

Environmental myopia: Avoiding short-sighted decisions with long-term studies

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Environmental myopia is...

...the equivalent of a person with short-sight believing that nothing of interest or importance could possibly lie beyond the range of his or her own, limited vision.

It is dangerous for the same reasons as its ocular namesake – the environment is neither featureless nor linear.

A classic example of Environmental Myopia

- Continuous Plankton Recorder, 1930s – 1980s
- In 1988, NERC cancelled funding
- In 1988/9 a regime shift occurred in the N. Atlantic from cold → warm communities
- CPR was saved by Sir Alastair Hardy Foundation for Ocean Science



Long-term data are needed to:

Detect environmental (and evolutionary) change that is:

- unpredictable
- episodic,
- cumulative
- slow-acting
- non-linear
- subject to thresholds (= tipping points)
- underestimated due to a shifting baseline.



\$1.75 C0

\$1.75 C2

\$1.75 C4

\$1.75 C6

\$1.75 C8



\$1.50 D0

\$1.50 D1

\$1.50 D2

\$1.50 D3

\$1.50 D4

\$1.50 D5

\$1.50 D6

\$1.50 D7

\$1.50 D8

\$1.50 D9



\$1.25 E0

\$1.25 E2

\$1.5 E4

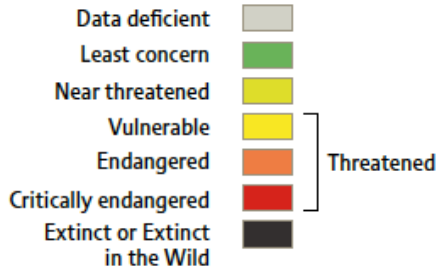
\$1.25 E6

\$1.25 E8

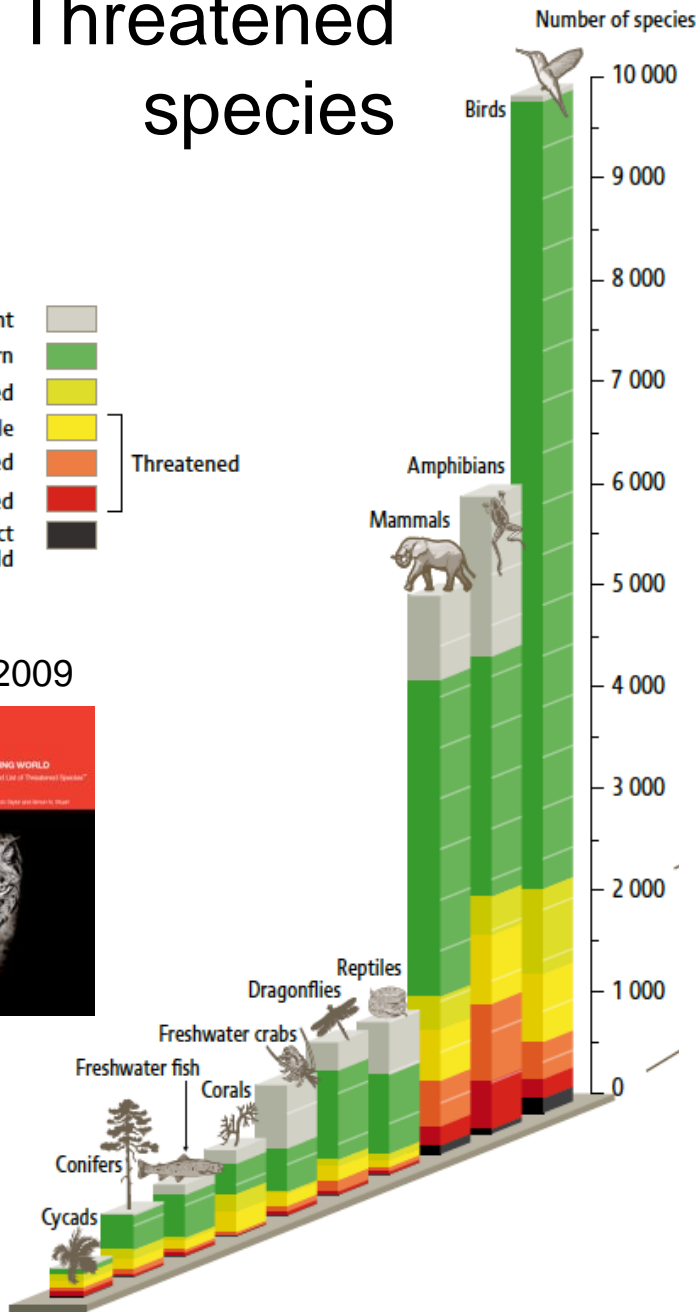
4 5 6
7 8 9
* 0 #



Threatened species



IUCN 2009

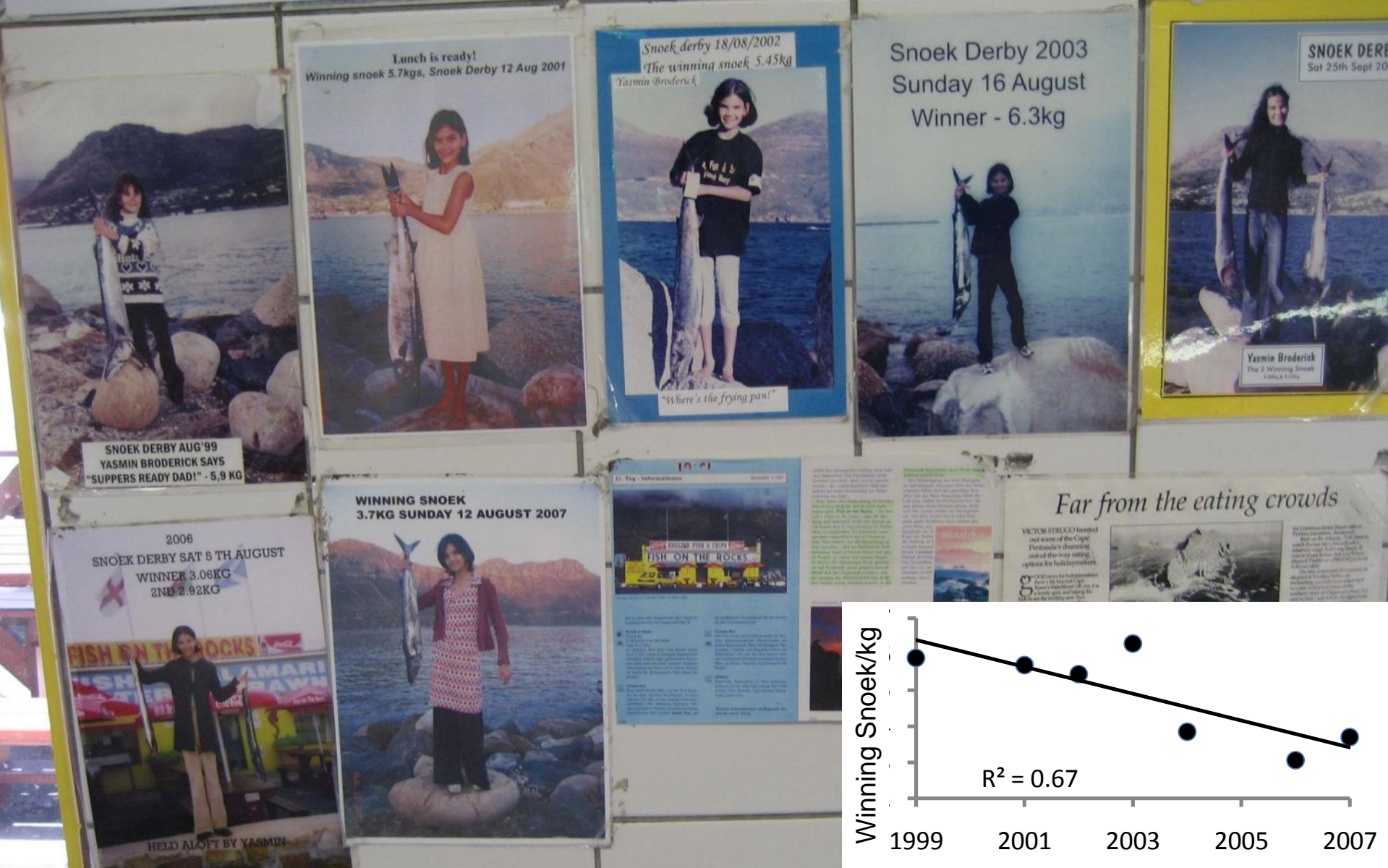


Data from IUCN 2009, graph from *Global Biodiversity Outlook 3* (2010)

The fate of snoek?



The Snoek Derby 1999 - 2007

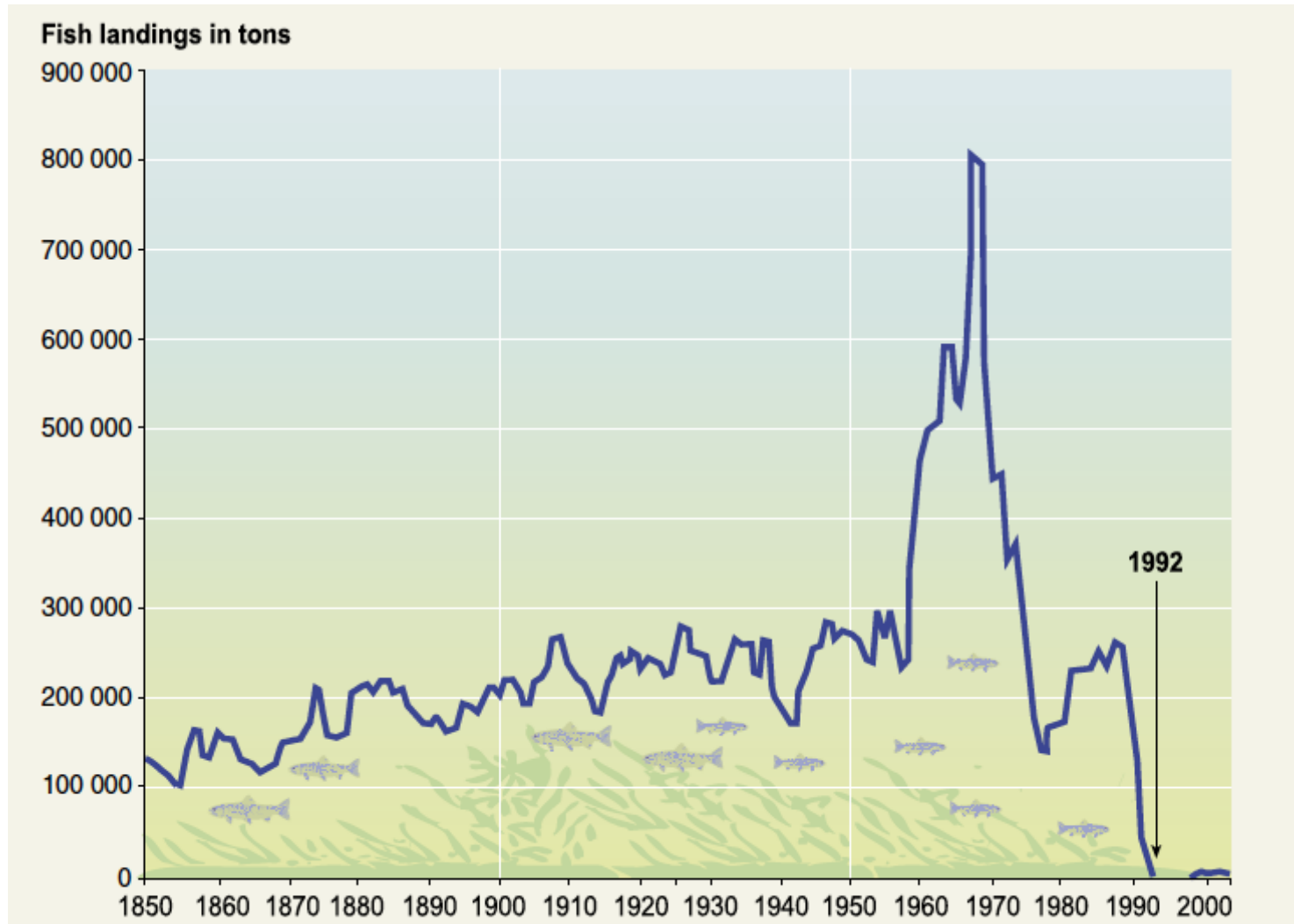


The collage consists of several newspaper clippings and photographs. The top row features four items: a photo of Yasmin Broderick with a snoek (caption: SNOEK DERBY AUG '99, YASMIN BRODERICK SAYS "SUPPERS READY DAD!" - 5.9 KG); a photo of her with a snoek (caption: Lunch is ready! Winning snoek 5.7kgs, Snoek Derby 12 Aug 2001); a photo of her with a snoek (caption: Snoek derby 18/08/2002 The winning snoek 5.45kg Yasmin Broderick "Where's the frying pan!"); and a photo of her with a snoek (caption: Snoek Derby 2003 Sunday 16 August Winner - 6.3kg). The middle row features two items: a photo of her with a snoek (caption: SNOEK DERBY Sat 25th Sept 2004 Yasmin Broderick The 2 Winning Snoek 6.60kg 4.10kg); and a newspaper clipping titled "Far from the eating crowds" about the Cape Peninsula's churning waters. The bottom row features two items: a photo of her with a snoek (caption: 2006 SNOEK DERBY SAT 5 TH AUGUST WINNER 3.06KG 2ND 2.92KG HELD ALOFT BY YASMIN); and a newspaper clipping titled "FISH ON THE ROCKS" about the derby. A line graph at the bottom right shows the trend of the winning snoek weight over time, with a regression line and $R^2 = 0.67$.

Year	Winning Snoek Weight (kg)
1999	5.9
2001	5.7
2002	5.45
2003	6.3
2004	6.6
2005	4.1
2006	3.06
2007	3.7



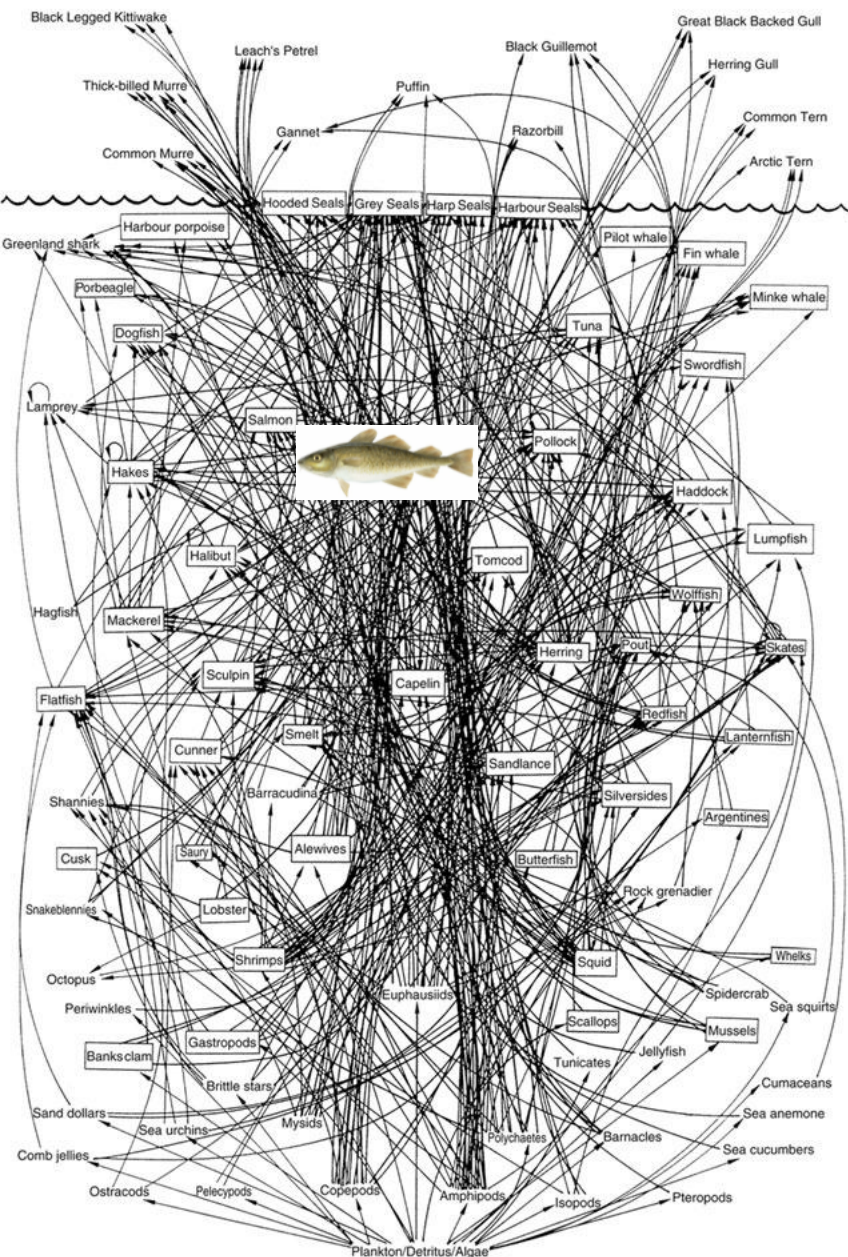
Collapse of the Newfoundland cod fishery



Source: Millennium Ecosystem Assessment



The NW Atlantic food web



A simplified food web for the Northwest Atlantic. © IMMA

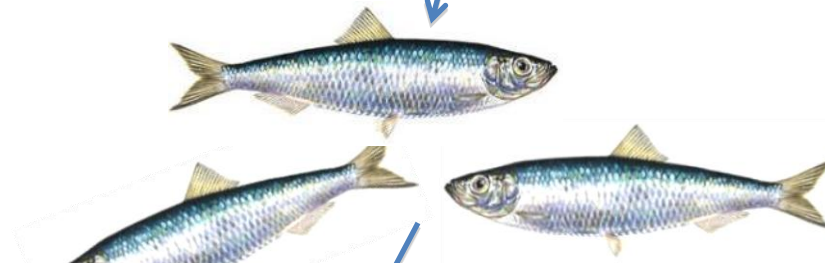
www.ifaw.org

Over-fishing irreversibly alters the food web

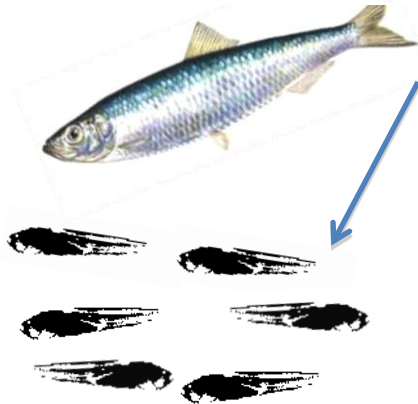
Adult Cod



Smaller
predatory
fish

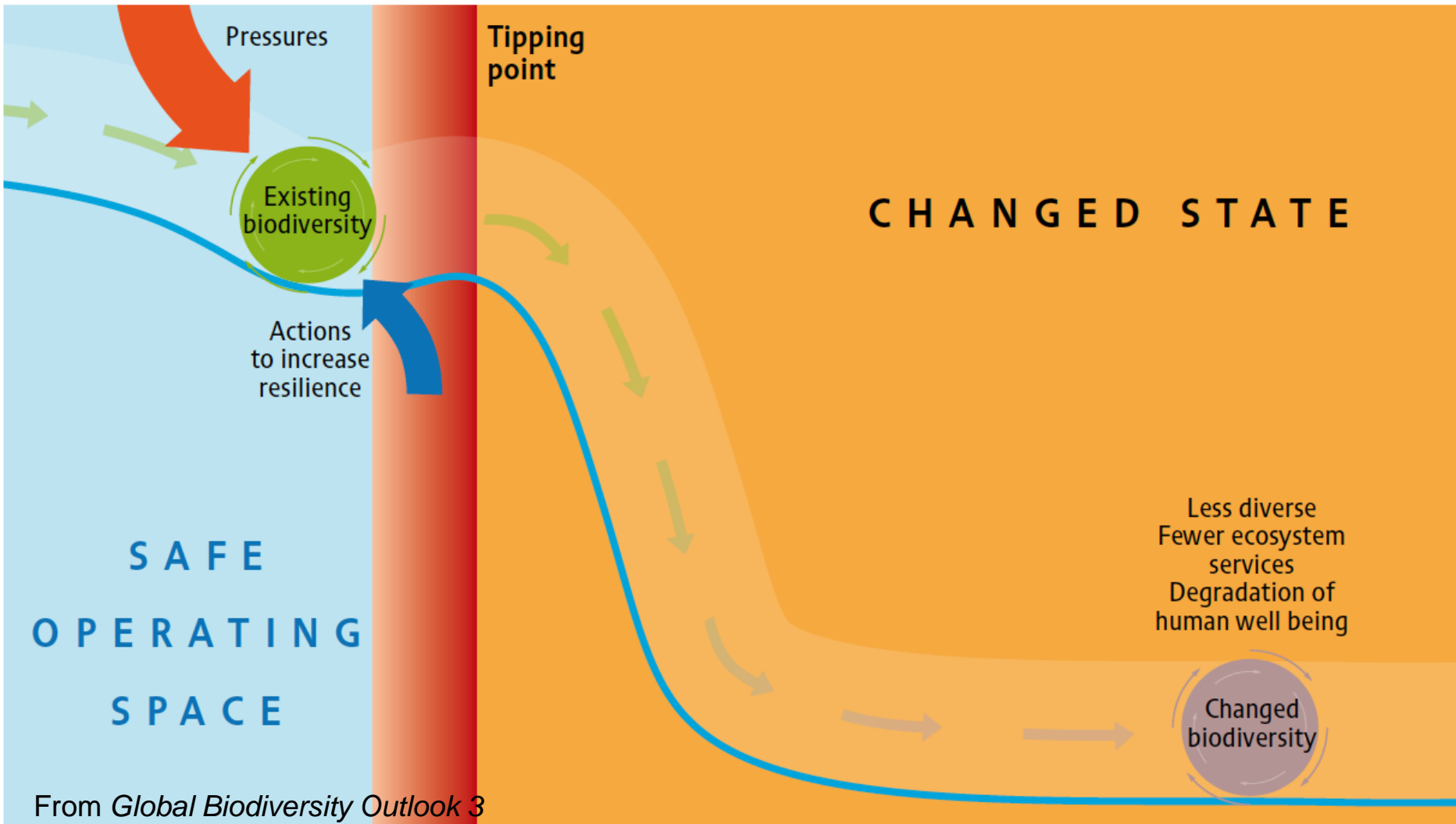


Cod fry



Tipping points

FIGURE 18 Tipping points – an illustration of the concept



How do we know we are near a tipping point?



1. Dynamical systems of all kinds lose resilience when they are near a tipping point
2. This can be detected in the speed with which the system recovers from **perturbation**
3. BUT, **long-term** data are required to detect *critical slowing down*
4. AND a reference (**control**) is needed

How do we know we are near a tipping point?



perturbation
long-term

+ control

= Long-Term Experiment

The Park Grass Experiment

Begun 1856



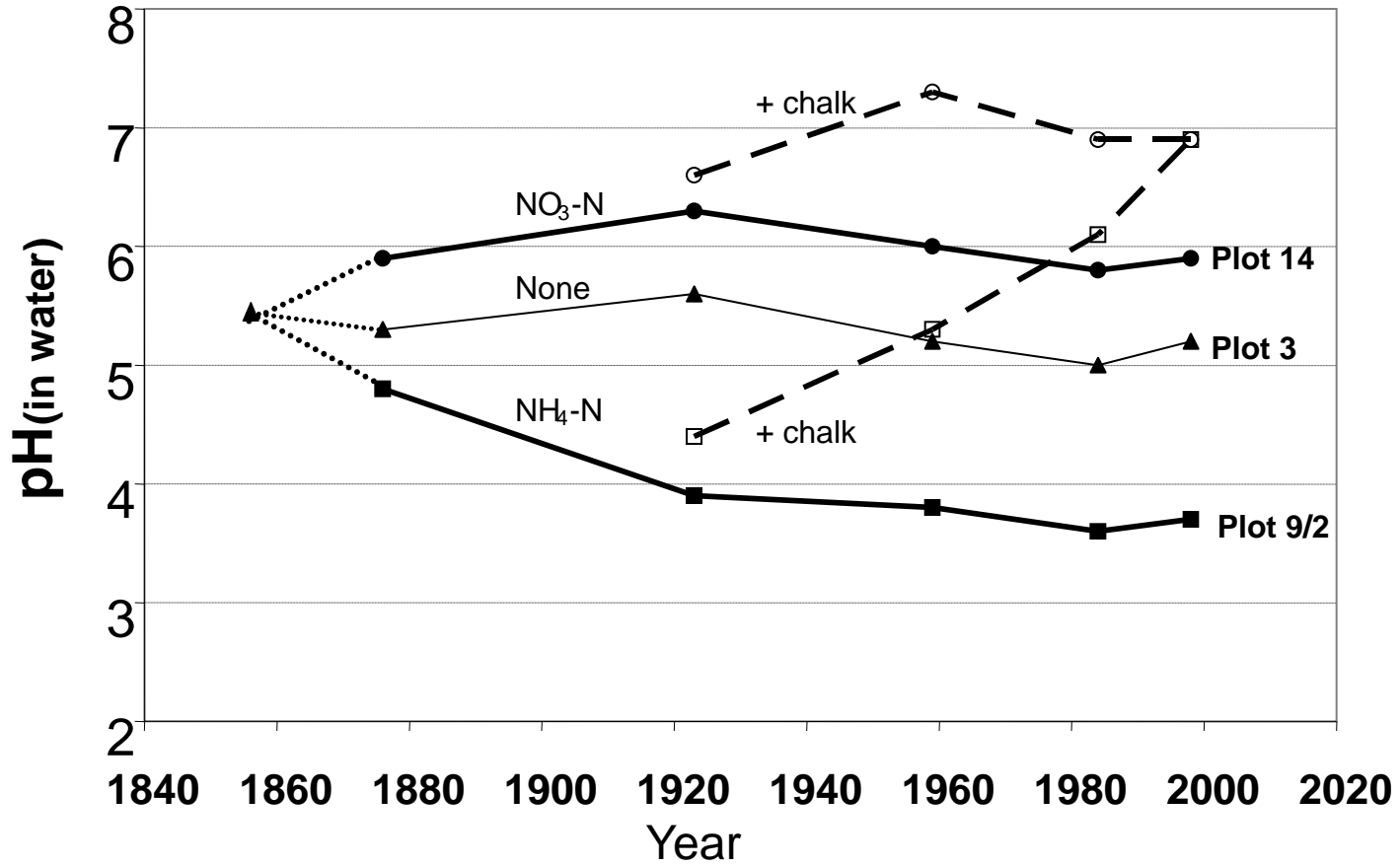
Hay Harvest 1941



Grass Picking 1890

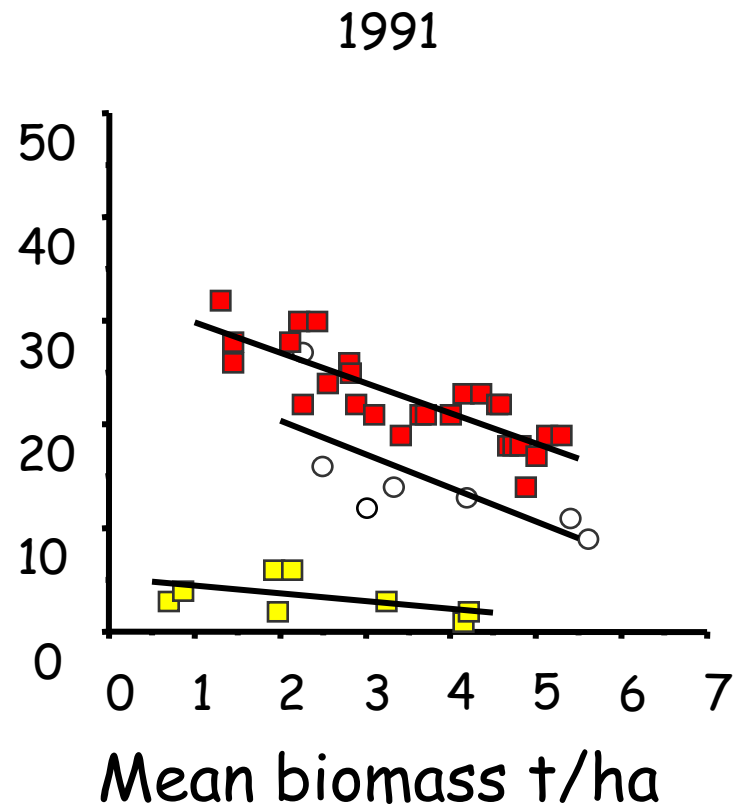
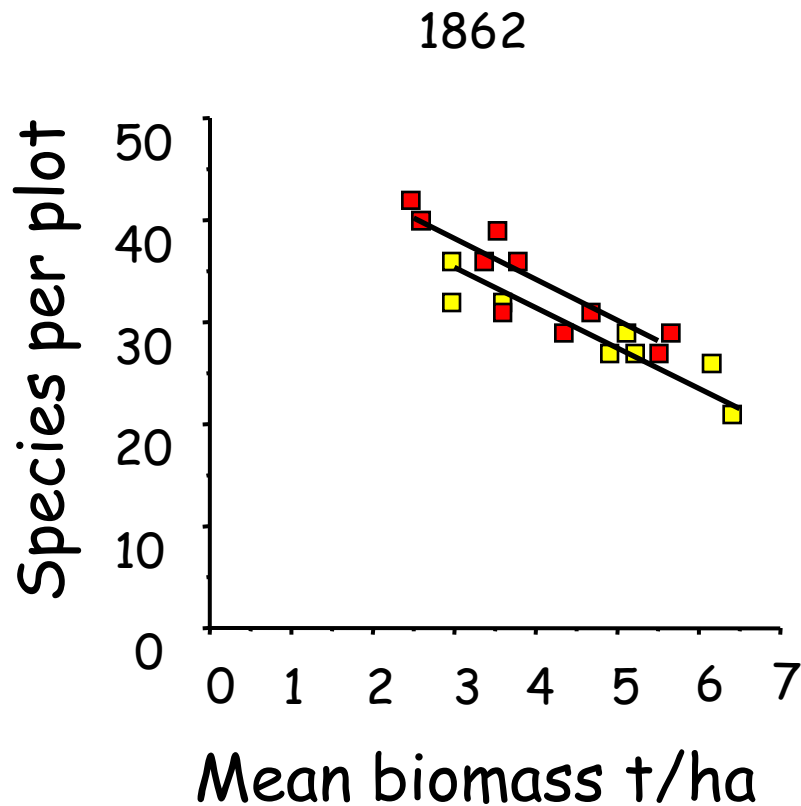


Soil pH 1856-2000

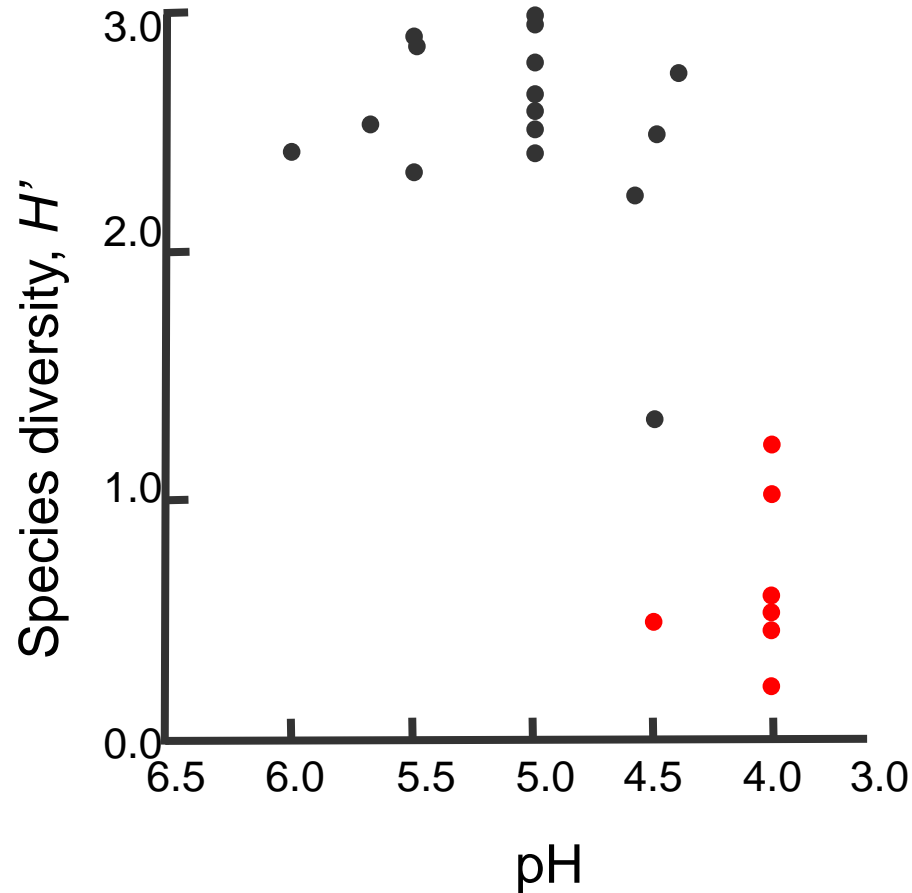


Data of Paul Poulton & A.E. Johnston, in Silvertown *et al.* *J.Ecol.* (2006)

Effect of biomass and pH on species richness



Threshold effect of pH on plant diversity*

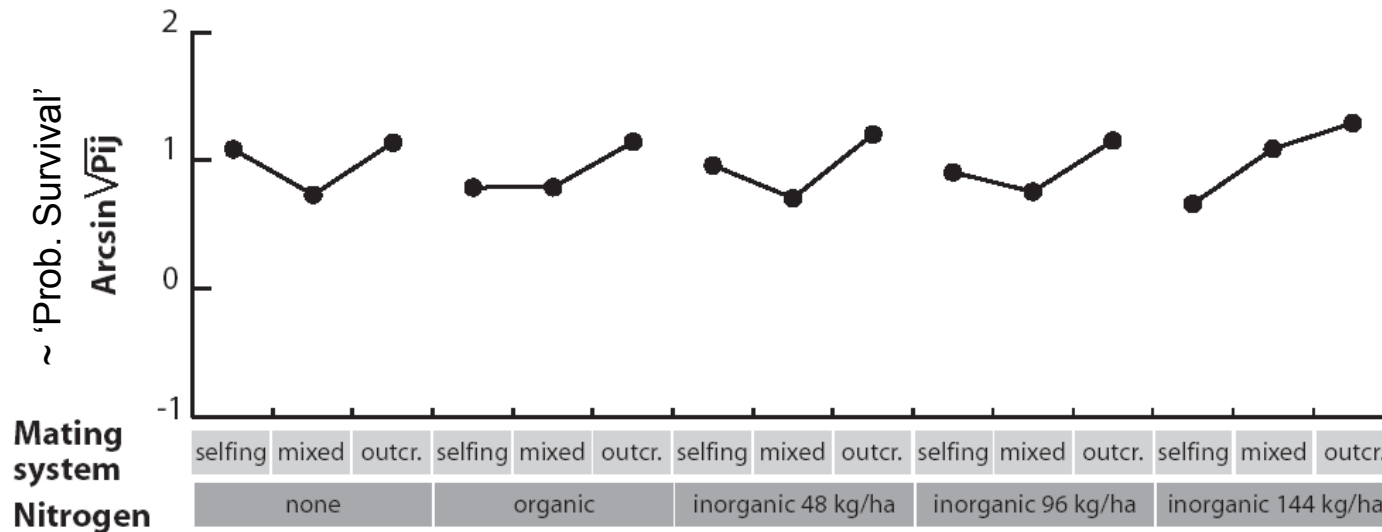


*Effect of biomass removed

Modified after Silvertown, J. *J. appl. Ecol.* **17**, 491-504 (1980)

Extinction is predicted by interactions between threat and life history traits

e.g. Nitrogen & mating system



$$F_{1,2189} = 3.26, P = 0.0011$$

Conclusions

- We must avoid Environmental Myopia
- To do so, we need long-term data
- Experiments in critical ecosystems are needed to understand mechanisms & aid prediction
- And as a general rule...

The older...

"An archaeologist is the best husband any woman can have.

The older she gets, the more interested he is in her."

Agatha Christie



... the more interesting



- A new UK charity supporting long-term experimental ecology and its application to conservation and sustainable land management.
- Its purpose is to provide future generations with the scientific resources that they will require to understand and to manage their environment for the benefit of people and of nature.

www.EcologicalContinuityTrust.org

Thanks

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- SAEON

 papers at: www.JonathanSilvertown.com