

An underwater photograph showing a vibrant blue ocean. In the foreground, there are dark, silhouetted coral reefs. Numerous small fish are visible swimming in the water. The sun is shining from the top left, creating a bright, hazy area in the upper part of the frame.

biodiversity change in the Anthropocene

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data providers

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European Research Council

Established by the European Commission



University of
St Andrews

600
YEARS

<http://synergy.st-andrews.ac.uk/diversity/>

Anthropocene

wikimedia commons



habitat destruction



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Change in forest cover 2000-2012



-1.5 million km²

Hansen *et al.* 2013

mass

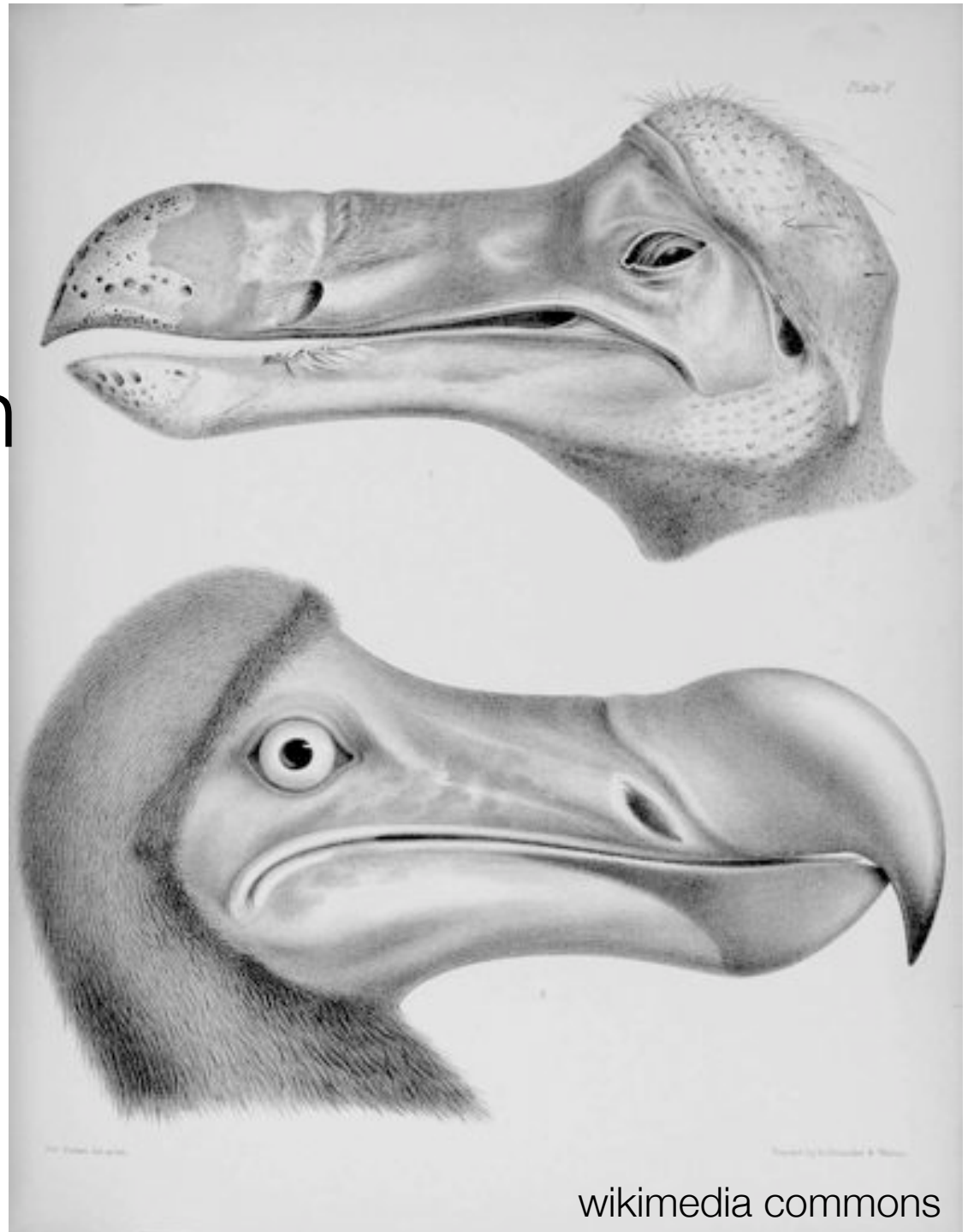
extinction



wikimedia commons

1000 x
higher than
background
extinction
rates

Pimm *et al.* 2014

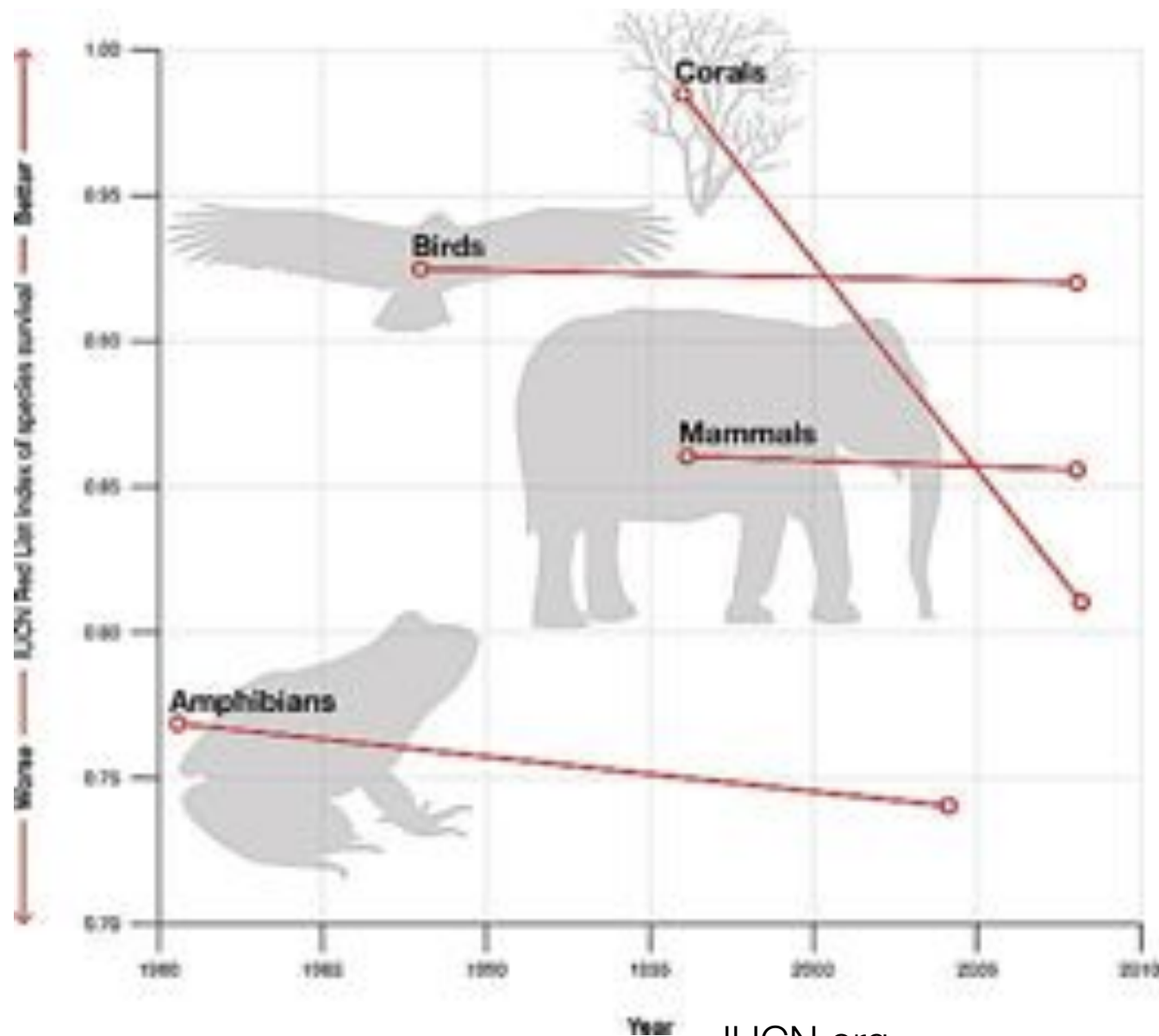


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Living Planet Index

7953 populations
of 2544 species
of vertebrates



IUCN.org

Red List Index

70,000
species
classified

An underwater photograph showing a dense coral reef in the foreground and a large school of small, dark fish swimming in the clear blue water above. The fish are mostly dark with some yellow markings. The coral is a branching, greyish-brown color. The text 'α diversity?' is overlaid in white on the right side of the image.

α diversity?

β diversity?



Our approach:

Collate time series of estimates of species abundance for consistently sampled assemblages

Quantify change in α and β diversity

Criteria:

- 1) More than 3 years of sampling
- 2) Sampling method consistent through time
- 3) All species in assemblage reported (i.e. assemblage, not population data)

Dataset

100 source datasets

6.1 million records

35,613 species

1900-present

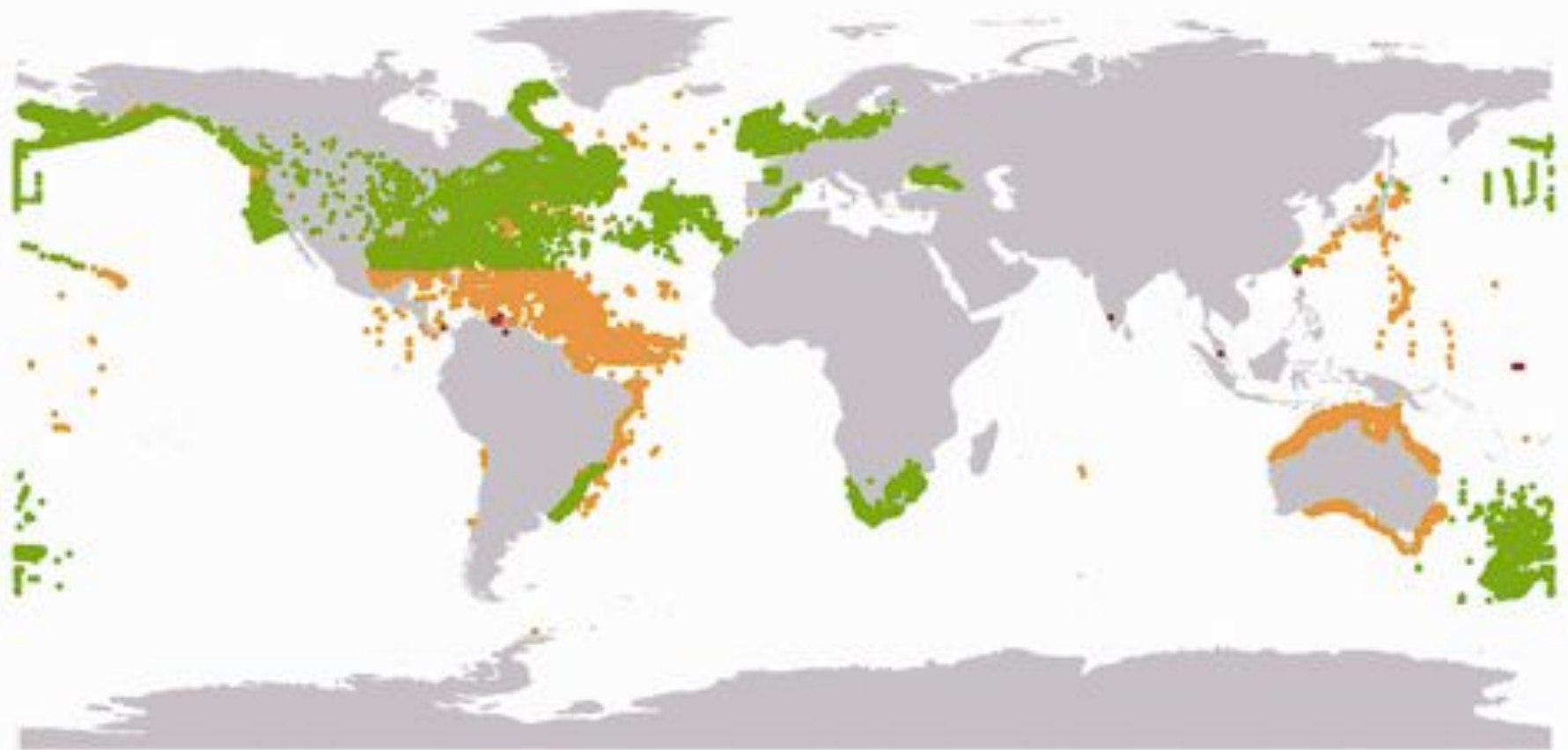
maadd@st-andrews.ac.uk



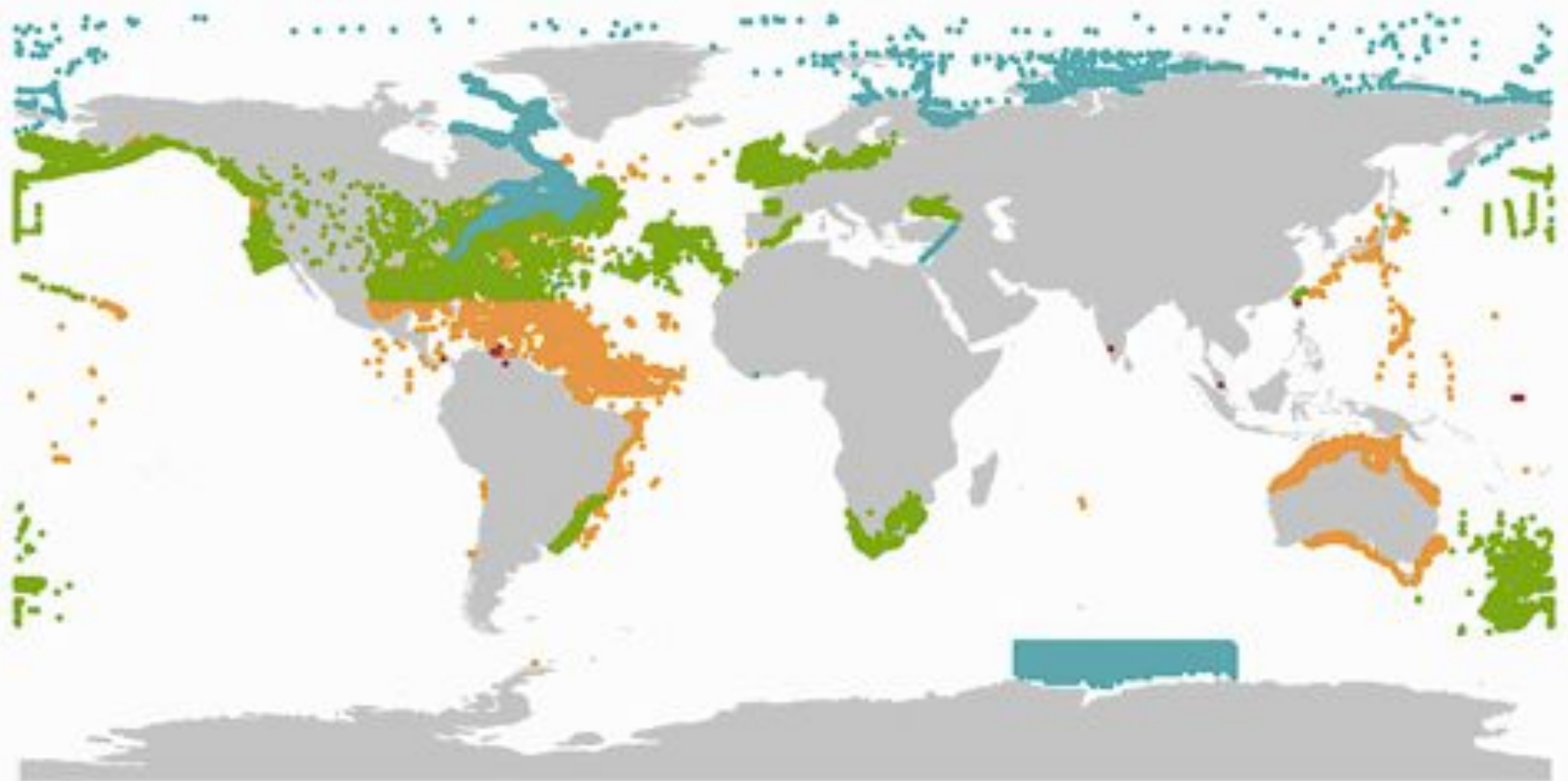
tropical



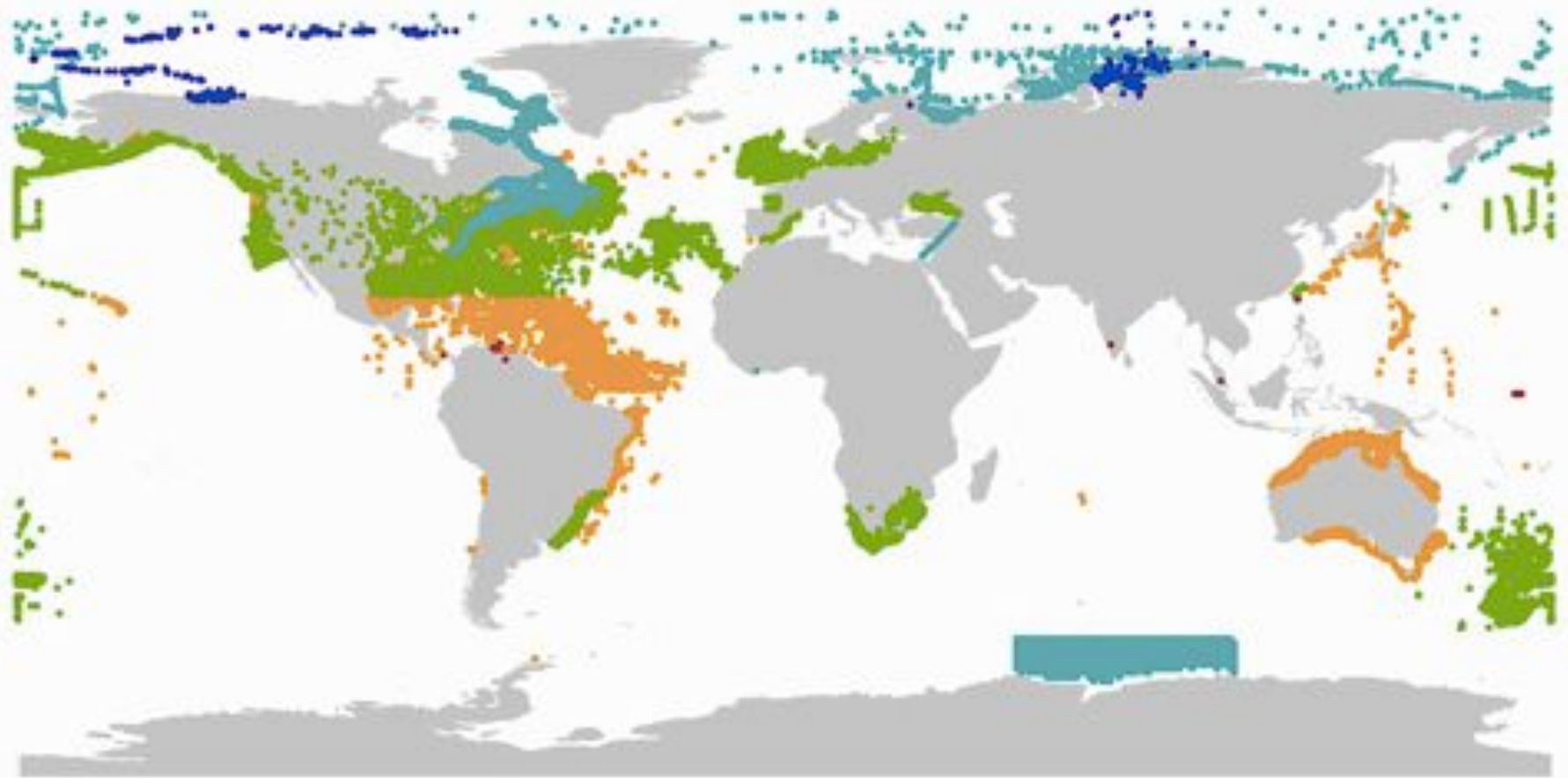
temperate-tropical tropical



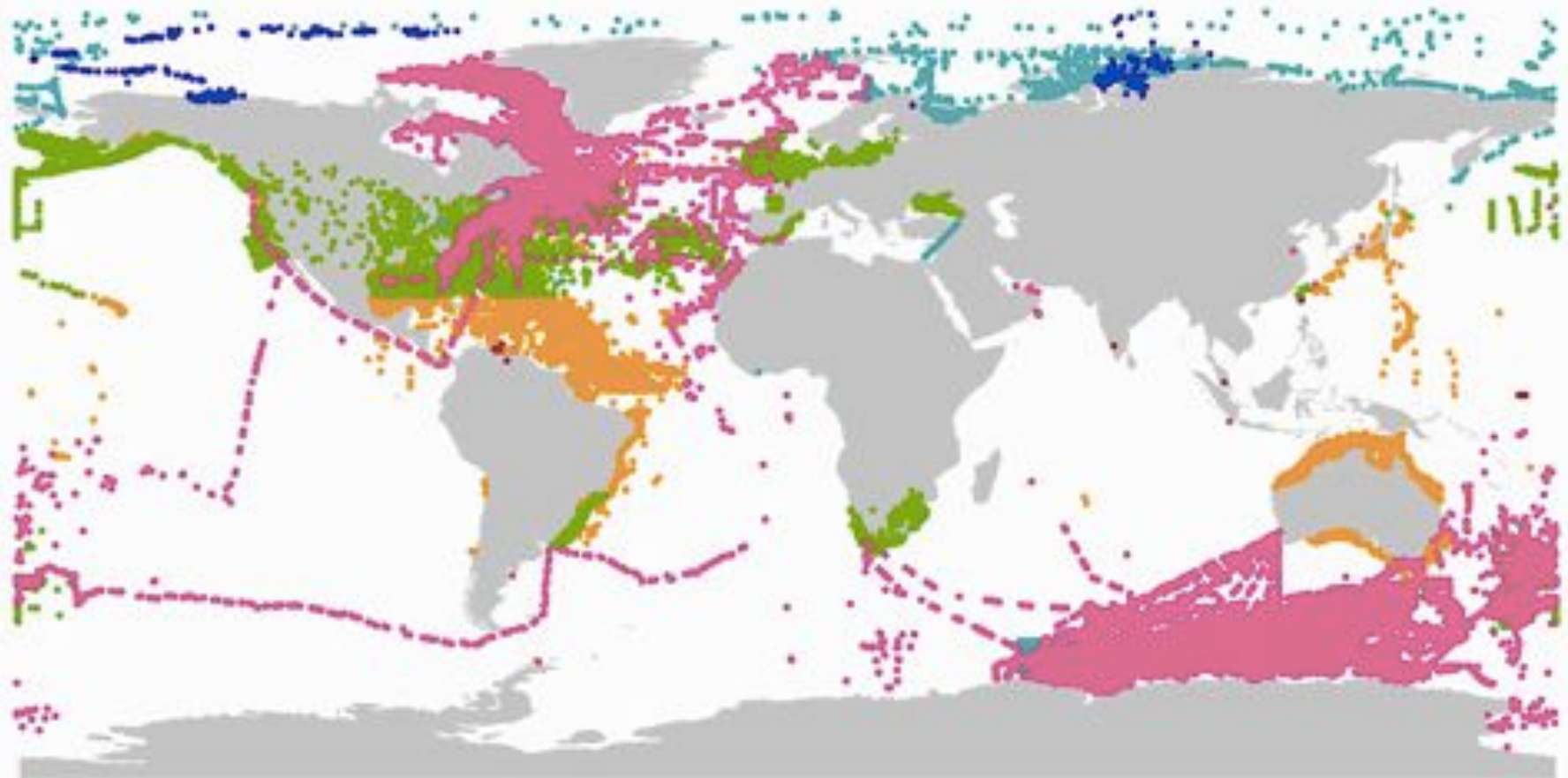
temperate temperate-tropical tropical



polar-temperate temperate temperate-tropical tropical



polar polar-temperate temperate temperate-tropical tropical



polar polar-temperate temperate temperate-tropical tropical global

Dornelas *et al.* 2014

sample rarefaction:

constant number of samples through
time within each study

α diversity

Metrics:

Species richness (S)

Numerical abundance (N)

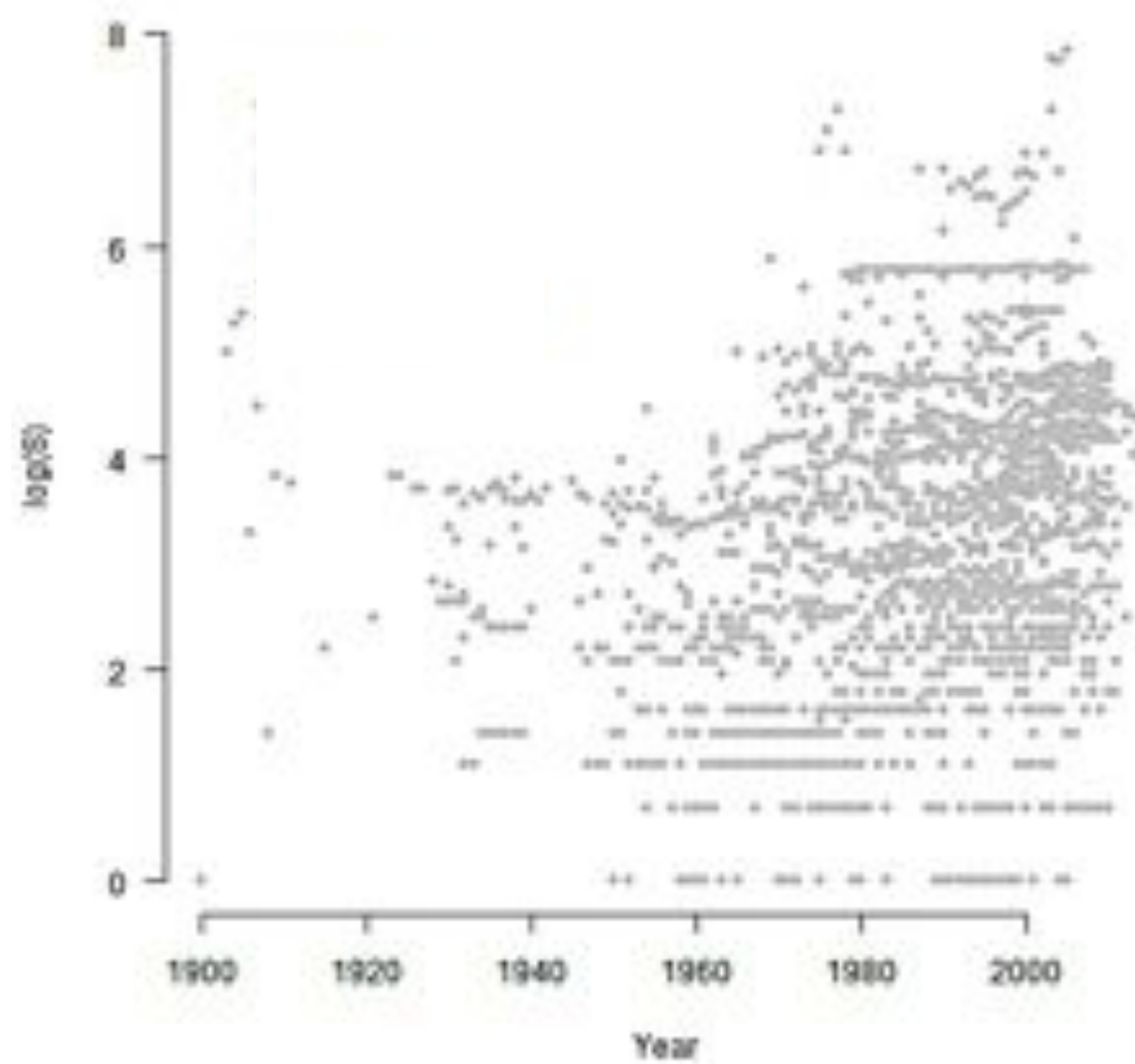
$N/S^{(1/2)}$

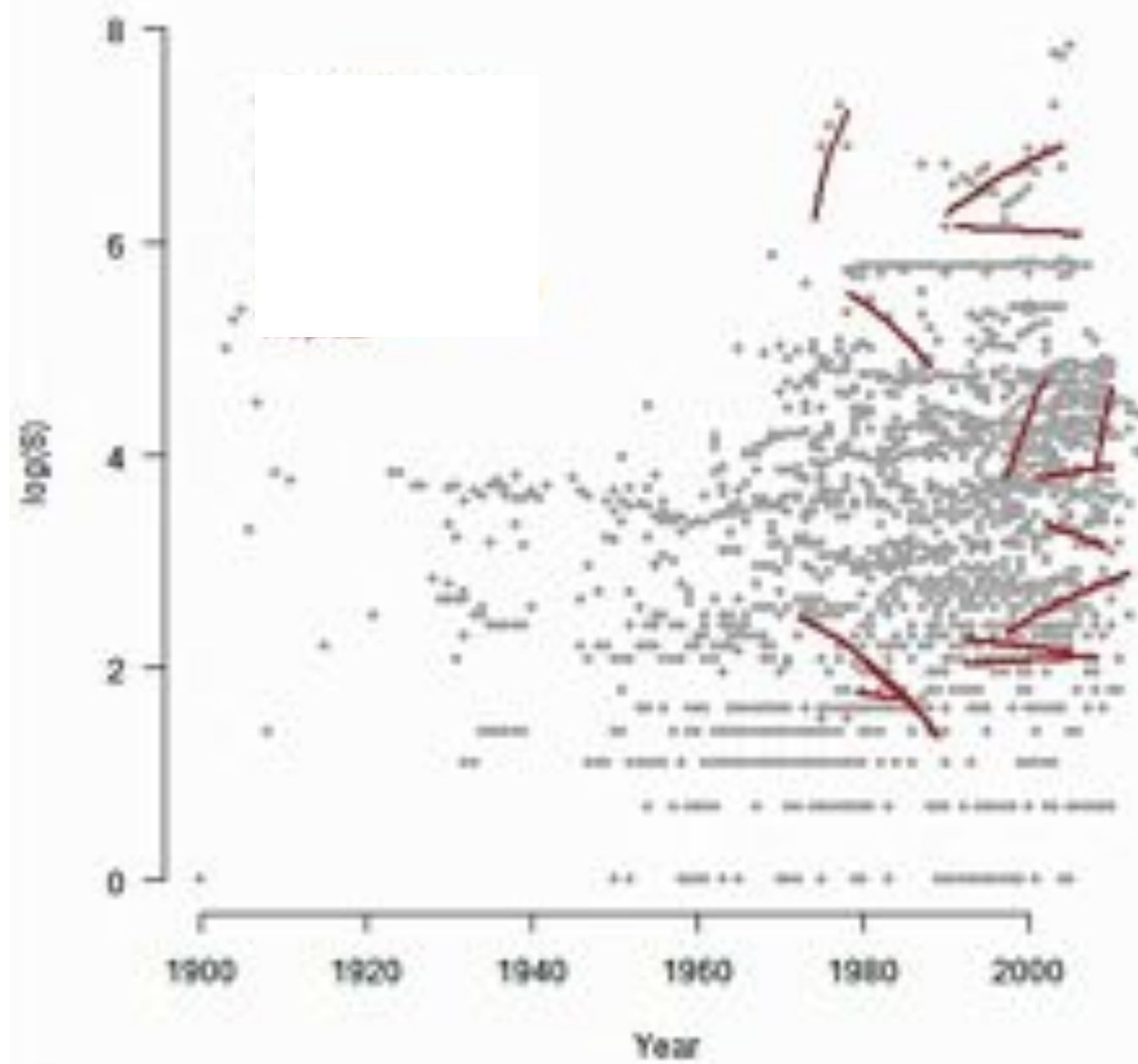
Evenness (PIE)

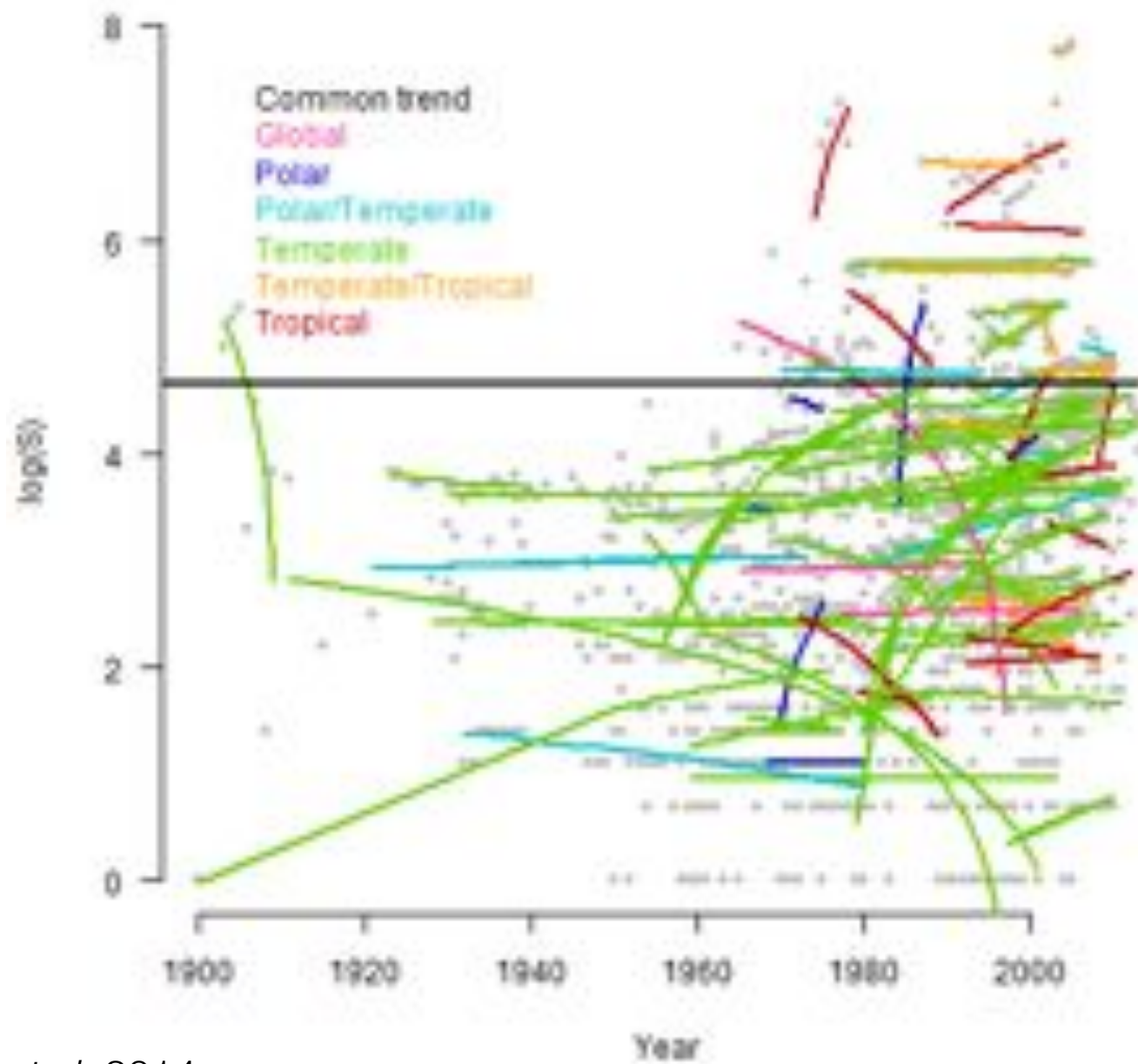
Dominance

Shannon diversity

Chao estimator of S







Dornelas *et al.* 2014



consistent with independent
meta-analysis

Vellend *et al.* 2013, O'Connor *et al.* in prep, Supp and Ernest 2014

β diversity

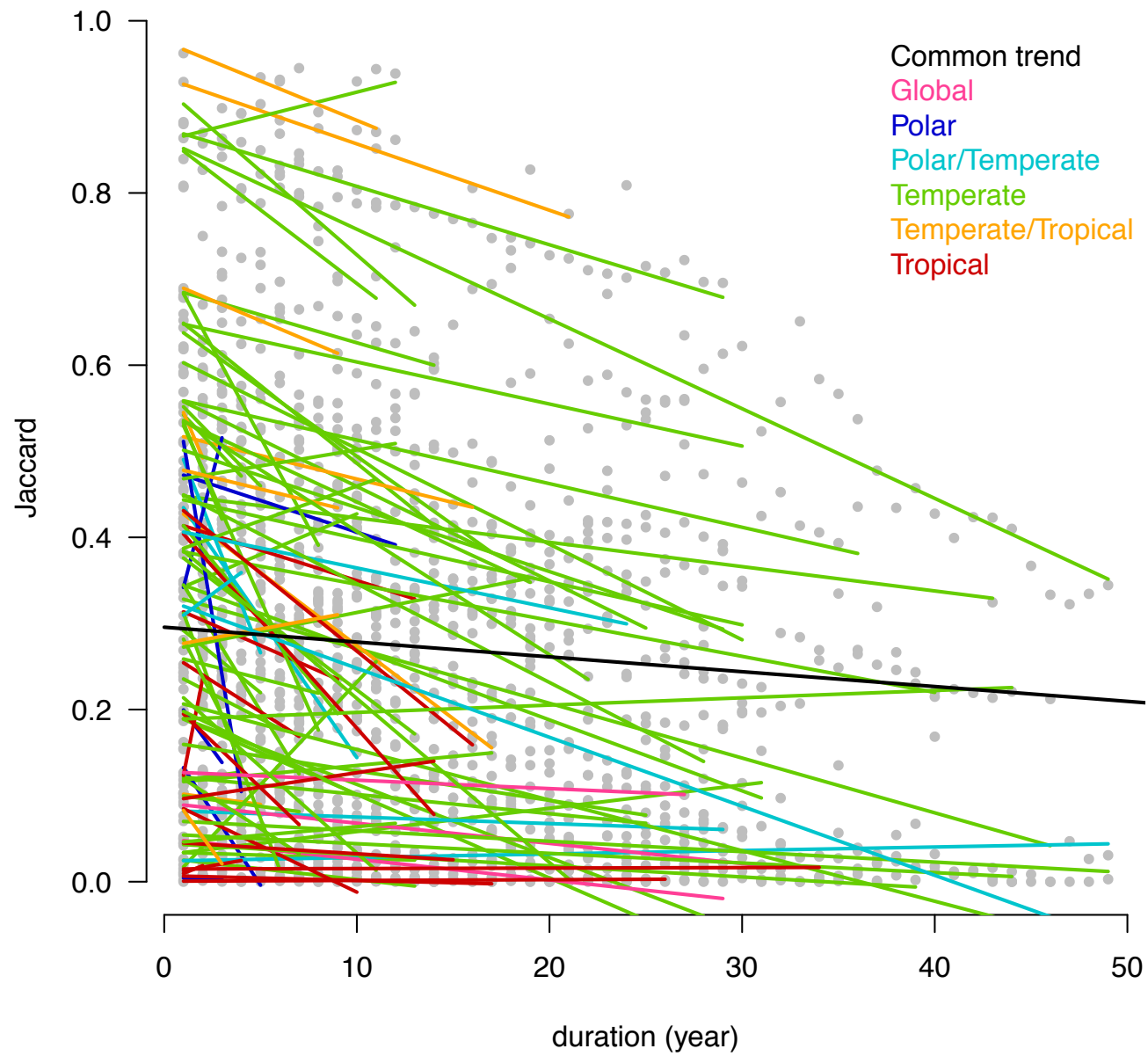
Metrics:

Jaccard

Morisita-Horn

Chao

Pearson correlation

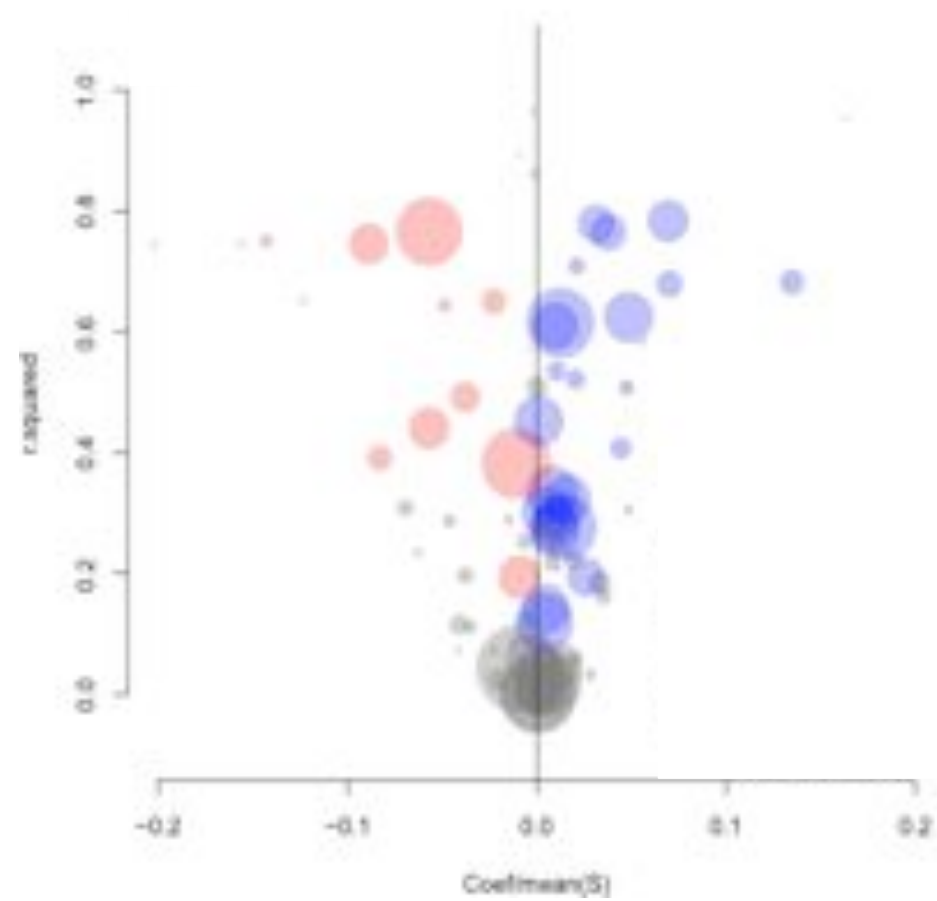


Data -0.01

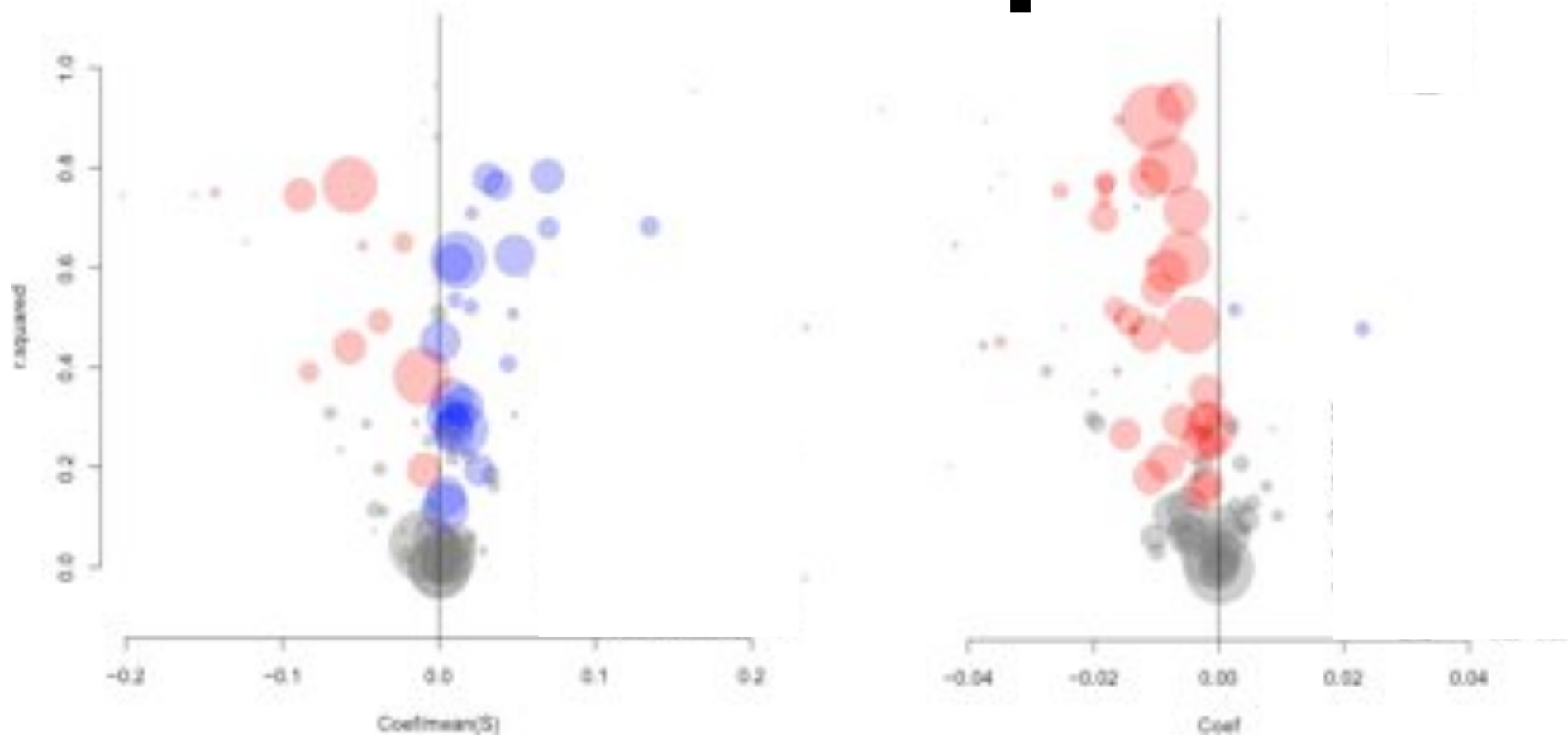
MCMC model -0.0000127

neutral model -0.000210

α vs. β diversity



α vs. β



systematic

biodiversity ~~loss~~

CHANGE



habitat destruction?



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Threatened species?

invasive species

Whitfield *et al.* 2007

wikimedia.com



biotic
homogenization



novel
ecosystems?

range migrations

Parmesan *et al.* 1999





sc | nat 

Swiss Academy of Sciences
Akademie der Naturwissenschaften
Accademia di scienze naturali
Académie des sciences naturelles

194^e Congrès annuel de l'Académie suisse des sciences naturelles

Les 100 ans du Parc national suisse dans une vision globale 100 Jahre Nationalpark im Spiegel globaler Entwicklungen