

# Bringing the Dead Alive



Dr Erica McAlister  
Senior Curator, Diptera and Siphonaptera

# Diptera Collection - 4 million specimens



# NHM Mosquito Collection statistics

- So much known – so little known

**1,200,000**

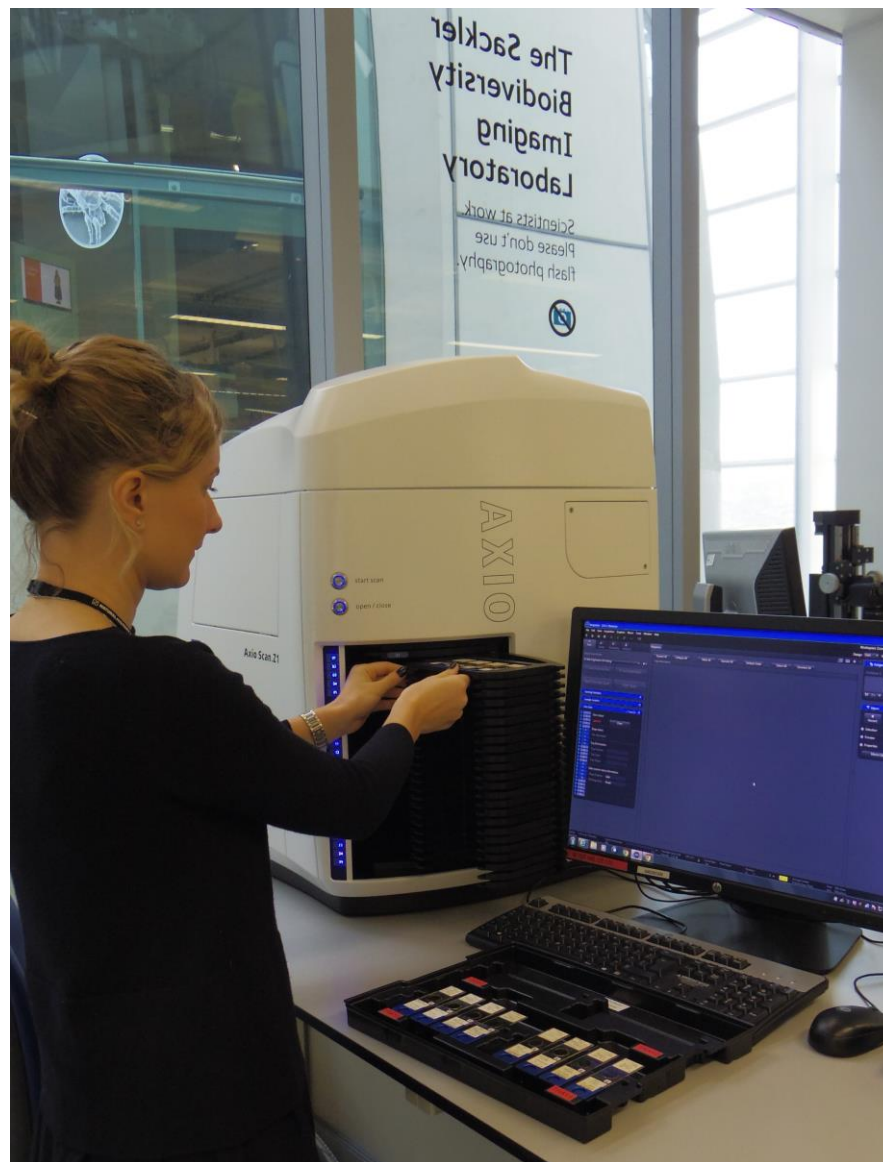
- 500 drawers of pinned material – main collection
  - 57,000 specimens
- 11 drawers of pinned material – British collection
  - 2,900 specimens
- 150 drawers of slide material
- 40 jars of spirit material

**specimens**

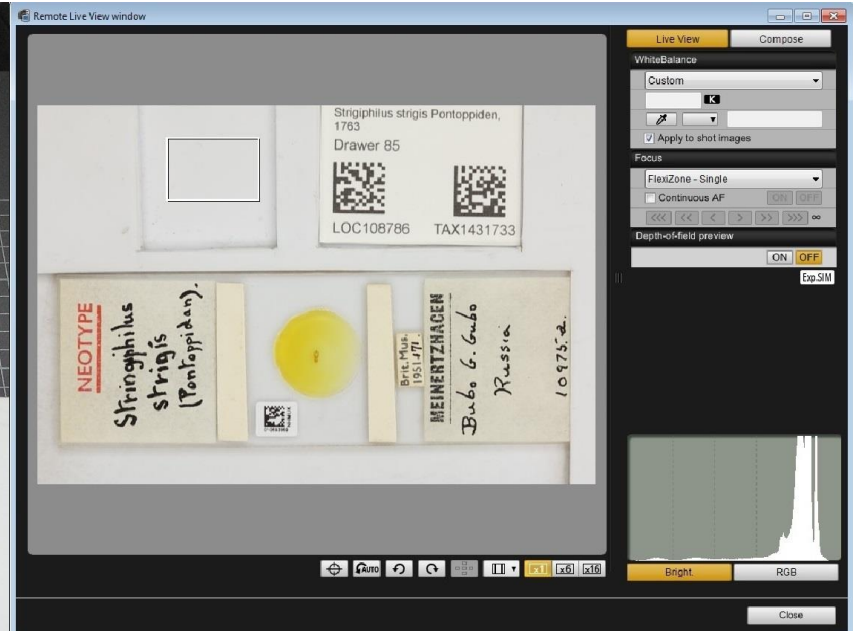
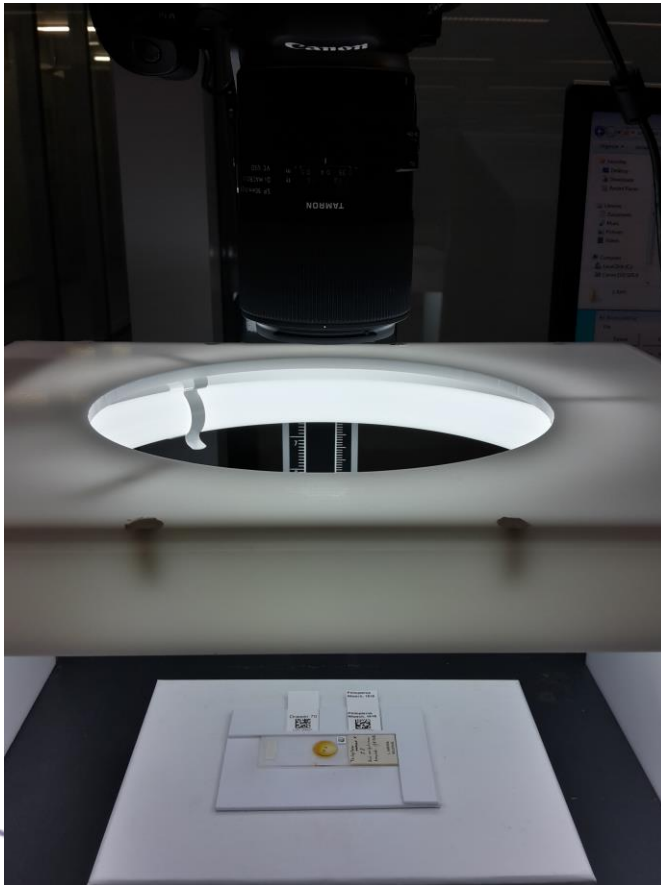
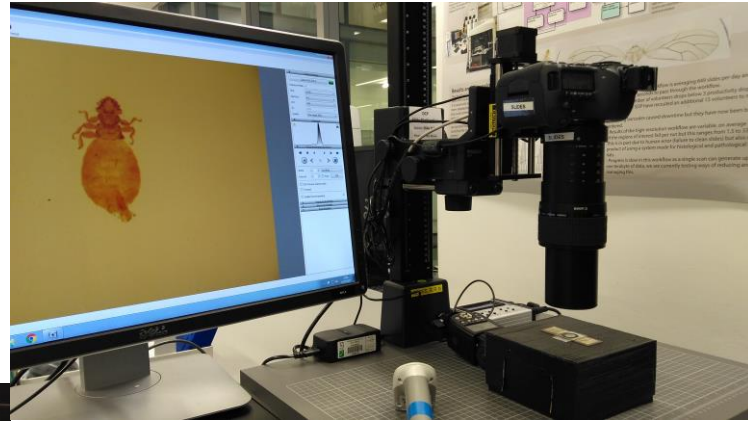
# NHM Mosquito Collection statistics

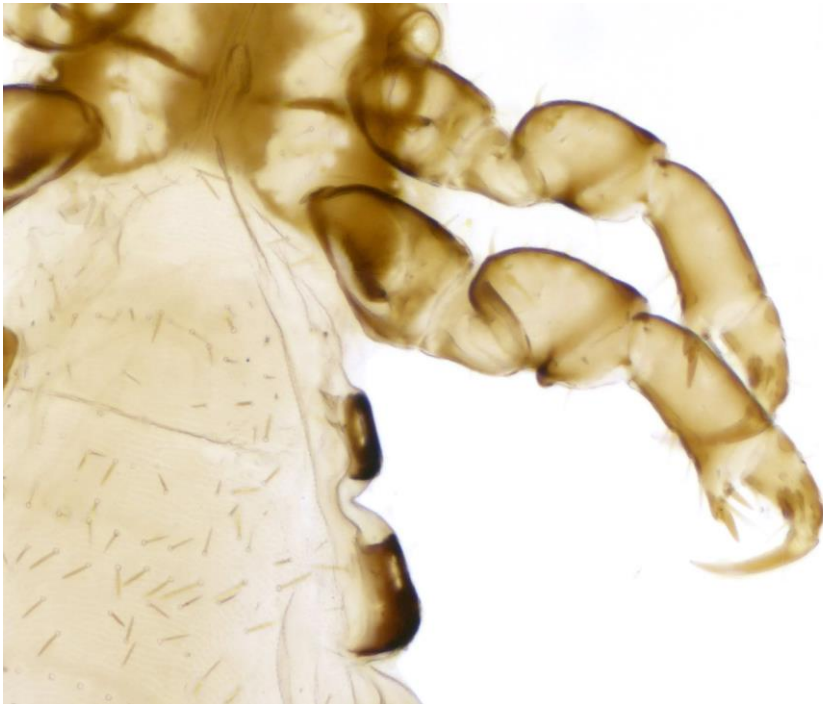
- 2,400 primary and secondary types
- 2,900 species (of 3,500)
  
- Individual specimen records – 2139 ☹️
- At current rate the mosquito collection will be digitised in 150,000 years

# Axio Scan

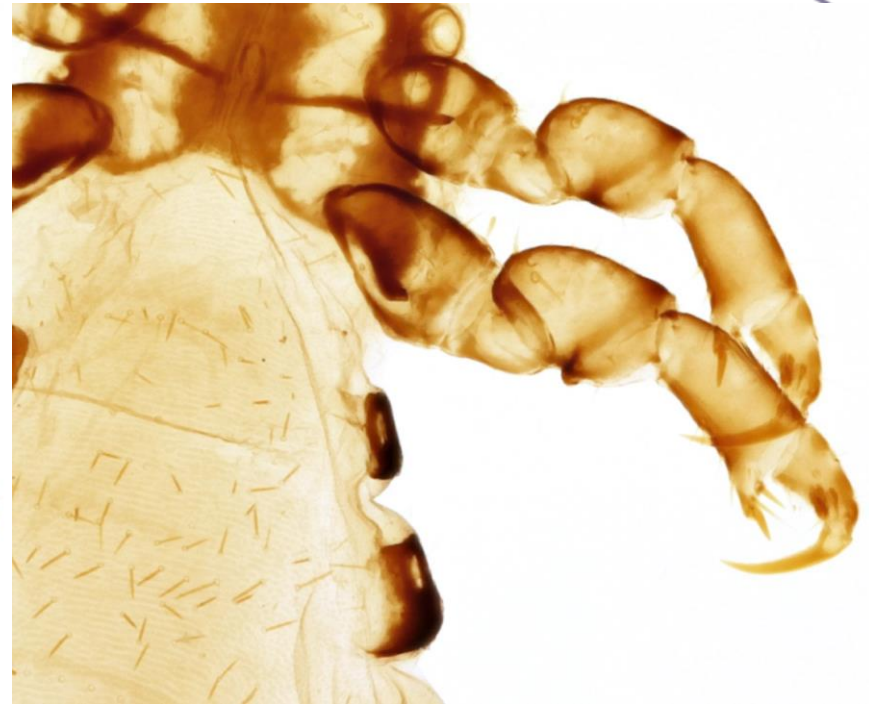


# SLR - stackshot





**Axio Scan**



**SLR-StackShot**

Explore and download the Natural History Museum's research and collections data.

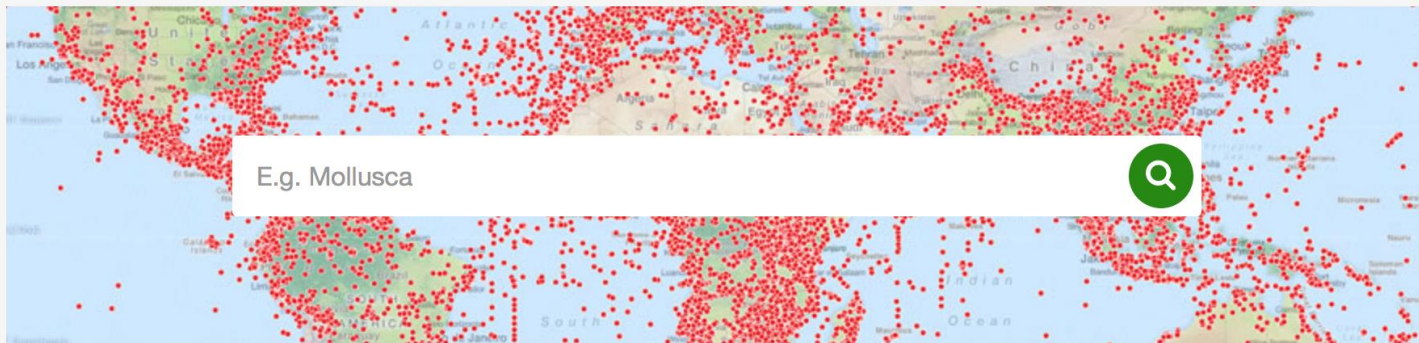
8.8M  
records


92  
datasets

33  
contributors

## Search the Natural History Museum Specimen Collection

3,810,248 of the Museum's 80 million specimens are now available online.



 400,705  
Palaeontology

 363,550  
Mineralogy

 668,471  
Botany

 1,003,122  
Entomology

 1,374,400  
Zoology



# Insect soup

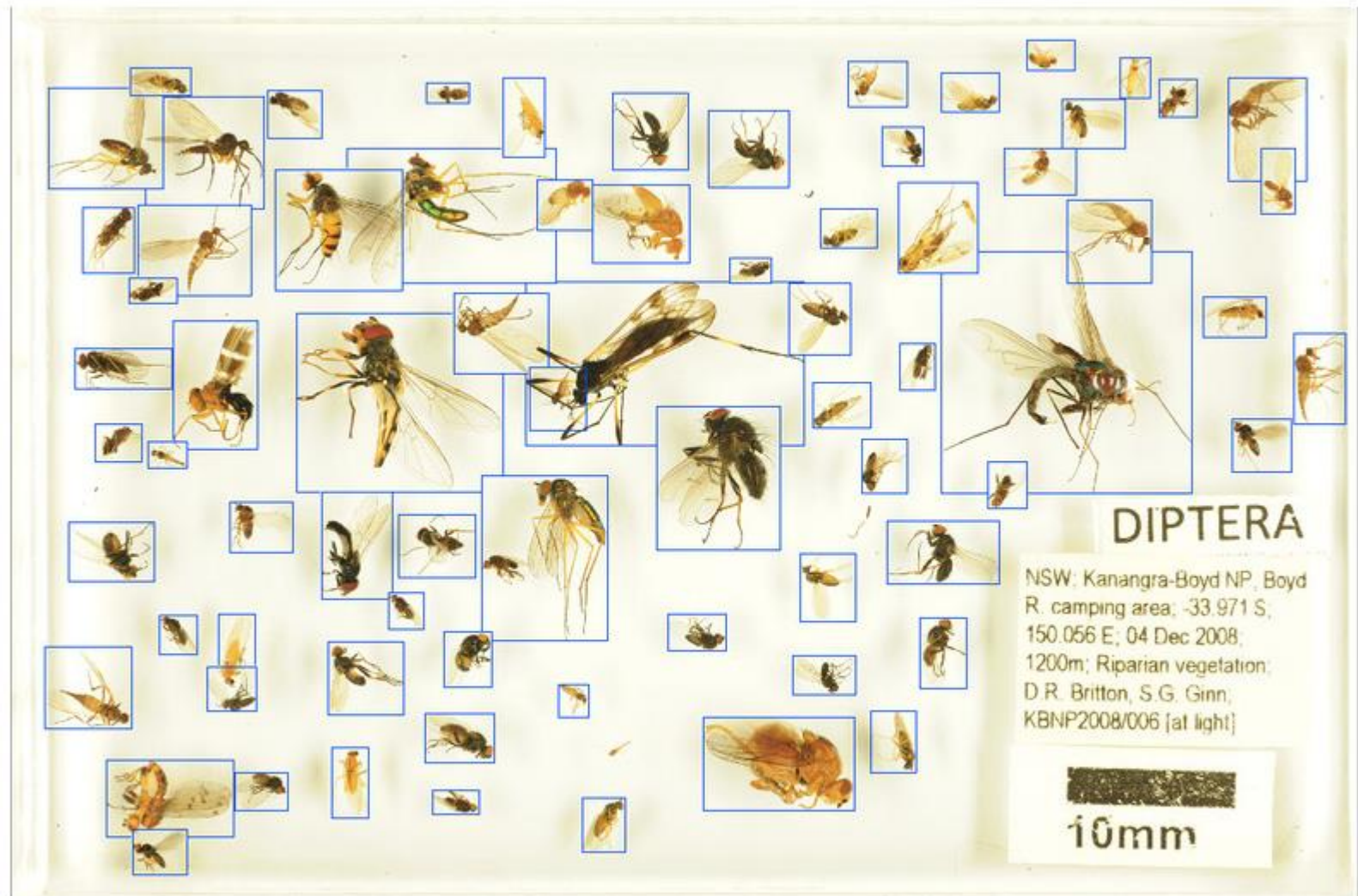
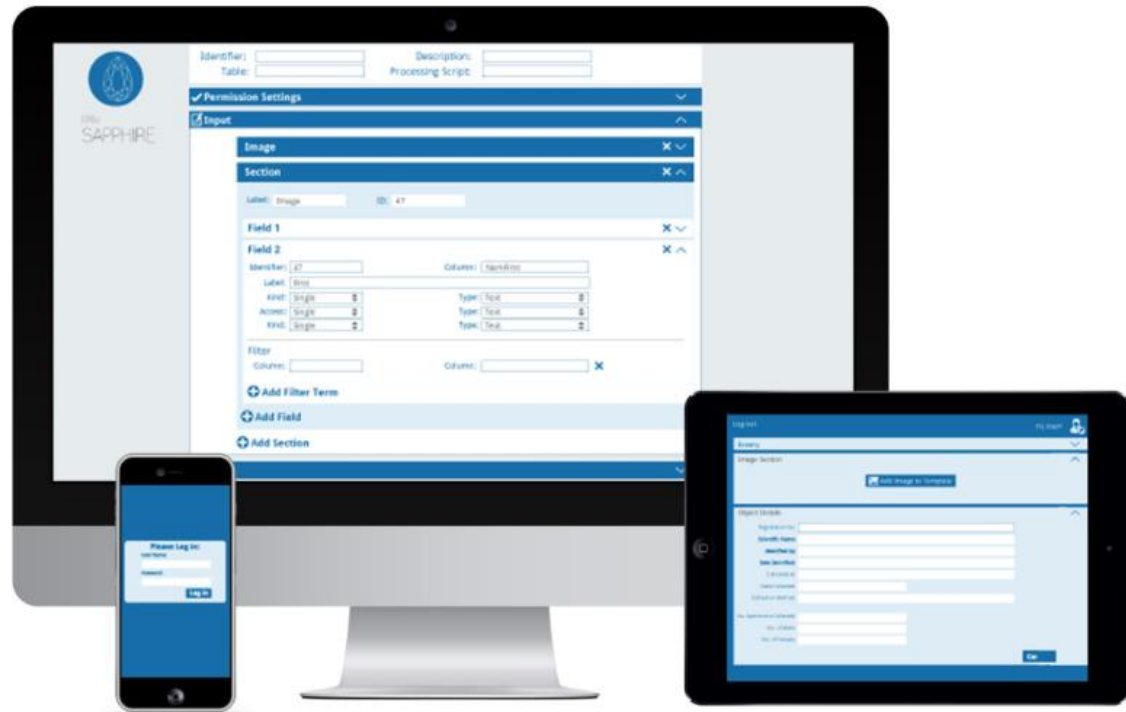


Image from the Australian Museum.

# Axiell Sapphire – rapid digitisation work flow



# Spatial surveillance

Specimen ID	County	Specific location	Collection method	Stage	Sex	Date	Time	Lat.	Long.	Collector	Genus	Species
90474 JK	Essex	Ranham Marshes Nature Reserve, pond near thames	Pond	Larvae	Female	5.vi.2010	N/A	51.492429	0.218206	Seth Irish	Aedes	detrifus
90476 JK	Essex	Ranham Marshes Nature Reserve, pond near thames	Pond	Larvae	Female	5.vi.2010	N/A	51.492429	0.218206	Seth Irish	Aedes	detrifus
90477 JK	Hampshire	West Side of Hayling Island	N/A	Adult	Female	11.v.2010	N/A	50.800063	-0.992136	Seth Irish	Aedes	detrifus
90478 JK	Wales	Gwynedd near Cregennon Lakes	Human biting	N/A	Female	15.v.2009	N/A	52.712862	3.984561	Seth Irish	Aedes	detrifus
90479 JK	Hampshire	West Side of Hayling Island	N/A	Larvae	Female	11.v.2010	N/A	50.800063	-0.992136	Seth Irish	Aedes	detrifus
90480 JK	Hampshire	Hayling Island	N/A	N/A	Female	11.v.2011	N/A	50.800063	-0.992136	Seth Irish	Aedes	detrifus
90481 JK	Wales	Gwynedd near Cregennon Lakes	Human biting	N/A	Female	15.v.2009	N/A	52.712862	3.984561	Seth Irish	Aedes	detrifus
90482 JK	Essex	Ranham Marshes Nature Reserve, pond near thames	Pond	Larvae	Female	5.vi.2011	N/A	51.492429	0.218206	Seth Irish	Aedes	detrifus
90483 JK	Essex	Ranham Marshes Nature Reserve, pond near thames	Pond	Larvae	Male	5.vi.2010	N/A	51.561324	-0.347486	Seth Irish	Aedes	detrifus
90484 JK	Essex	Ranham Marshes Nature Reserve, pond near thames	Pond	Larvae	Male	5.vi.2010	N/A	51.492429	0.218206	Seth Irish	Aedes	detrifus
90485 JK	Hampshire	West Side of Hayling Island	N/A	Larvae	Male	11.v.2010	N/A	50.800063	-0.992136	Seth Irish	Aedes	detrifus
90486 JK	Greater London	South Harrow	CDC light trap	N/A	Male	23.vi.2010	N/A	51.561324	-0.347486	Seth Irish	Culiseta	moritans
90487 JK	Greater London	South Harrow	Sweep sample	N/A	Male	23.vi.2010	N/A	51.561324	-0.347486	Seth Irish	Culiseta	moritans
90488 JK	Greater London	South Harrow	Sweep sample	N/A	Female	23.vi.2011	N/A	51.561324	-0.347486	Seth Irish	Aedes	cantans
90489 JK	Kent	Near wastewater treatment plant	Sweep sample	N/A	Male	4.vi.2010	N/A	N/A	N/A	Seth Irish	Culiseta	annulata
90490 JK	Essex	Ranham Marshes Nature Reserve, pond near thames	Pond	Larvae	Female	5.vi.2010	N/A	51.492429	0.218206	Seth Irish	Aedes	caespis
90491 JK	Hampshire	Hayling Island	N/A	Pupa	Female	11.v.2010	N/A	50.800063	-0.992136	Seth Irish	Aedes	caespis
90492 JK	Greater London	South Harrow, Ranham Marshes Nature Reserve	Sweep sample	N/A	Male	23.vi.2010	N/A	51.492429	0.218206	Seth Irish	Culiseta	moritans
90493 JK	Hampshire	West Side of Hayling Island	N/A	Larvae	Female	11.v.2014	N/A	50.800063	-0.992136	Seth Irish	Aedes	caespis
90494 JK	Hampshire	Hayling Island	N/A	Larvae	Female	11.v.2012	N/A	50.800063	-0.992136	Seth Irish	Aedes	caespis
90495 JK	Hampshire	Hayling Island	N/A	Pupa	Male	11.v.2011	N/A	50.800063	-0.992136	Seth Irish	Aedes	caespis
90496 JK	Kent	Near wastewater treatment plant	Sweep sample	N/A	Male	4.vi.2011	N/A	N/A	N/A	Seth Irish	Culiseta	annulata
90497 JK	Greater London	South Harrow	Sweep sample	N/A	Female	23.vi.2010	N/A	51.561324	-0.347486	Seth Irish	Culiseta	moritans
90498 JK	Hampshire	Hayling Island	N/A	Larvae	Female	11.v.2013	N/A	50.800063	-0.992136	Seth Irish	Aedes	caespis
90499 JK	Greater London	South Harrow	CDC light trap	Adult	Female	23.vi.2014	N/A	51.561324	-0.347486	Seth Irish	Aedes	cantans
90500 JK	Greater London	South Harrow	Sweep sample	N/A	Female	23.vi.2012	N/A	51.561324	-0.347486	Seth Irish	Aedes	cantans
90501 JK	Greater London	South Harrow	Sweep sample	N/A	Female	23.vi.2010	N/A	51.561324	-0.347486	Seth Irish	Aedes	cantans
90502 JK	Greater London	South Harrow	CDC light trap	Adult	Female	23.vi.2015	N/A	51.561324	-0.347486	Seth Irish	Aedes	cantans
90503 JK	Greater London	South Harrow	Sweep sample	N/A	Female	23.vi.2011	N/A	51.561324	-0.347486	Seth Irish	Aedes	cantans
90504 JK	Greater London	South Harrow	Sweep sample	N/A	Female	23.vi.2010	N/A	51.561324	-0.347486	Seth Irish	Culex	jipponensis
90505 JK	Greater London	South Harrow	N/A	N/A	N/A	5.vi.2010	N/A	51.561324	-0.347486	Seth Irish	Coquillettoides richardi	
90506 JK	Greater London	South Harrow	Sweep sample	N/A	Female	23.vi.2010	N/A	51.561324	-0.347486	Seth Irish	Culex	jipponensis
90507 JK	Greater London	South Harrow	Sweep sample	N/A	Female	23.vi.2010	N/A	51.561324	-0.347486	Seth Irish	Culex	jipponensis
90508 JK	Hampshire	West Side of Hayling Island	N/A	N/A	Female	11.v.2010	N/A	50.800063	-0.992136	Seth Irish	Undersfordia	(flavescens?)

Lack of detailed data on the past and present distribution of mosquito vectors is a major limiting factor for modeling of vector-borne diseases

Lack of data causes problems as problems of local scale within country

Dr. Steve Le Comber





- 5423 records of mosquitoes in UK – 2900 from NHM
- Specimens are biased!
  - Dirichlet Process Mixture (DPM) model of geographic profiling
  - jack-knifing approach to estimate the bias

# DNA extraction

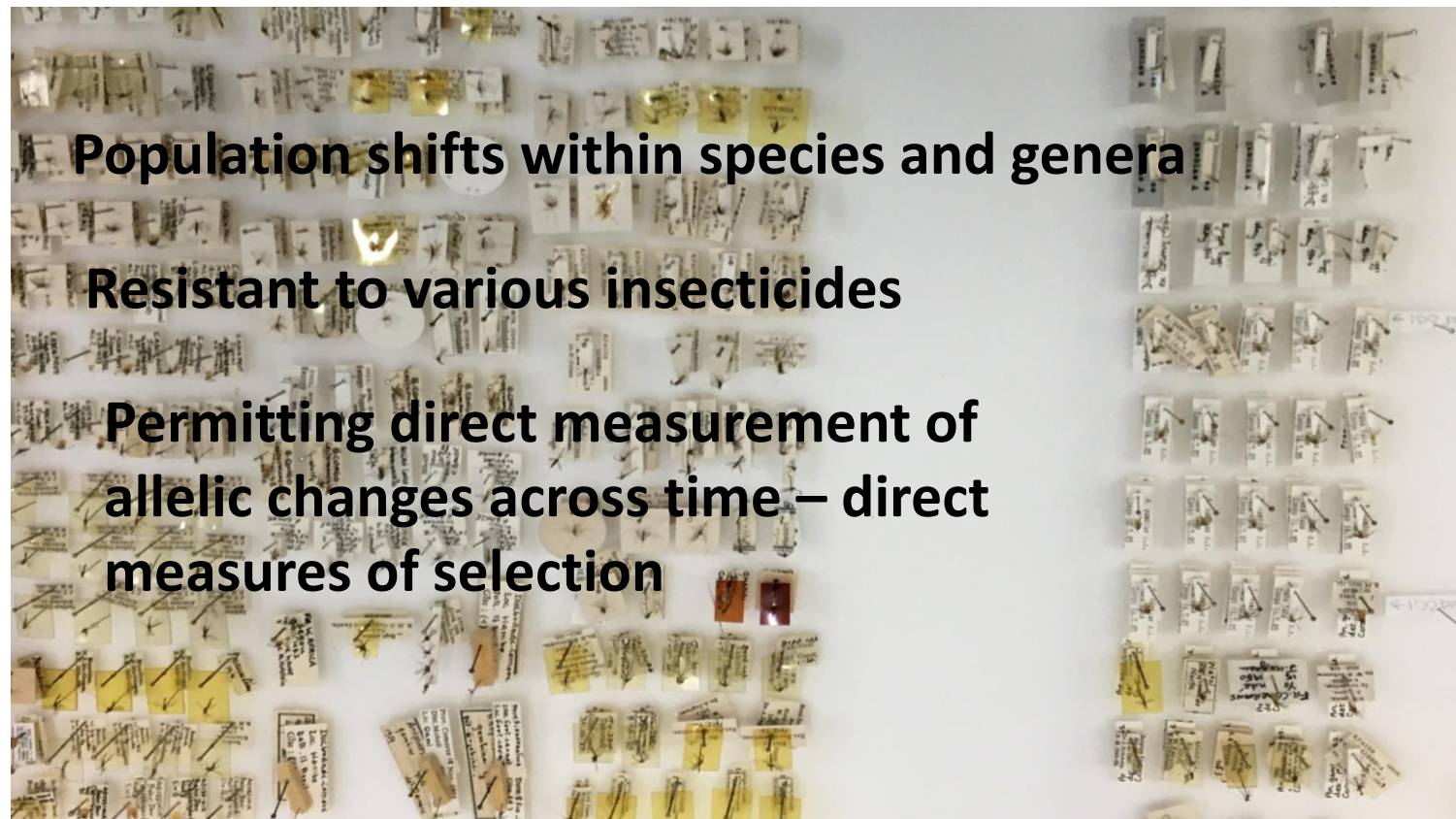


- Underutilized genetic resource
- Most material in collections not used
  - Fragile/valuable specimens
  - DNA sampling can be destructive
  - Badly degraded DNA therefore not suitable for most PCR- based gene sequencing
- NGS – able to extract meaningful amounts

# A present look into the past

... but what happened over the last 100 years?

last 15 years



**Population shifts within species and genera**

**Resistant to various insecticides**

**Permitting direct measurement of allelic changes across time – direct measures of selection**

# aDNA methods in a historical context

Obtaining *Anopheles* (and *Plasmodium*) genome sequences



... with minimal sample destruction

DNA preservation assessment  
Developing new and implementing established aDNA methods

## To date....

- Slide scanning and specimen data uploading to portal
- Pinned specimens to be made digi-ready
- Development of aDNA protocols
- Further implications - pollinators



Thanks



- The NHM and all that she encompasses
- The World and all the specimens it has provided
- Mara Lawniczak, Sanger Institute
- Steve le Comber, Queen Mary's University