

Reconciling phenological observations with flowering records in herbaria

Jonathan Davies
McGill University &
University of British
Columbia

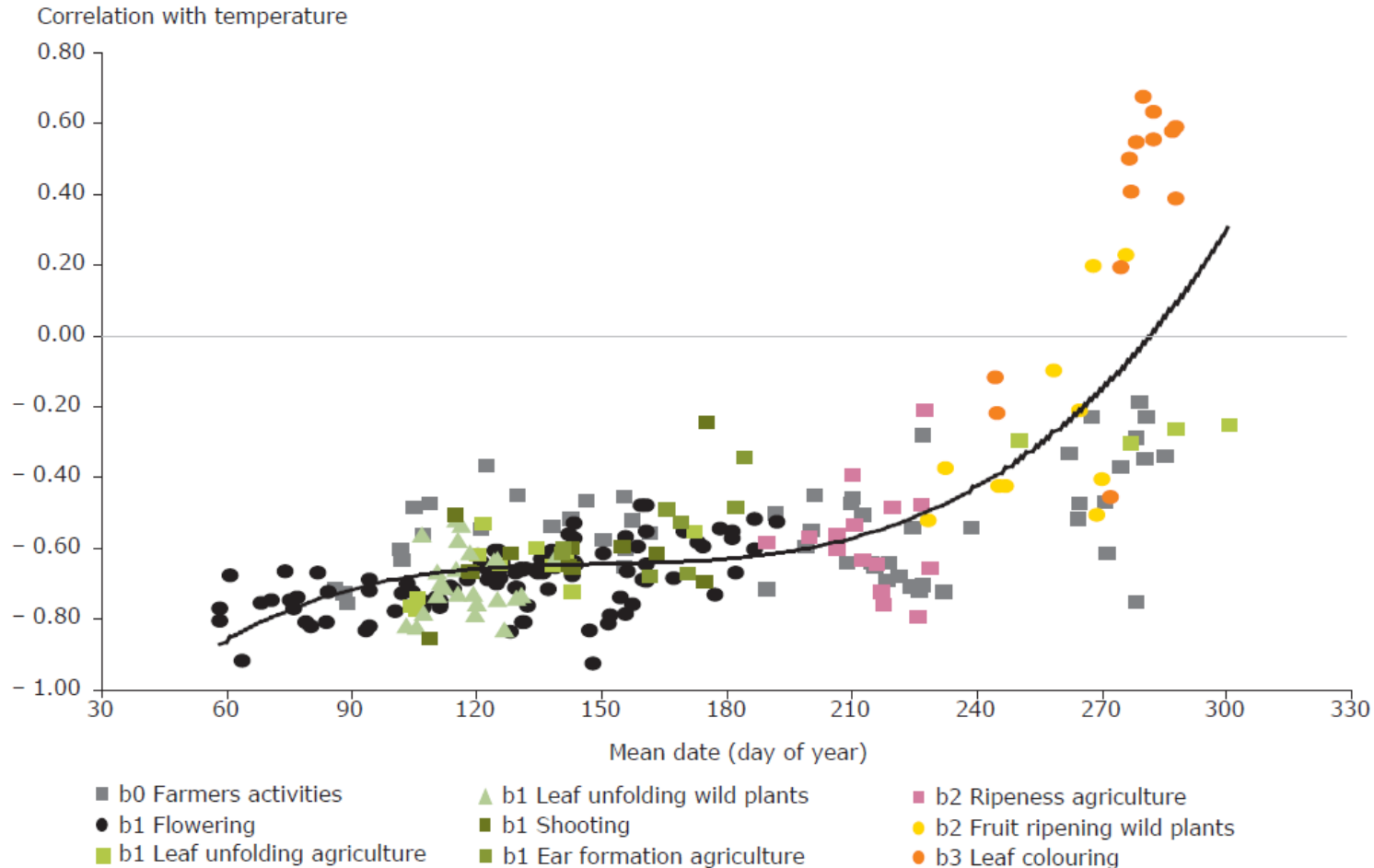
William Pearse
Utah State University



University of Johannesburg TreeBOL Africa	
Name	<i>Polygala virgata</i> Thunb.
Family	Polygalaceae
Country	South Africa
Locality	Umtamvana Nature Reserve
GPS data	S31 00 29.8 E30 10 33.7 (WGS84)
Collectors	Tony Abbott
Voucher	Abbott9243 UJ DNA No UJ04733
Identifier	Tony Abbott

Reconciling observations with herbaria

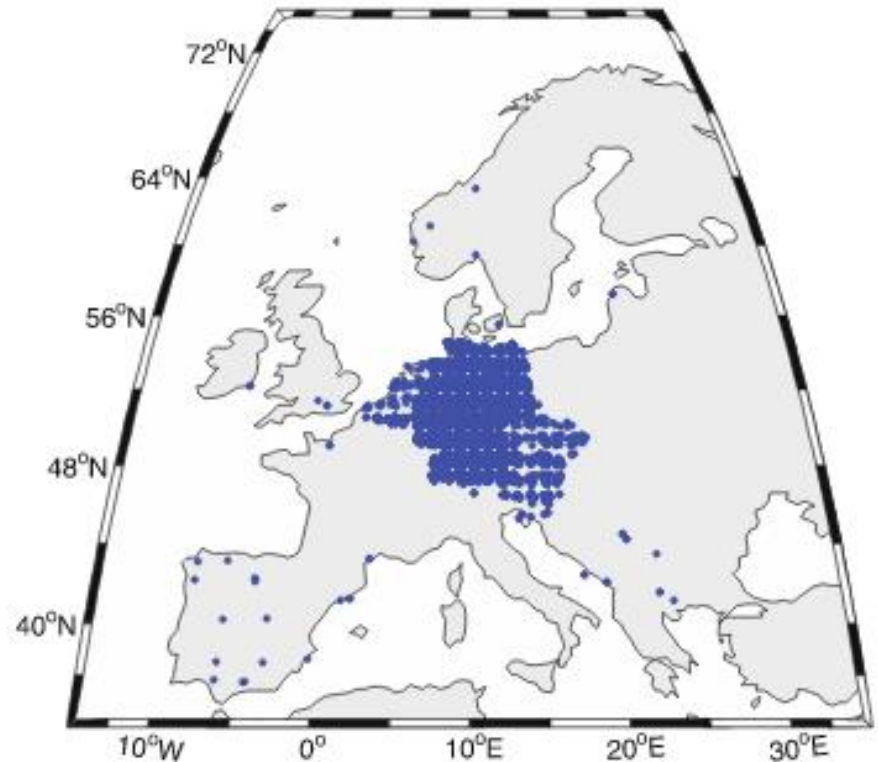
Change in time



Reconciling observations with herbaria

Spatial, temporal and taxonomic distribution of phenological data highly uneven.

Pan European Phenology Project
PEP725



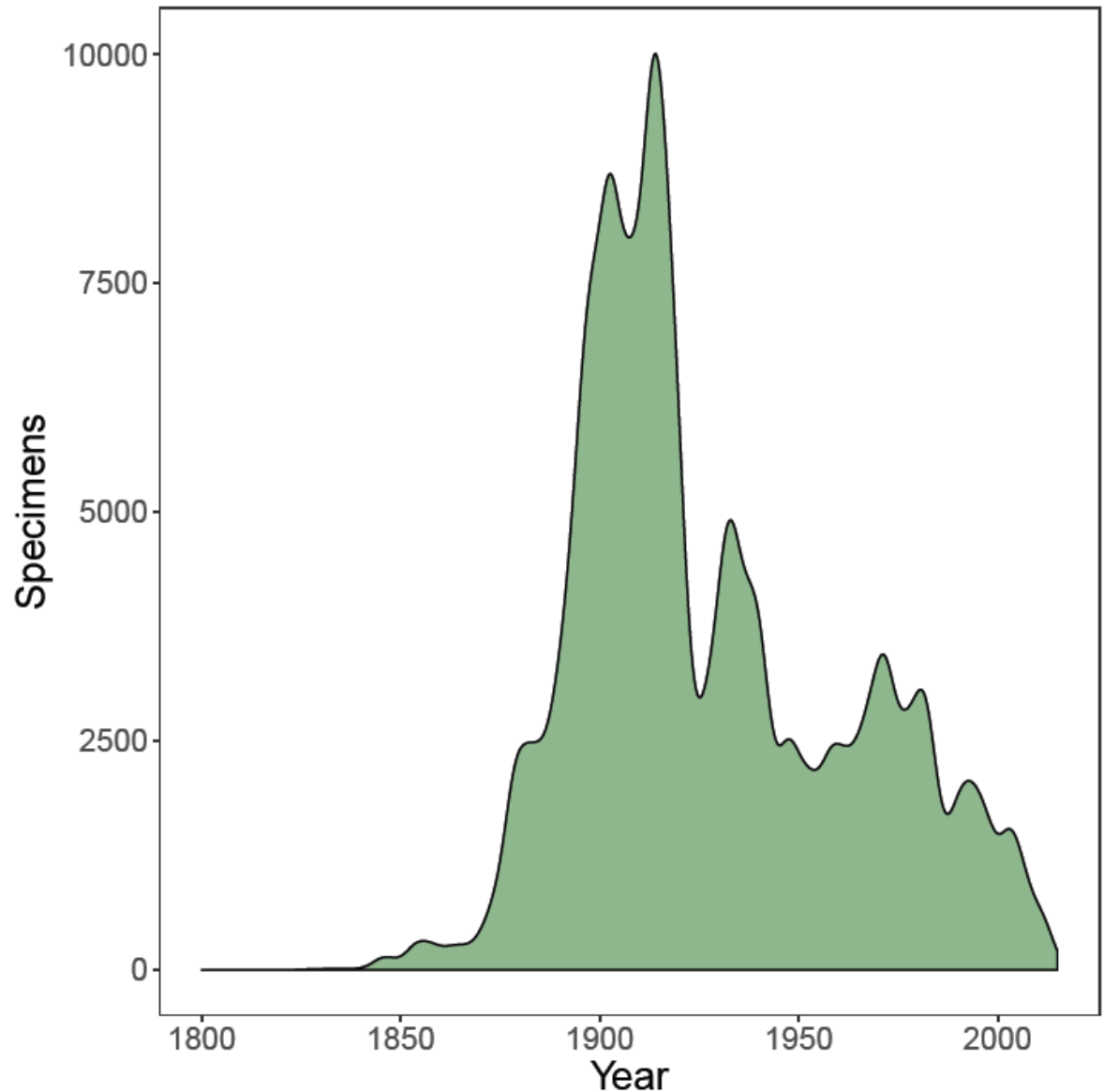
Reconciling observations with herbaria



Reconciling observations with herbaria

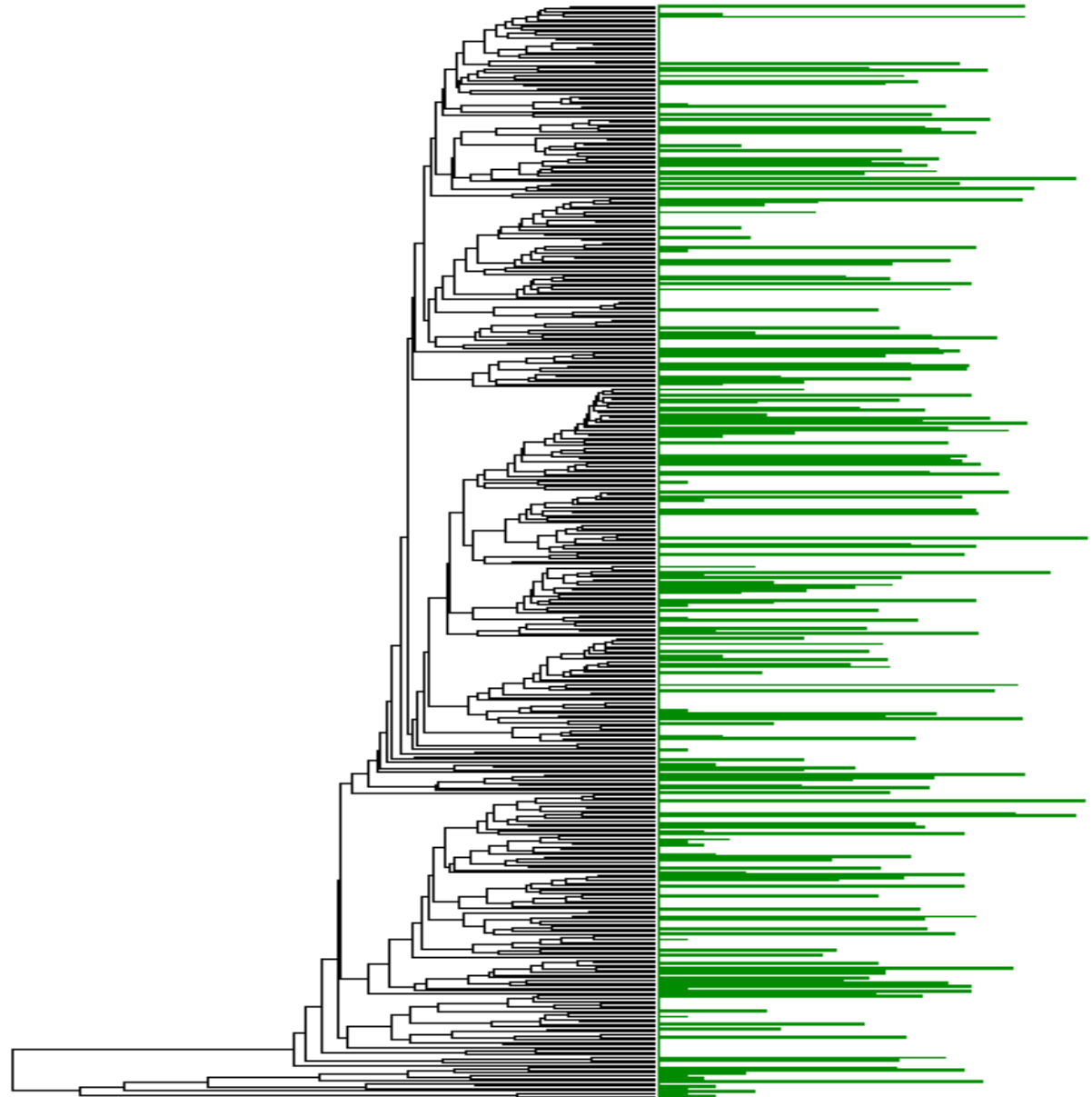
The herbaria of New England house more than half a million herbarium specimens.

Can serve as baselines prior to anthropogenic change.

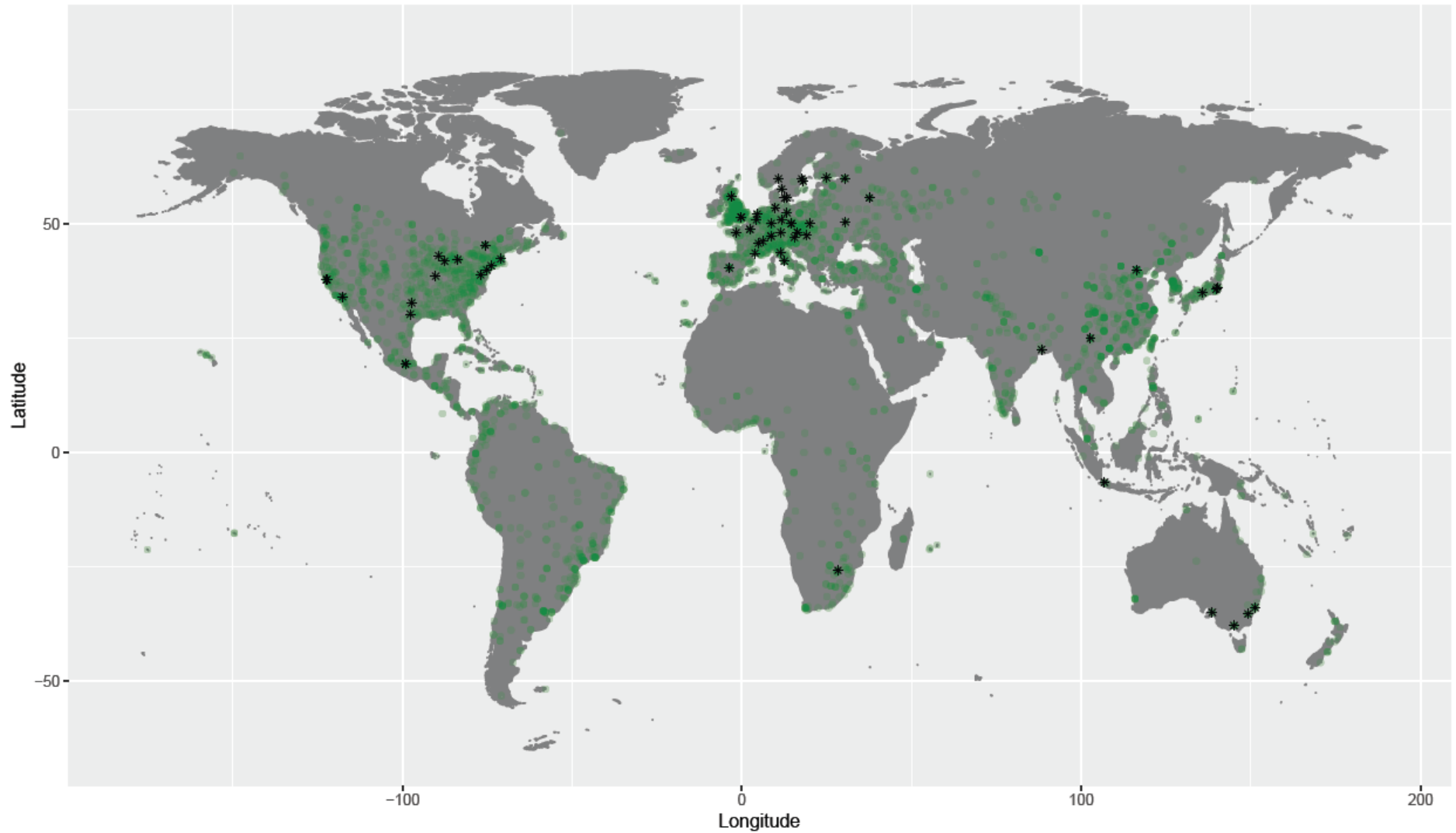


Reconciling observations with herbaria

.... and span most branches
of the vascular plant tree of
life

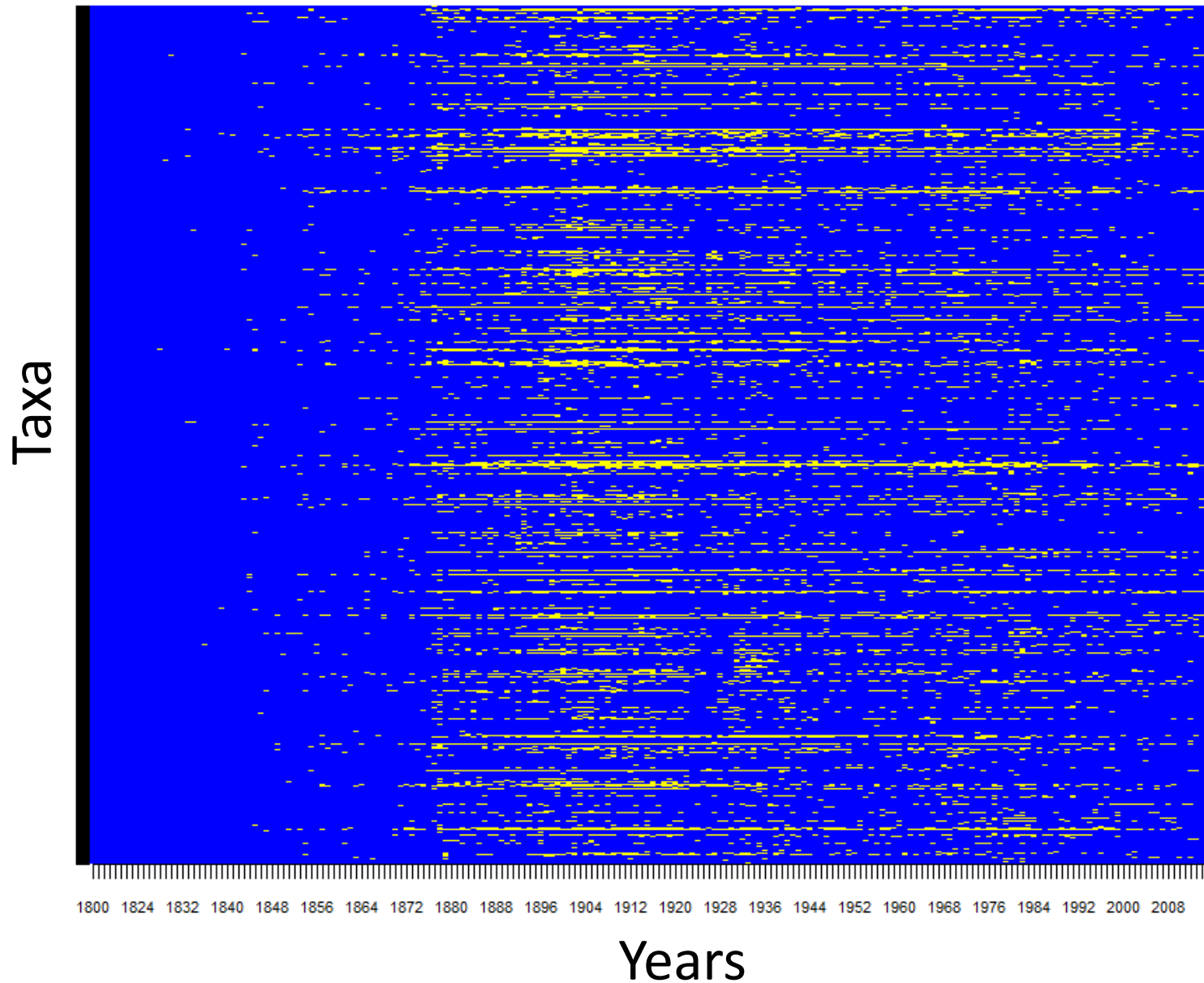


Reconciling observations with herbaria



Herbaria are distributed worldwide, and many house >million specimens

Reconciling observations with herbaria



Reconciling observations with herbaria

Herbarium specimens are a bit like German tanks ...



=



Reconciling observations with herbaria

The German Tank Problem



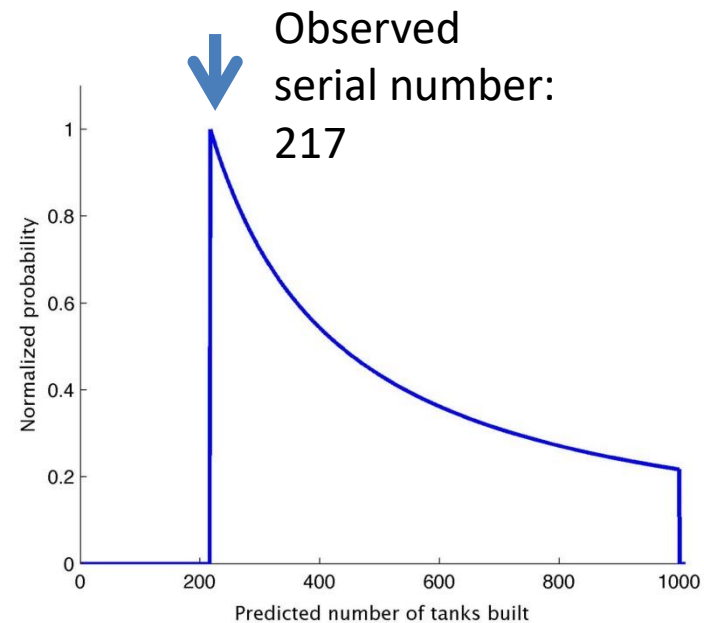
Month	Intelligence estimate
June 1940	1,000
June 1941	1,550
August 1942	1,550

Reconciling observations with herbaria

The German Tank Problem



Month	Intelligence estimate
June 1940	1,000
June 1941	1,550
August 1942	1,550



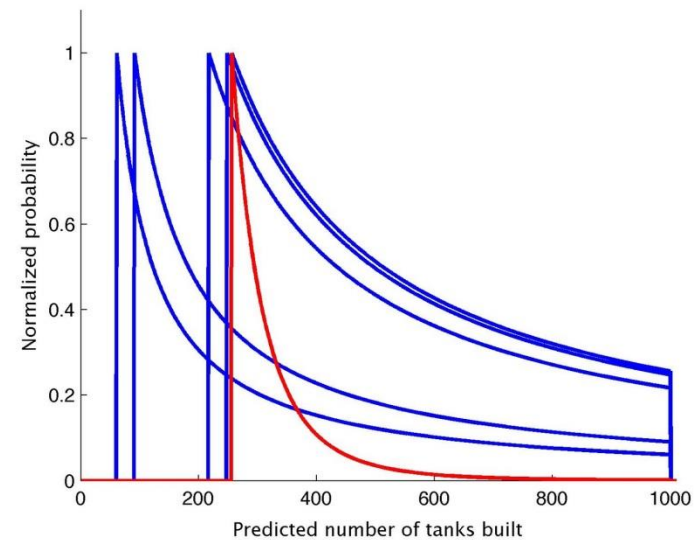
(assuming tanks are numbered sequentially)

Reconciling observations with herbaria

The German Tank Problem



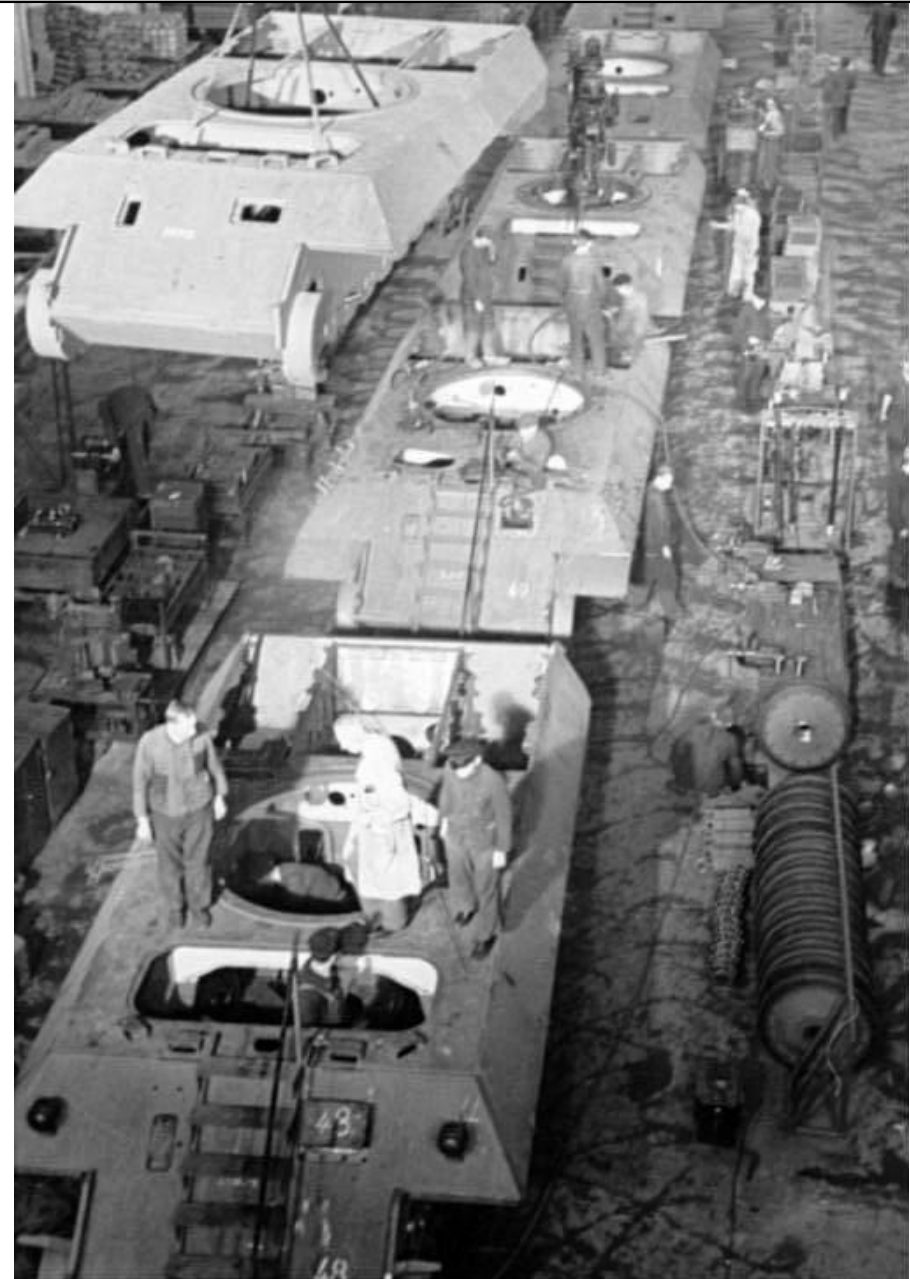
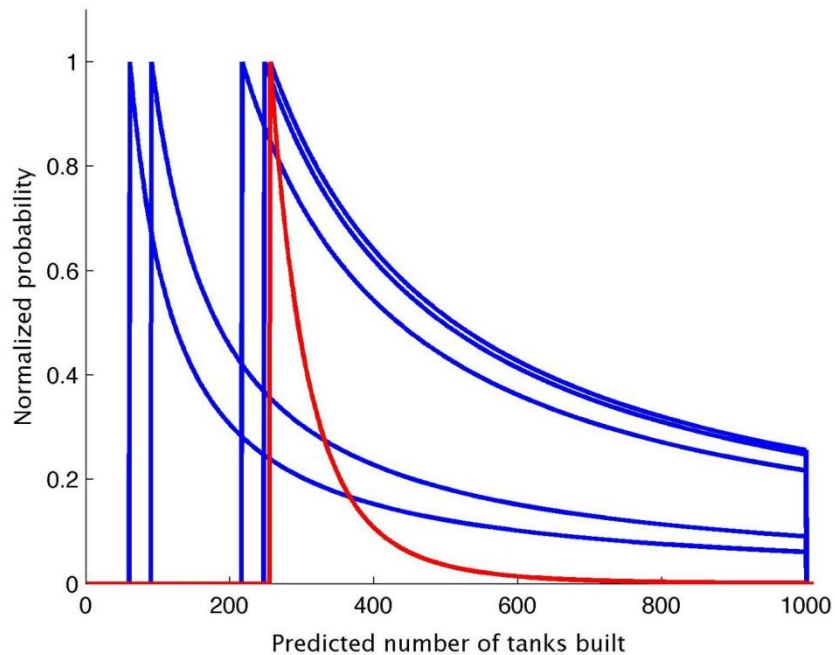
Month	Intelligence estimate
June 1940	1,000
June 1941	1,550
August 1942	1,550



Reconciling observations with herbaria

The German Tank Problem

Month	Statistical estimate	Intelligence estimate
June 1940	169	1,000
June 1941	244	1,550
August 1942	327	1,550

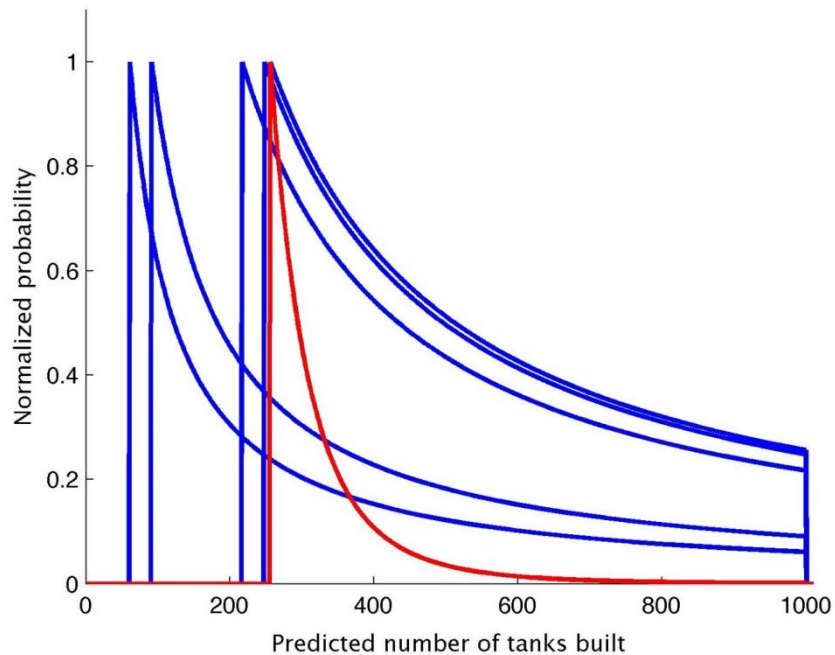


Reconciling observations with herbaria

The German Tank Problem



Month	Statistical estimate	Intelligence estimate	German records
June 1940	169	1,000	122
June 1941	244	1,550	271
August 1942	327	1,550	342

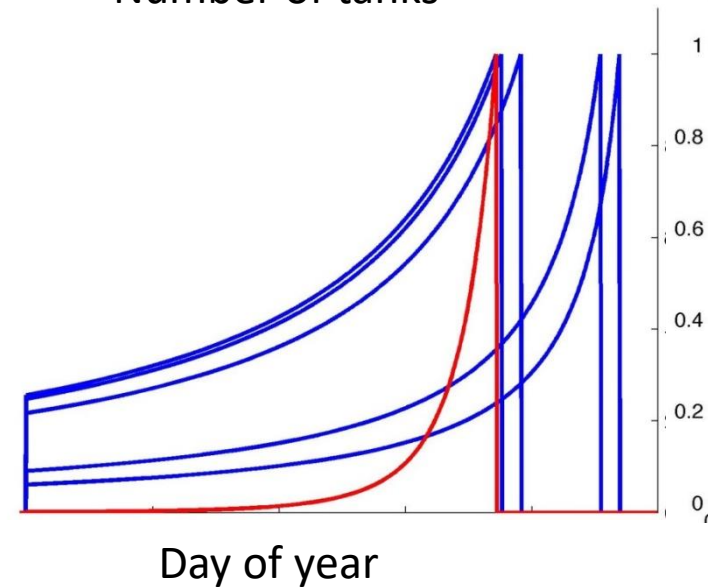
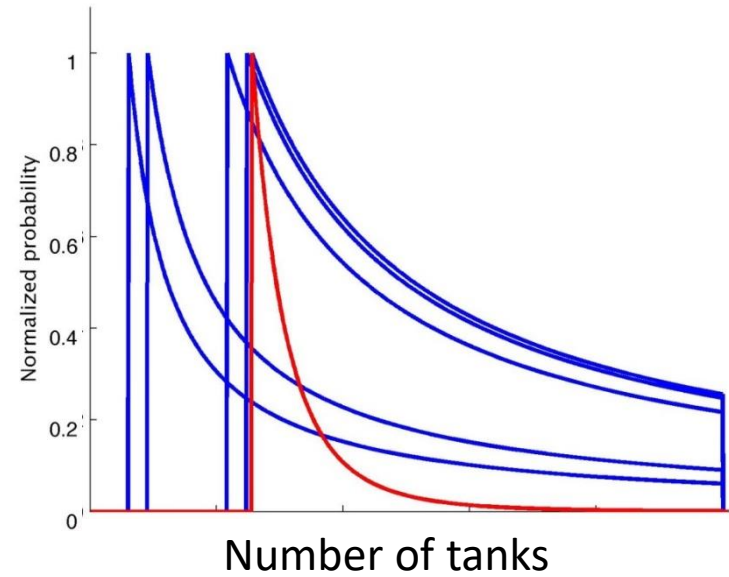


Reconciling observations with herbaria

Herbarium specimens equivalent to observations of defeated tanks

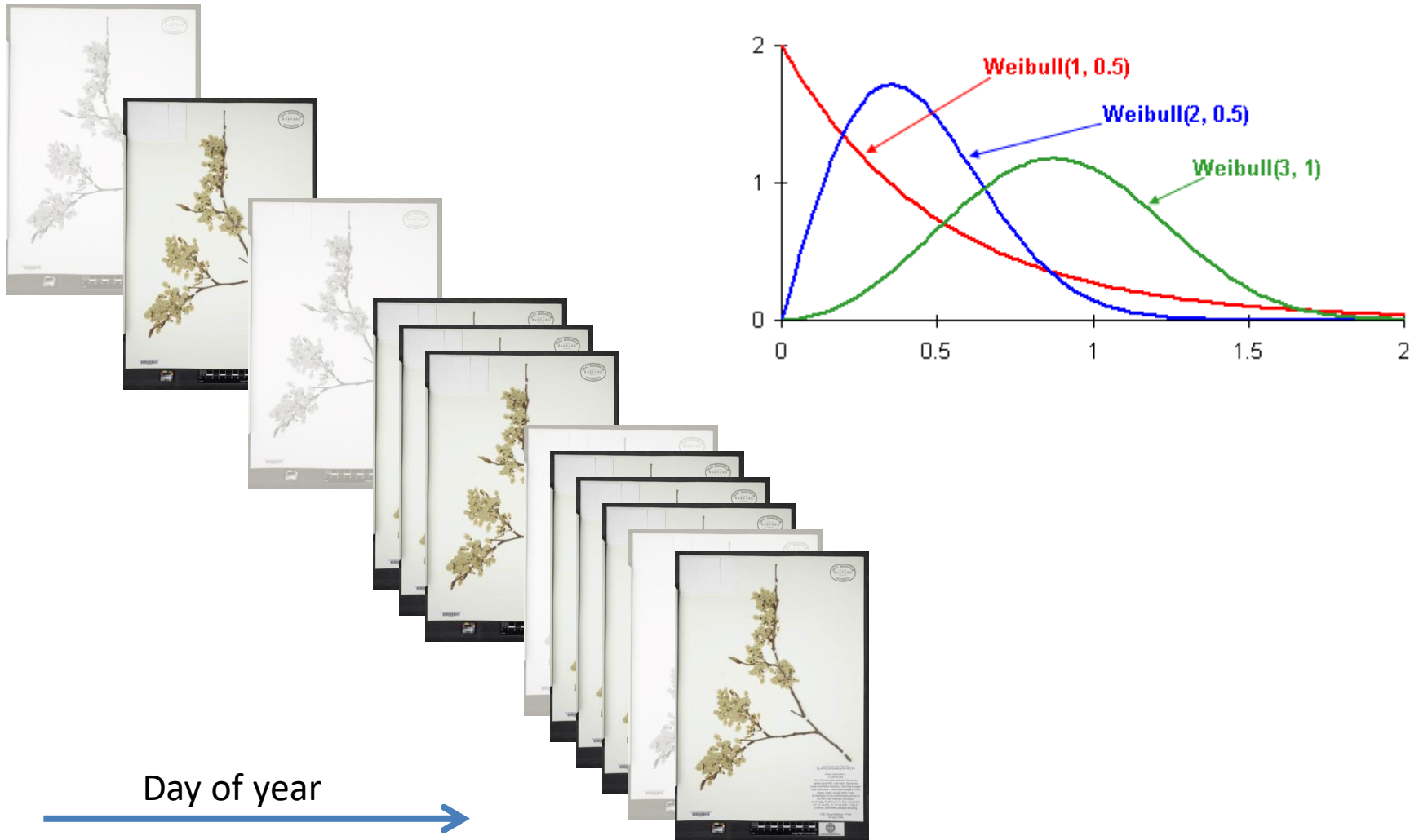


Reconciling observations with herbaria



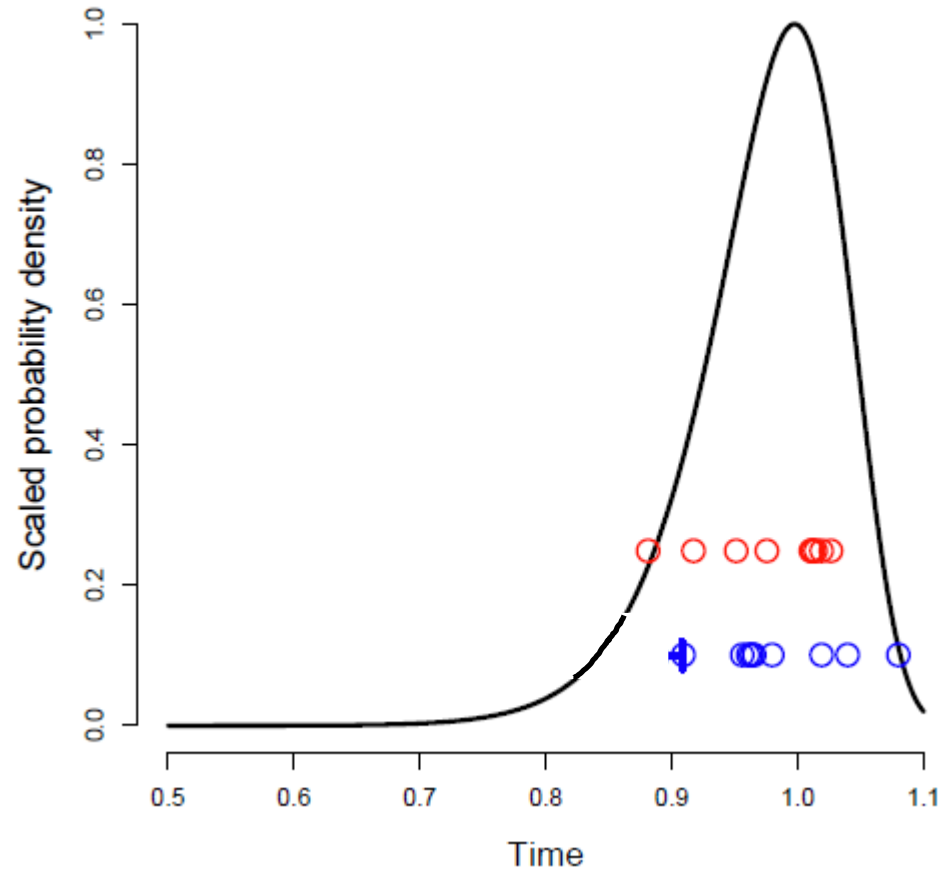
Reconciling observations with herbaria

Herbarium specimens equivalent to observations of defeated tanks



Reconciling observations with herbaria

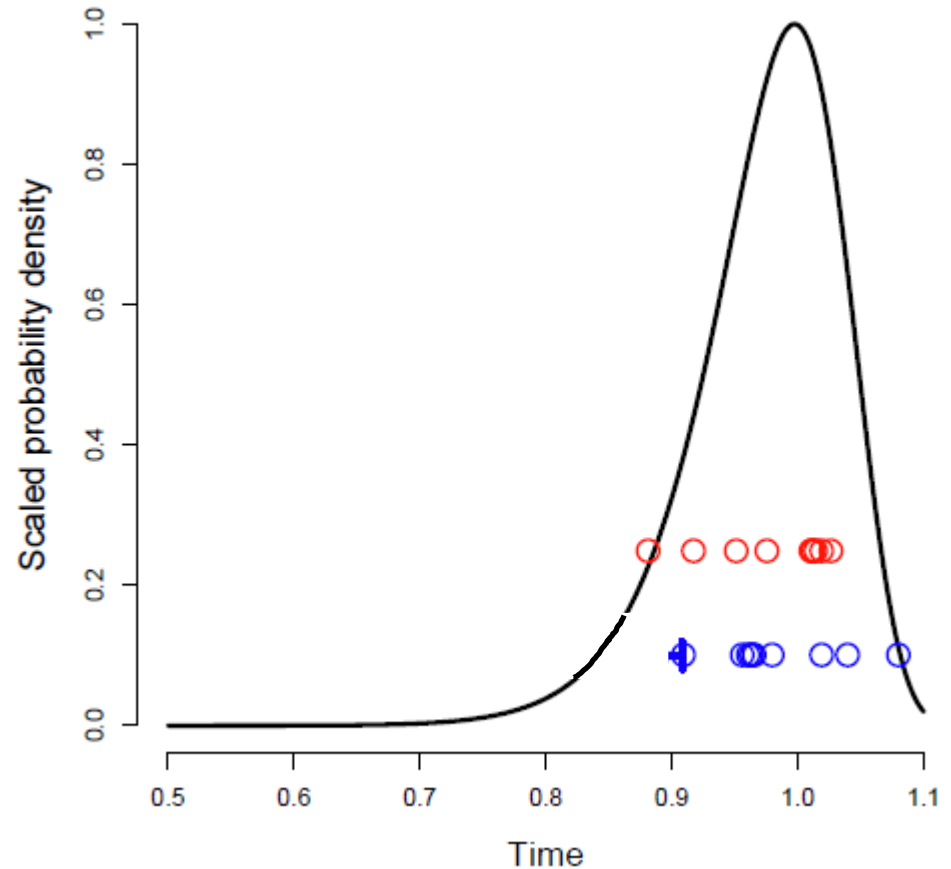
Herbarium specimens equivalent to observations of defeated tanks or dodo sightings



Two random draws (red and blue) from the same distribution (in black)

Reconciling observations with herbaria

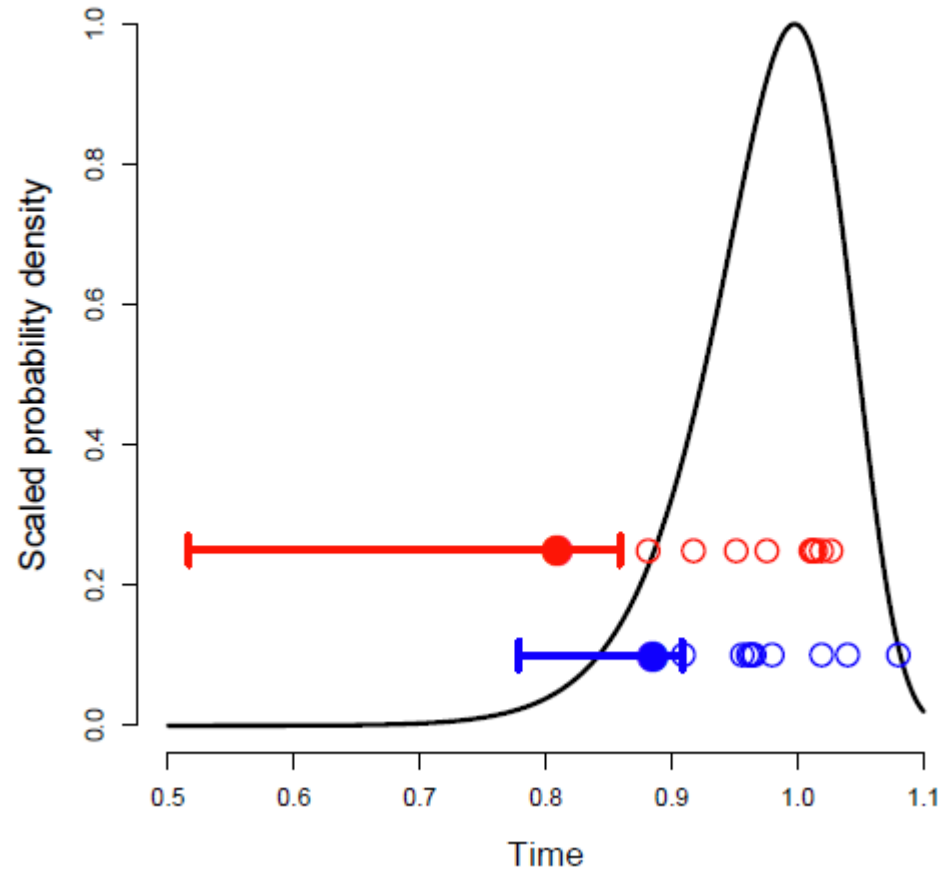
Herbarium specimens equivalent to observations of defeated tanks or dodo sightings



Two random draws (red and blue) from the same distribution (in black)

Reconciling observations with herbaria

Herbarium specimens equivalent to observations of defeated tanks or dodo sightings



Two random draws (red and blue) from the same distribution (in black)

Reconciling observations with herbaria



Pogonia ophioglossoides

15 25



Platanthera lacera

16 14



Platanthera grandiflora

16 11



Cypripedium acaule

17 19



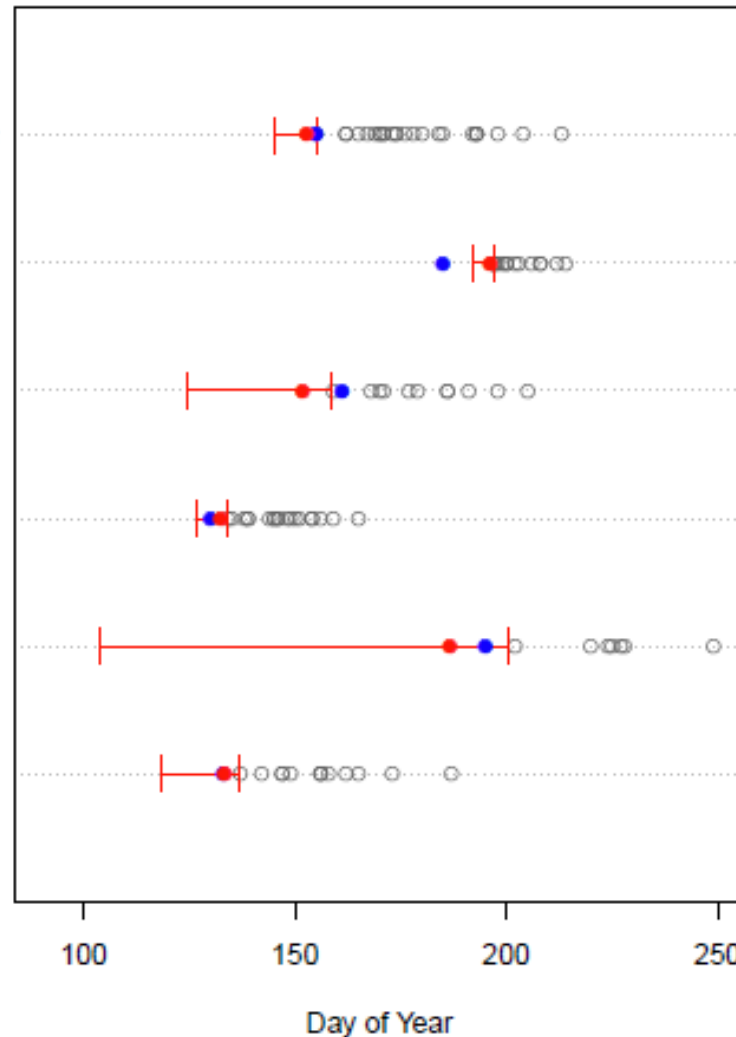
Corallorhiza maculata

13 7



Arethusa bulbosa

17 13



Open circles:
herbarium
specimens

Red: statistical
estimate

Blue: observations

Estimates of first flowering from herbarium records and field surveys (Thoreau's Woods, MA) 1853-1903

Thanks to:

Emily Meineke (Harvard University)

Charles Davis (Harvard University)

Richard Primack (Boston University)

David Inouye (University of Maryland)



University of Johannesburg	
TreeBOL Africa	
Name	<u>Polygala virgata Thunb.</u>
Family	Polygalaceae
Country	South Africa
Locality	Umtamvuna Nature Reserve
GPS data	S31 00 29.8 E30 10 33.7 (WGS84)
Collectors	Tony Abbott
Altitude	352 m
Voucher	Abbott9243
Identifier	UJ DNA No UJ04733
Date	21/05/2010

Reconciling observations with herbaria

Power analysis:

Percentage of simulations where the 95% confidence intervals of our estimate overlapped the true value.

