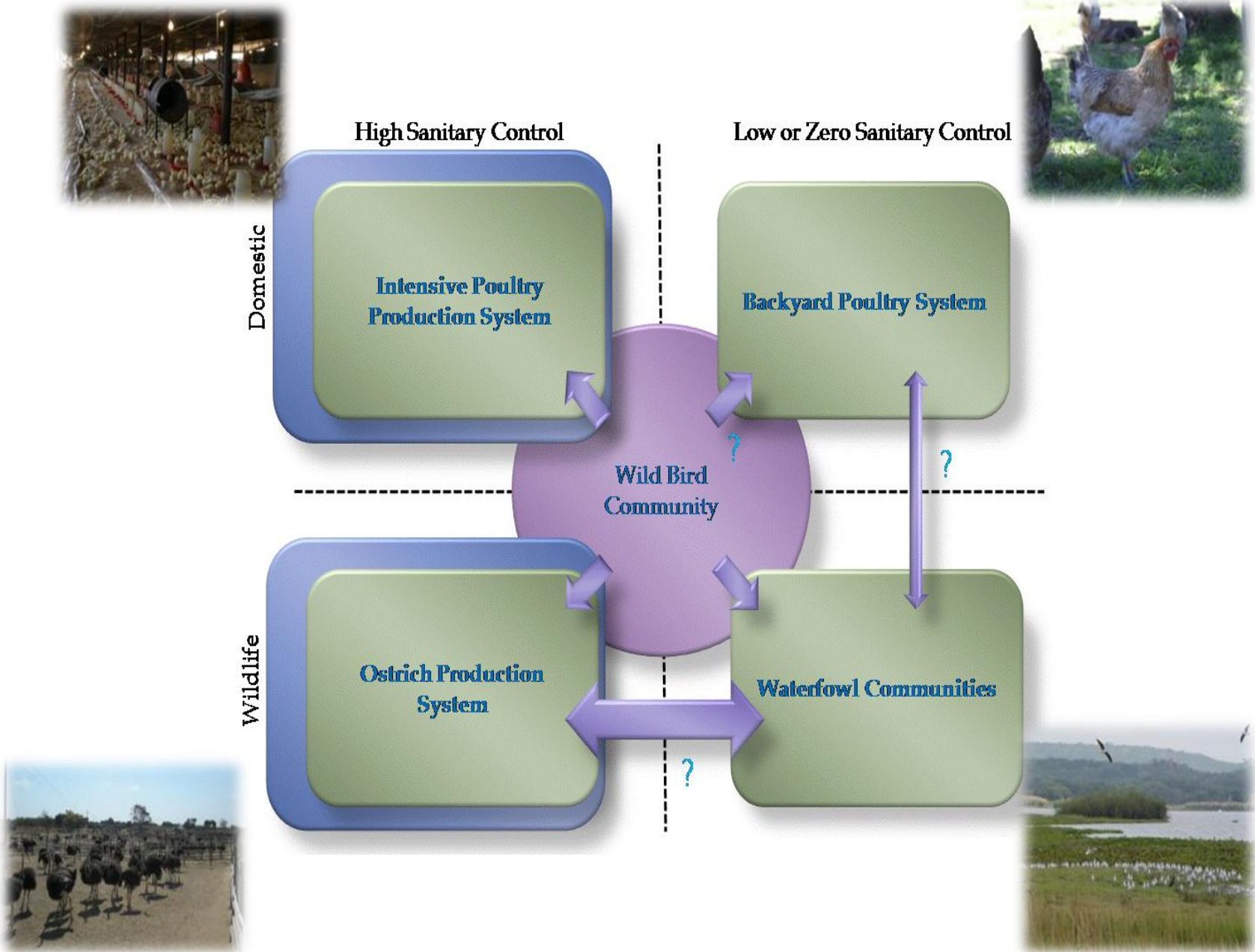
At a local level,
any wild bird species can act as a potential bridge species, depending on its susceptibility to AIV, its movements and contact between infected and naive bird populations;
BUT little information is available.



Study site



Model



Data collection



- **Focal bird count:** for each site, 30mn, 4 times a week, every two months.



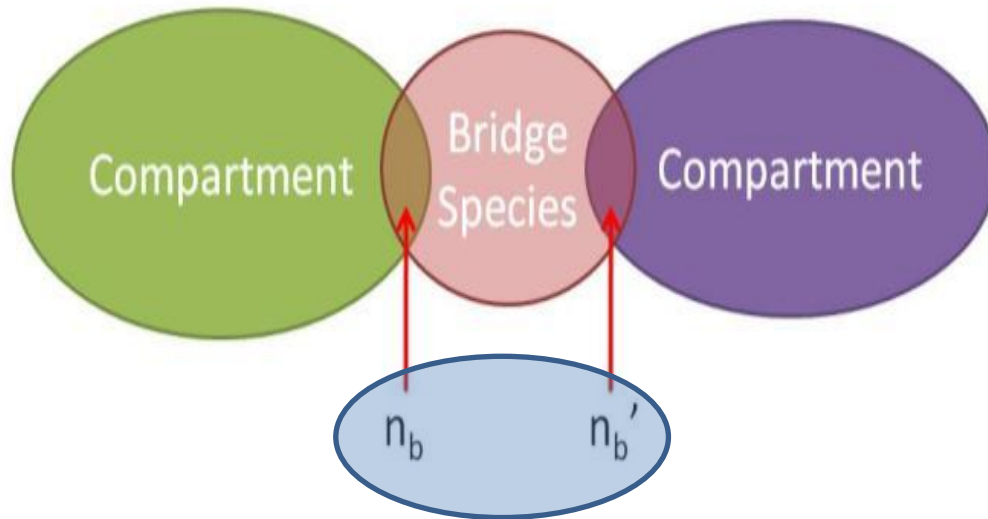
- **Intensive protocol:** 1 year, 15 waterfowl sites + 19 domestic sites



- **Longitudinal propotcol:** 3 years, 7 waterfowl sites, 6 domestic sites (no ostrich sites)

Identification of potential bridge species

- Shared community of birds between compartments

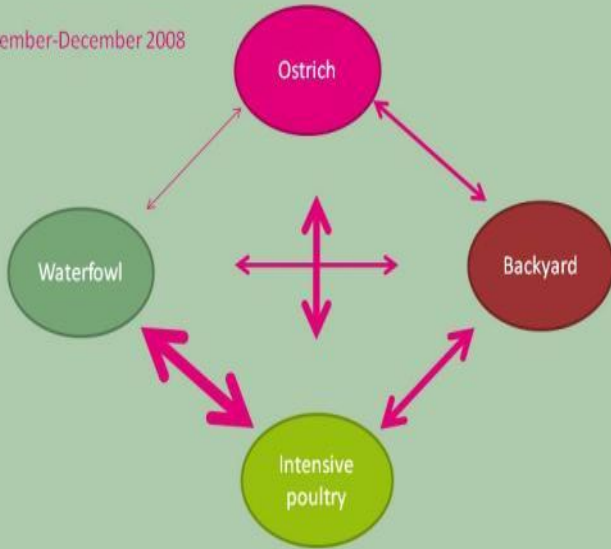


- Using bird counts in 4 compartments
- Identifying as potential bridge species, species present in 2 compartments during the same counting session
- n_b, n_b' = number of individuals of one bird species shared by the two compartments
- $\Sigma (n_b * n_b')$ = potential bridge species in interaction at the community level

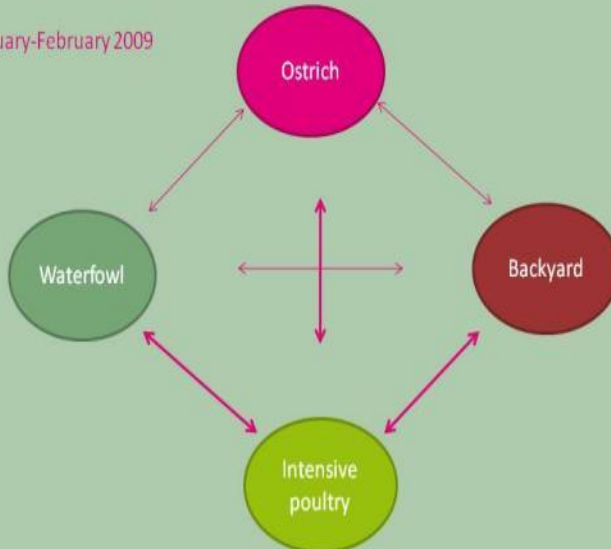
- Explore variability of $\Sigma (n_b * n_b')$ that we will call from now on: Epidemiological Interaction

Variability of bridge species interaction

November-December 2008



January-February 2009



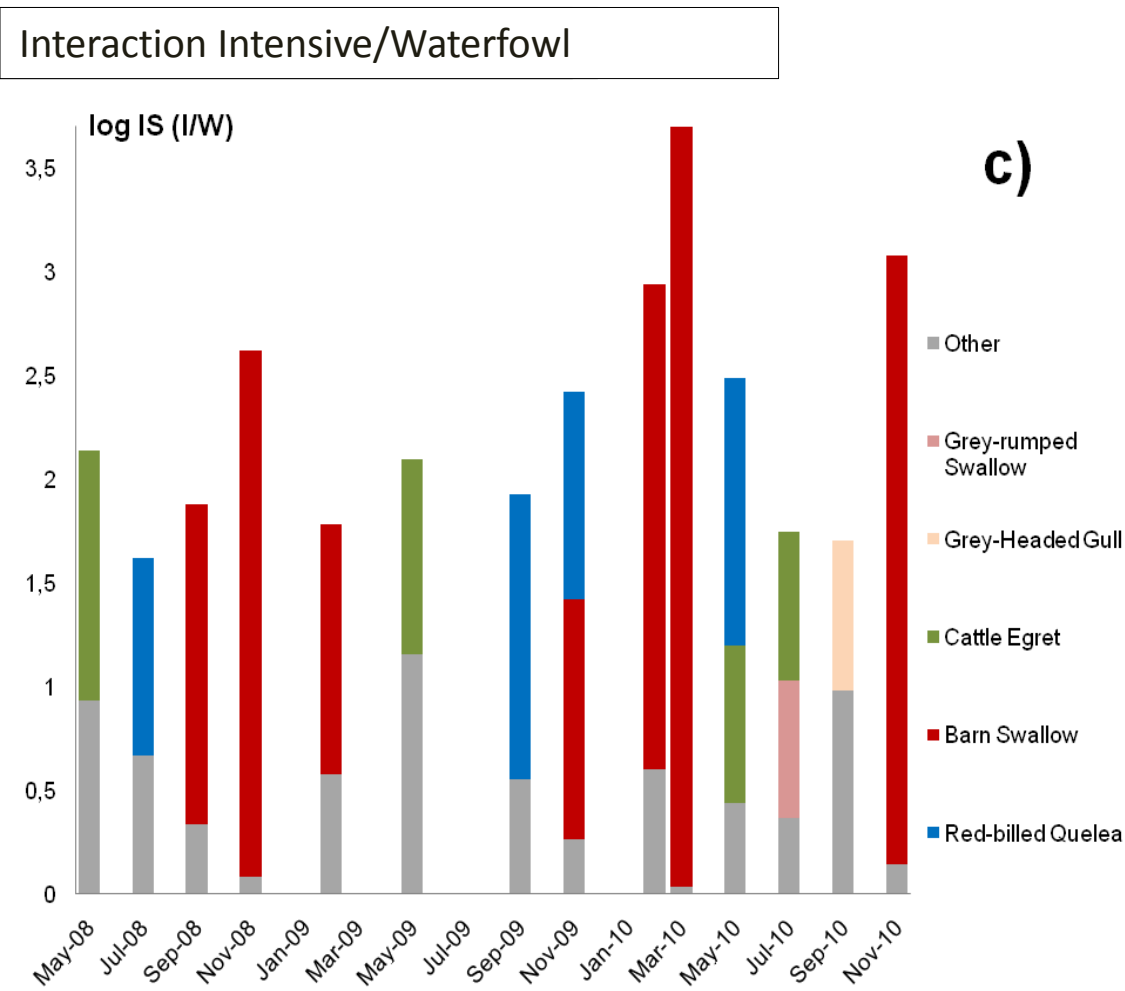
Variability of $\Sigma(nb*nb')$

Not homogenous:

→ across compartments

→ across seasons

Species Composition of the potential interactions



In colour, species representing more than 25% of the epidemiological interaction each session

- Most of the risk is represented by a few species

- There is a seasonality in the risk

- This seasonality is dependent on the ecology of the host (e.g. reproduction, movements)




Susceptibility of bridge species identified

- **Red-billed Queleas (*Quelea quelea*):**
 - potential spreader of HPAI H5N1 (Breithaupt et al. 2010) ;
 - positive for LPAI in Mali (Cappelle, personal obs.)
- **Barn swallows (*Hirunda rustica*):**
 - positive for LPAI in Europe (Gronesova et al, 2008, Mizakova et al, 2008)
 - positive for LPAI in Zambia and Zimbabwe (Caron, personal obs)
- **Cattle egret (*Bulbucus ibis*)**
 - positive for LPAI in Northern America (Squires et al. 2008)
- **And in our ecosystem in Zimbabwe?**



Confirming bridge species

- Sampling targeted on potential bridge species during higher risk period
- As our study is based on contacts, we tested potential bridge species for AIV, NCD and WNV (by PCR)

	N=	AIV	NCD	WNV
 Red-billed Quelea	206	2(0.97%)	15(7.28%)	6 (2.91%)
 Barn swallow	133	4(3.00%)	8(6.02%)	2(1.50%)
 Brown-throated swallow	74	1(1.35%)	3(4.05%)	0(0.00%)
Cattle egret	166	0(0.00%)	1(0.60%)	0(0.00%)
Domestique pigeon	104	0(0.00%)	0(0.00%)	NA

Implications for risk management

- **Risk of bridge species = a few species making a high proportion of the risk:**
 - Out of 249 bird species observed, 12 & 13 represented more than 10% in any of the counts (respectively for intensive and longitudinal protocol) and 4 species dominated most high risk period
- **Targeted management of these species would reduce significantly the interaction and risk**
- **Management options should use the ecology of bridge species at the wildlife/domestic interface:**
 - Limit access to wild bird attractor such as water and artificial feeding
 - Limiting roosting in or close to buildings during high risk period (Sept-Mars for Barn swallow)

Conclusions

- Predicting and managing transmission at the wildlife/domestic interface using the identification of bridge species is possible and less complex than previously thought → identification process based on counts or ornithological databases.
- AIV susceptibility is not taken into account a priori but in practice, it is nevertheless impossible (avian biodiversity too high)
- Our main result is that the risk is concentrated on a few species during high risk period: is this an ecosystem specific result or a common property of epidemiological interaction at the wild/domestic interface?



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Mammal Research
Institute, Uni. Of Pretoria



Onderstepoort
Veterinary Laboratory,
Pretoria



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Merci de votre attention