

Measuring biodiversity: do we look at the right thing?

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When, for the first time, the traveller wanders in these primeval forests, he can scarcely fail to experience sensations of awe.

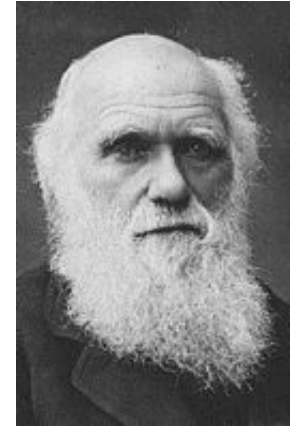
A.R. Wallace. 1855
Natural Selection and
Tropical Nature.



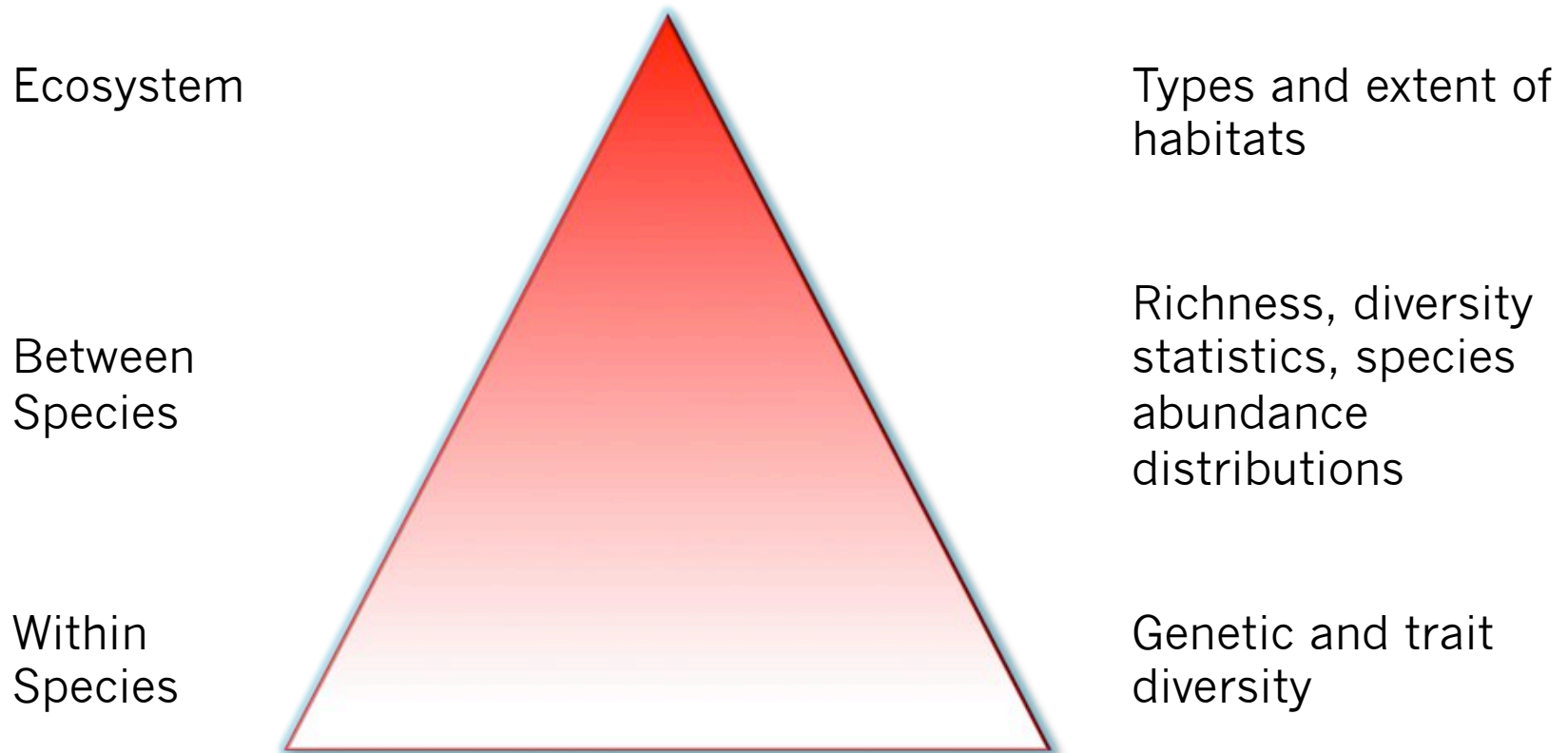
In 1855 Darwin recorded all the plants in the meadow, Great Pucklands, next to his family home at Downe

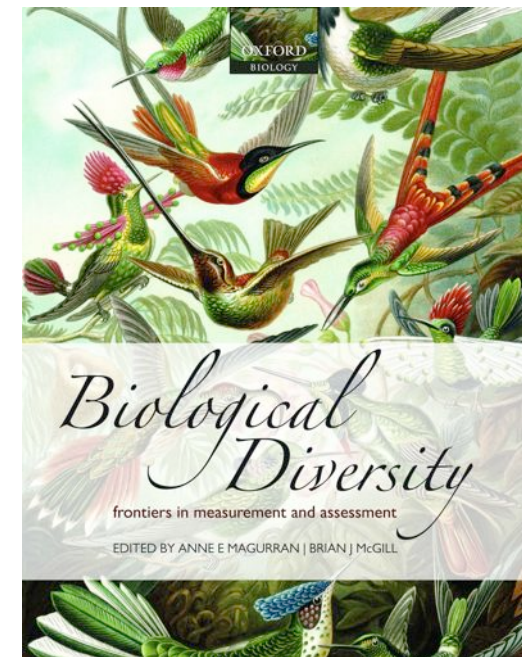
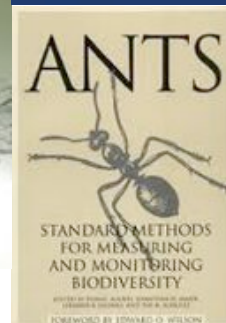
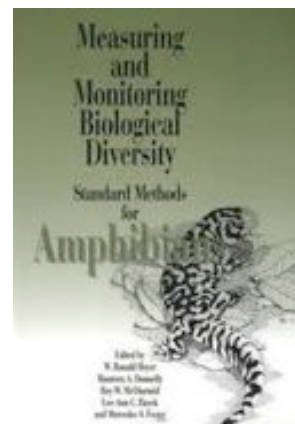
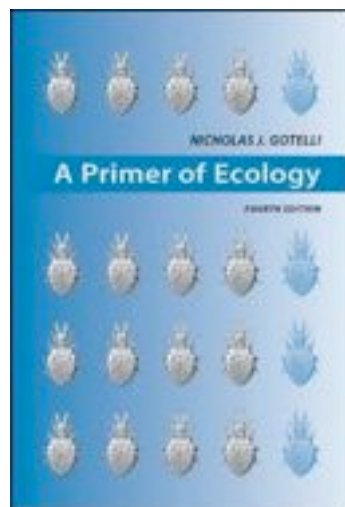
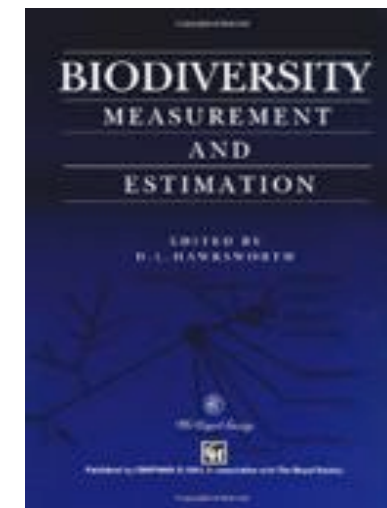
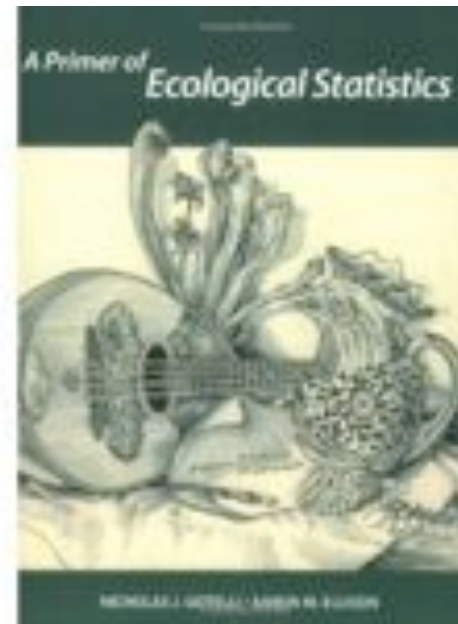
This appears to be the first systematic survey of species richness

Darwin recorded 142 species; 119 were present in 2006



Biological Diversity: variety of life





[illegible]

How many species are there?





UK 24 million ha. and c. 40 species of freshwater fish



Trinidad & Tobago 513,000 ha.
c. 50 species of freshwater fish

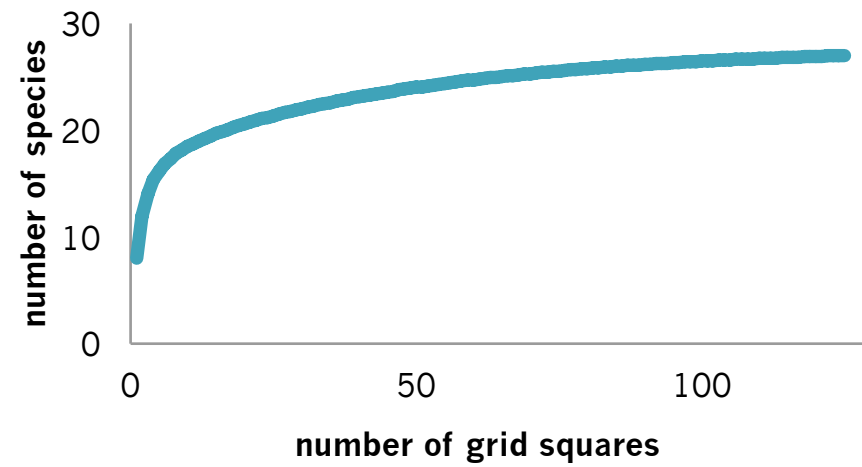
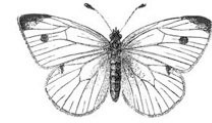


Mamirauá Reserve 1,124,000 ha

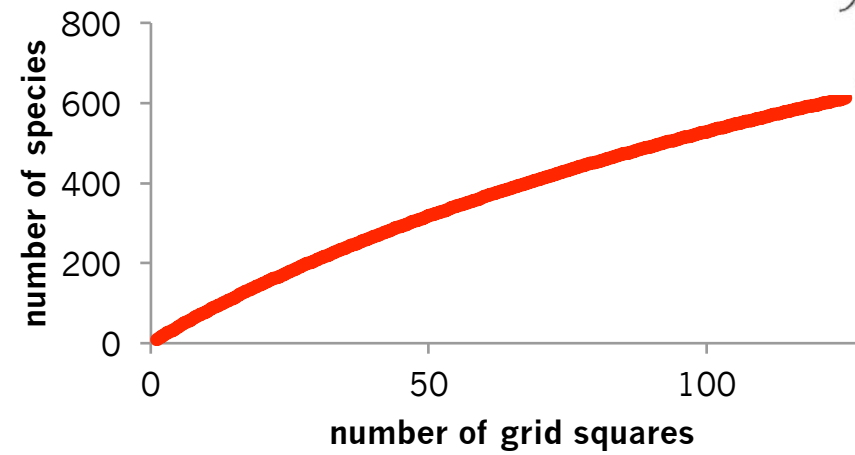
>300 species of fish



butterflies



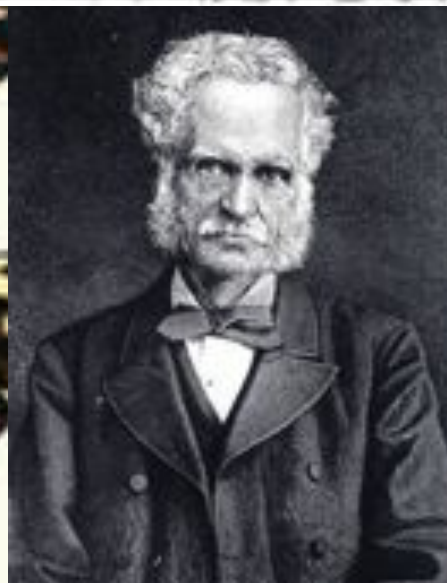
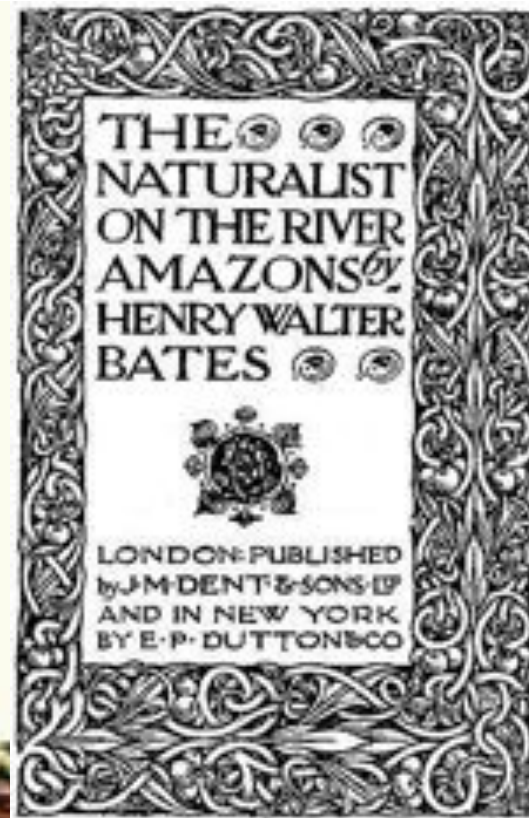
beetles



It will convey some idea of the diversity of butterflies when I mention that about 700 species of that tribe are found within an hour's walk of the town; whilst the total number found in the British Isles does not exceed 66, and the whole of Europe supports only 390.

H. W. Bates 1863. A naturalist on the river Amazons.





Mamirauá

Trees 520 spp

Birds 330 spp

Fish >300 spp

Terrestrial mammals 69 spp

Bats ??

Amphibians & reptiles??

Insects >>7000 spp

Other invertebrates ??

Microbes???



How many species on earth?



How many stars in our galaxy?

10^{11} stars in the galaxy

On earth

c. 1.5 million species
documented

5 million?

10 million?

100 million?

+ microbes





Only about half of the world's tropical rain forest still exists. It is being lost at the rate of 1% of original forest habitat each year

Ethical
Aesthetic
Utilitarian



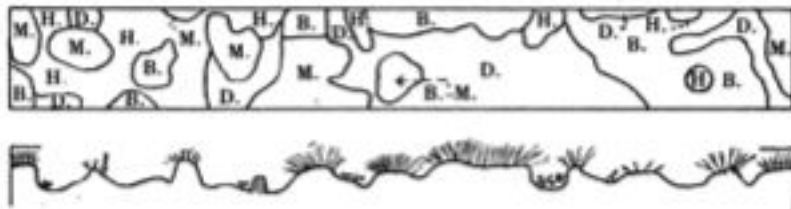


Ecosystem Services

Goods and
processes by
which our
environment
supports human
wellbeing



Watt, A.S. 1947
Pattern and process
in the plant
community. *Journal of
Ecology* 35: 1-22



A. S. Watt

Processes as well as **patterns**

How communities
change through
time –
understanding and
working with
background change



Change through time

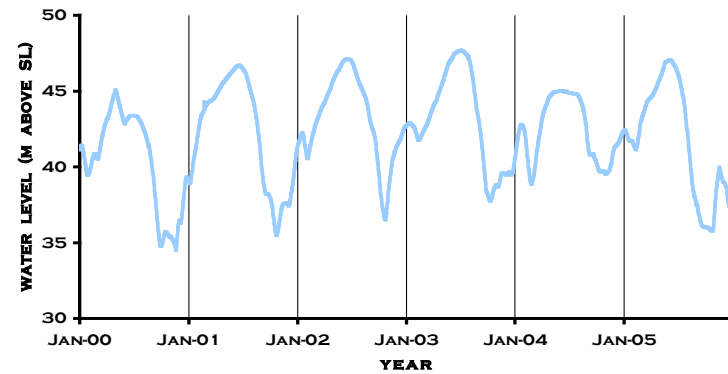
'....we forget that each species, even where it most abounds, is constantly suffering enormous destruction at some period of its life, from enemies or from competitors for the same place and food; and if these enemies or competitors be in the least degree favoured by any slight change of climate, they will increase in numbers; and as each area is already fully stocked with inhabitants, the other species must decrease.'
Charles Darwin, Origin of Species







seasonality
immigration
local extinction
population dynamics
shifting resource
availability
invasive species
competition
predation
disturbance
mutualism
succession



TURNOVER

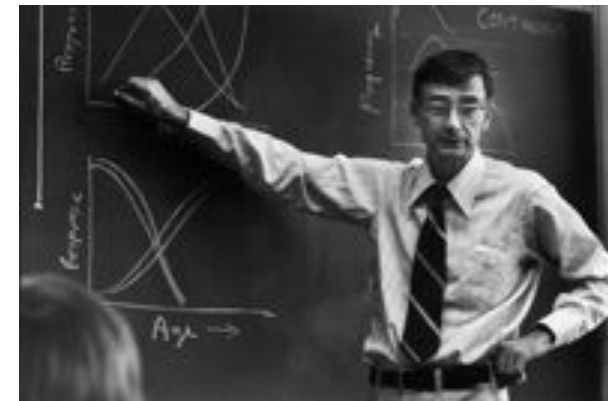
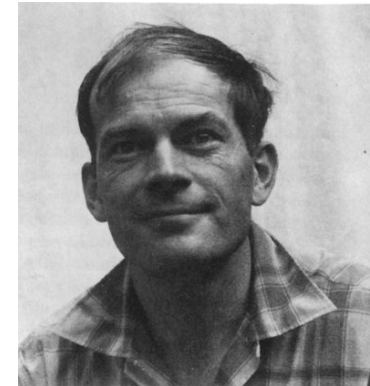
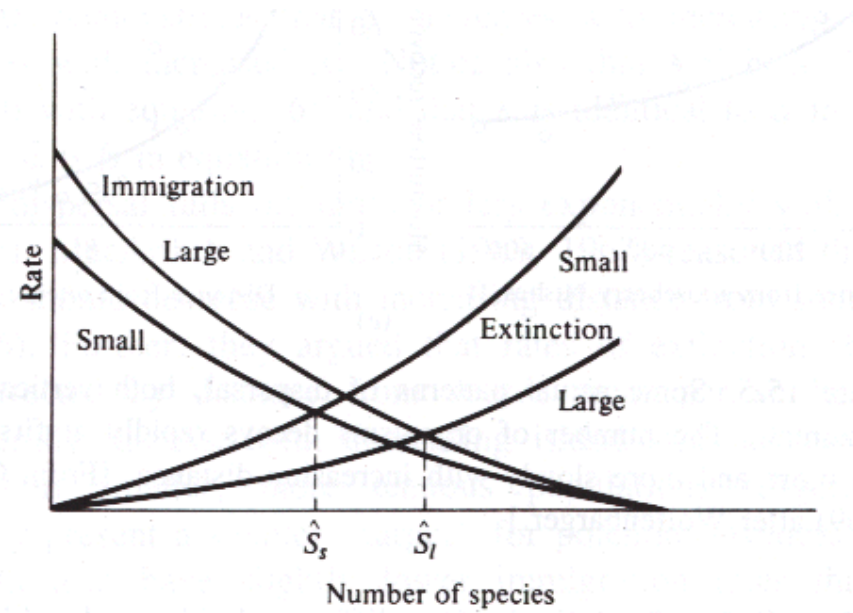
Immigration

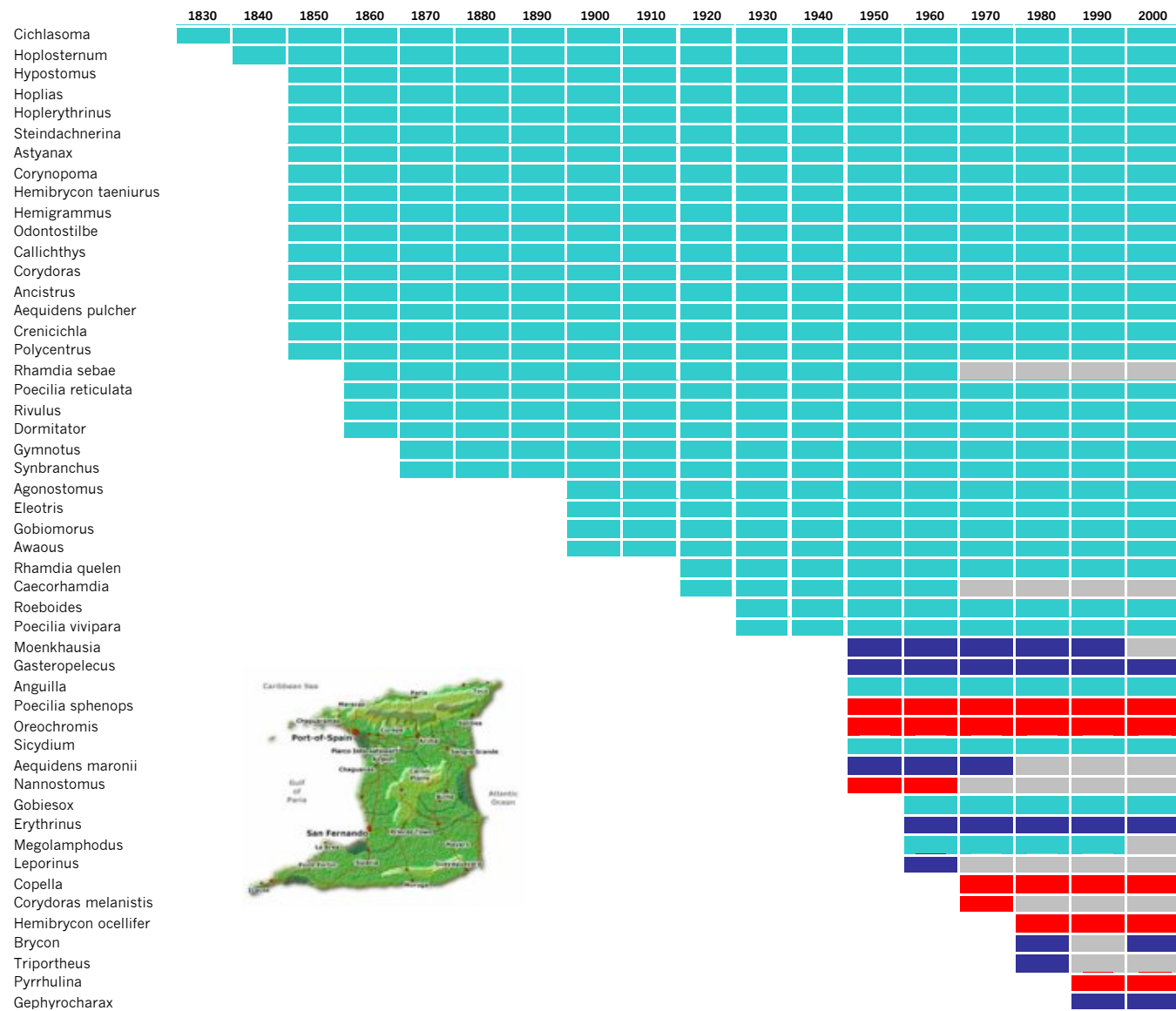
Local Extinction

Change in abundances
through time



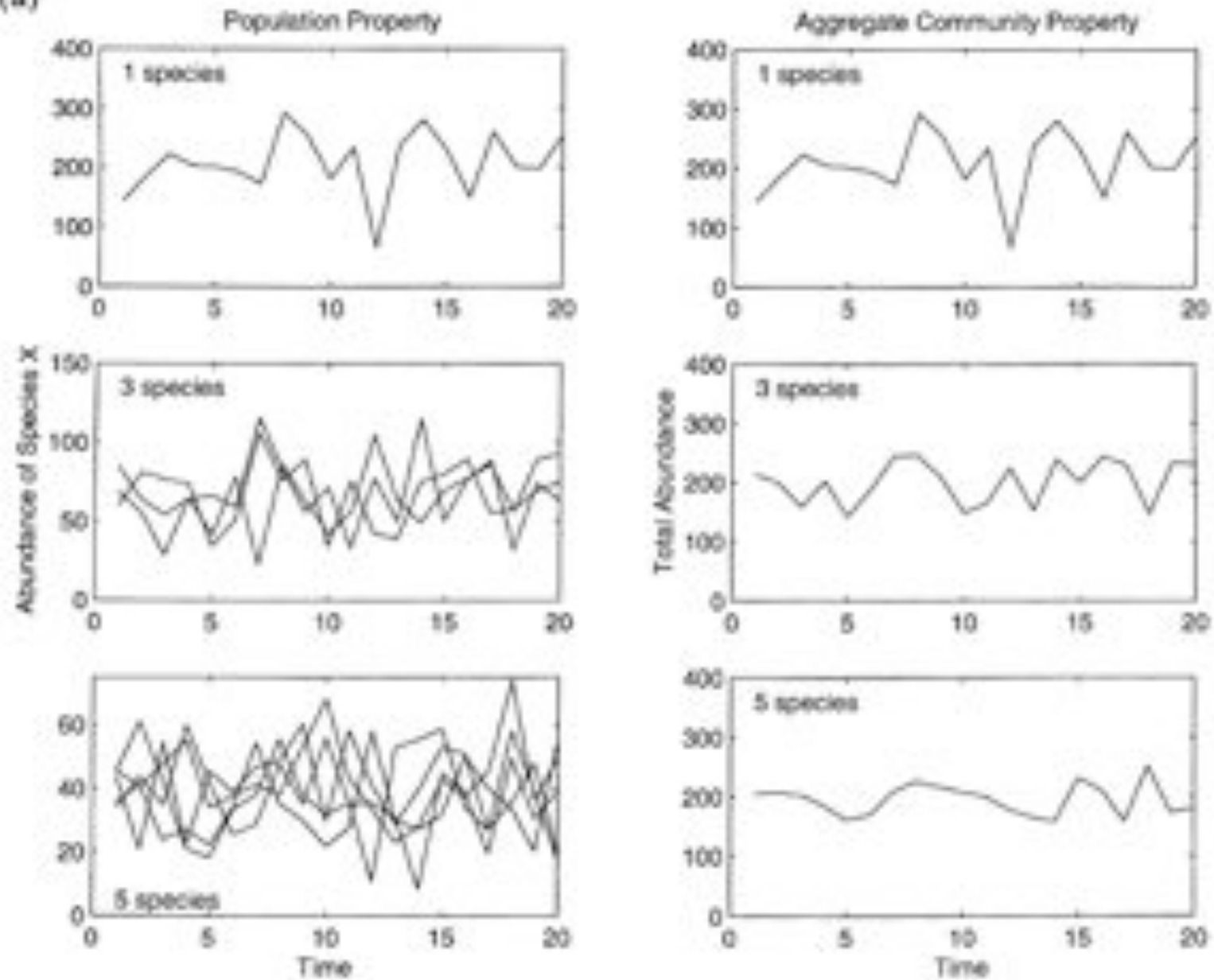
Turnover





native fauna, natural colonist, introduced exotic, possibly extinct

(a)



From Cottingham et al. 2001 Ecology Letters

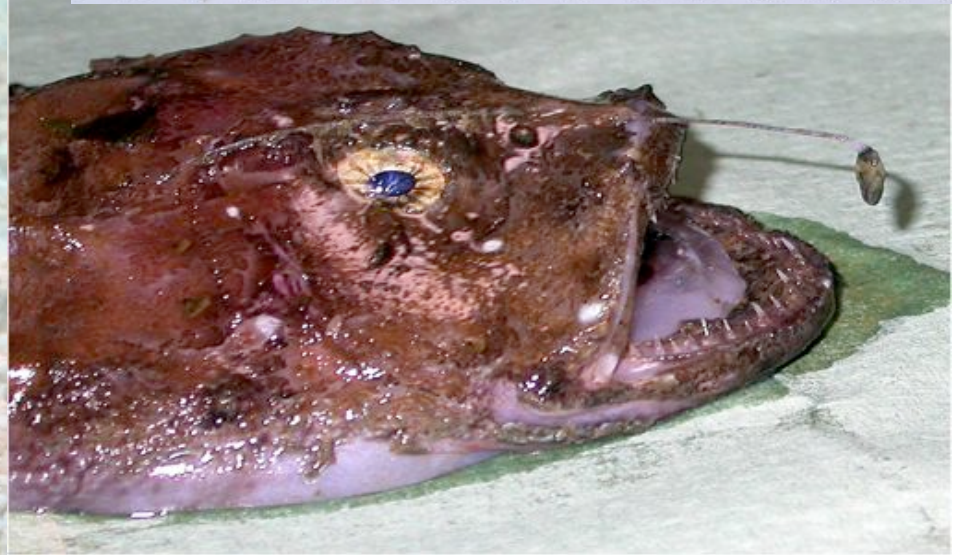


Peter Henderson

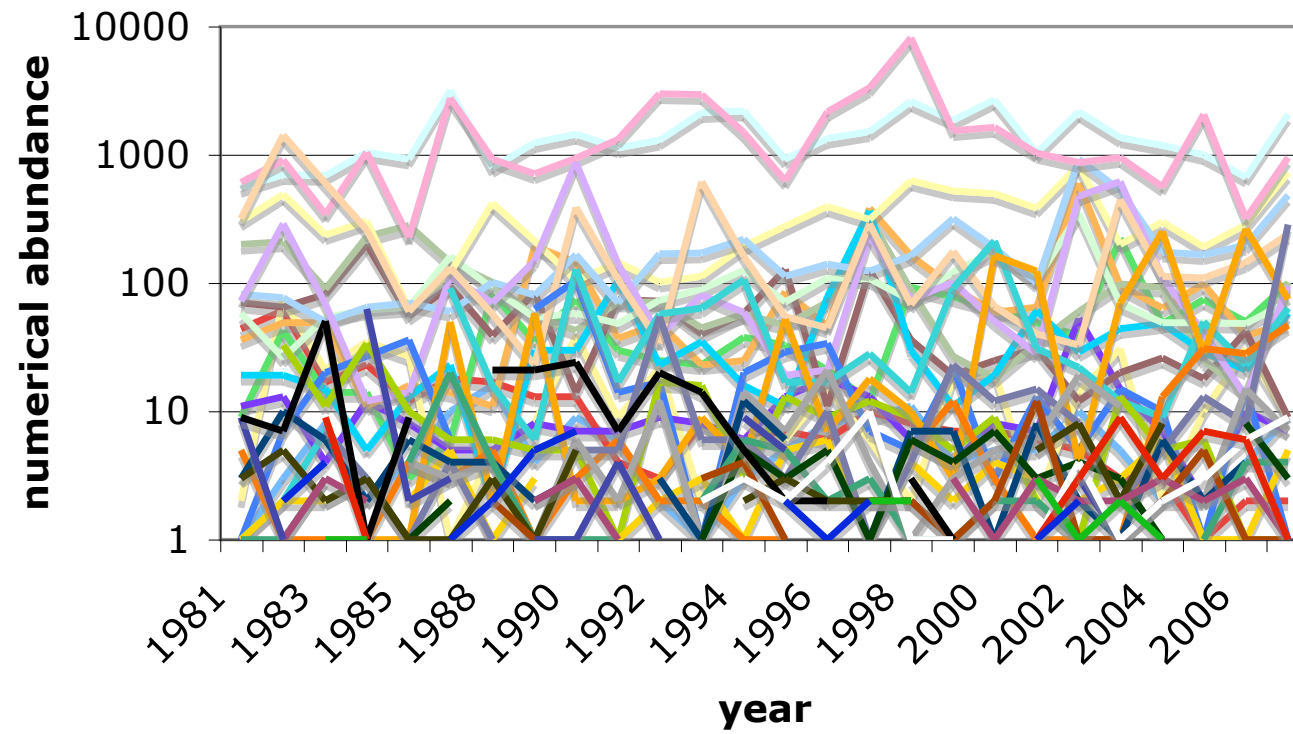
Bristol Channel fish



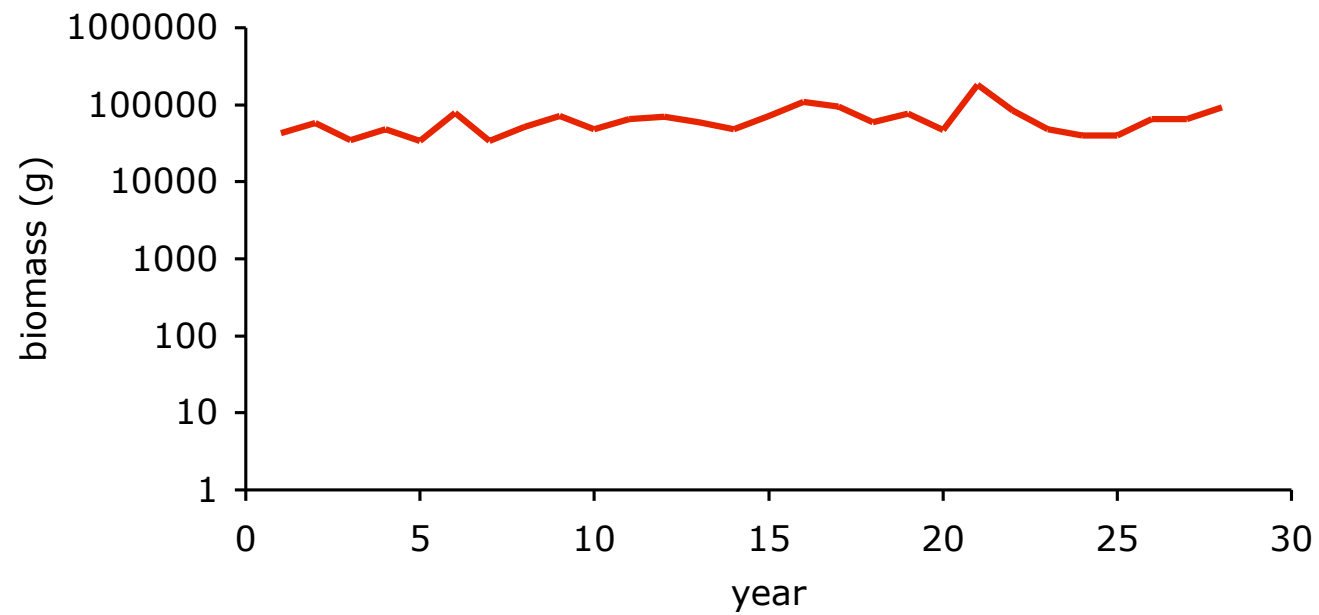
3 decade time series
monthly sampling
 $S > 80$ species &
 $N > 100,000$ individuals



core species



biomass



What questions should we be asking?

How do ecological communities change through time?

How do we assess the impact of anthropogenic change relative to this natural turnover?

What is the best way of conserving biological diversity in a changing world?



Thanks to

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Mamirauá Institute

Dawn Phillip

Peter Henderson

Abigail Cabrelli

& the NCEAS SADs working group

