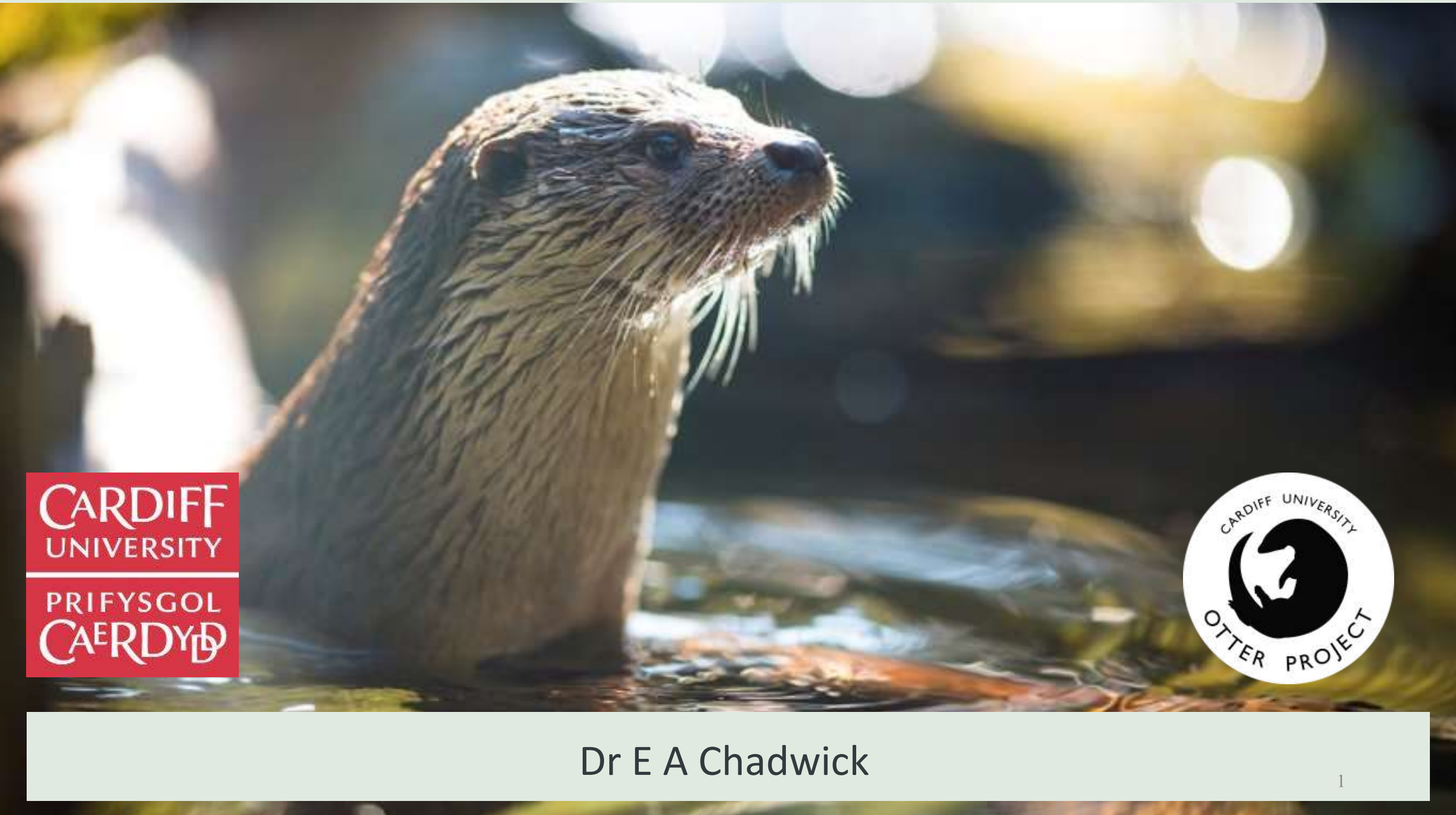
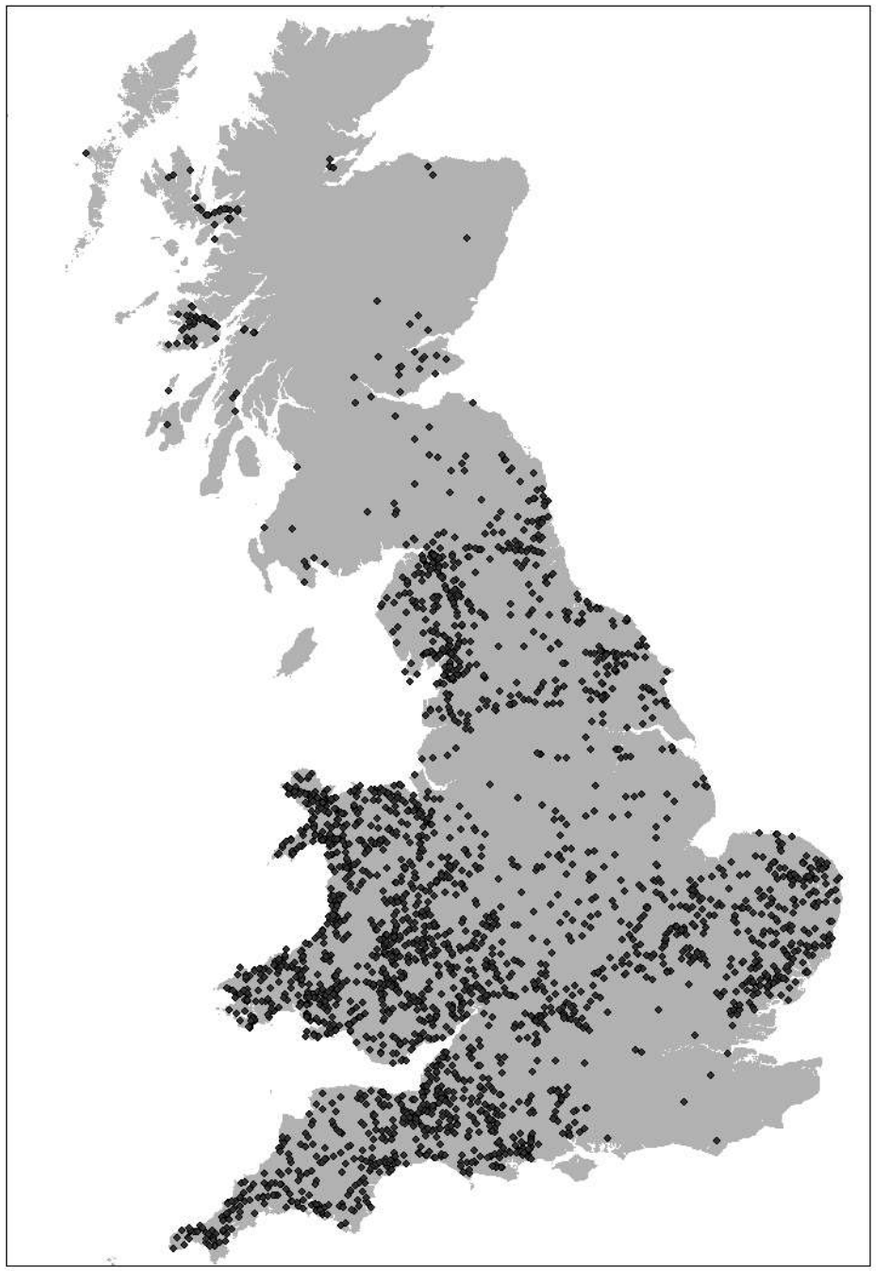
Cardiff University Otter Project



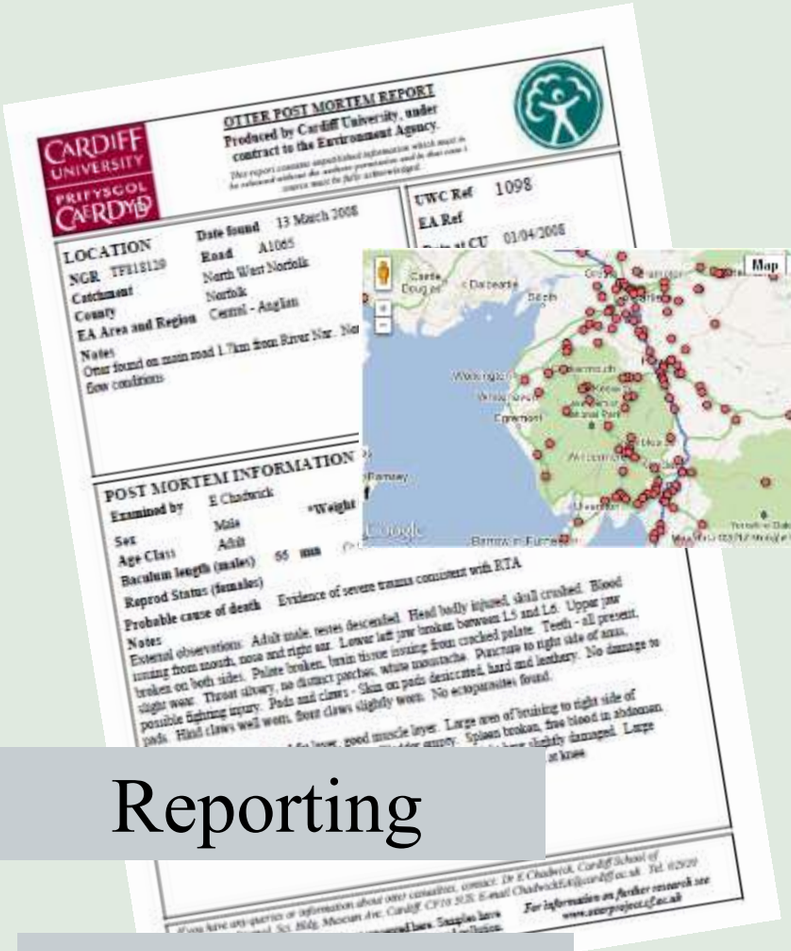
Dr E A Chadwick

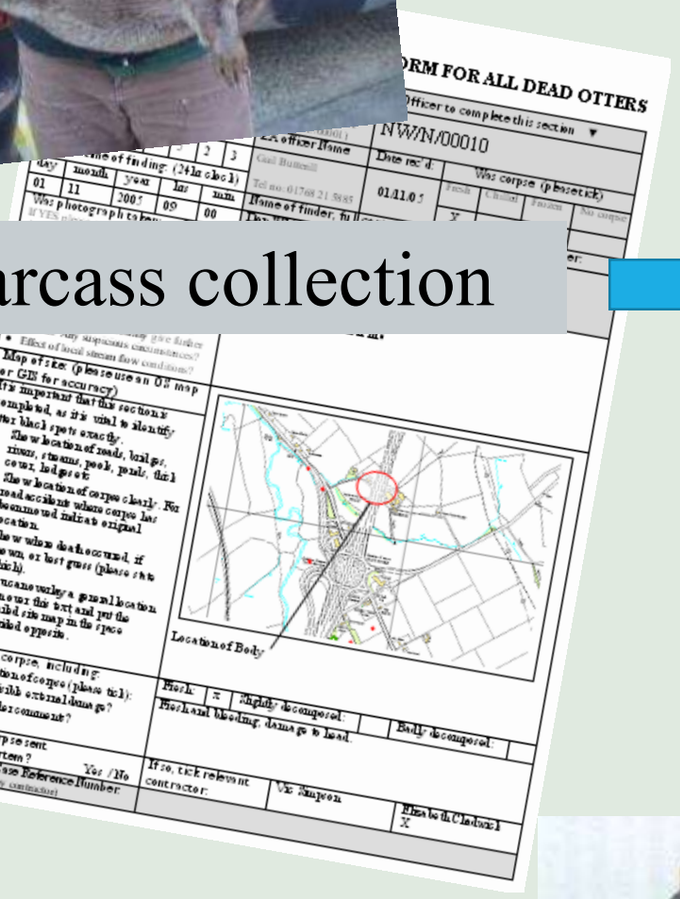
The Cardiff University Otter Project

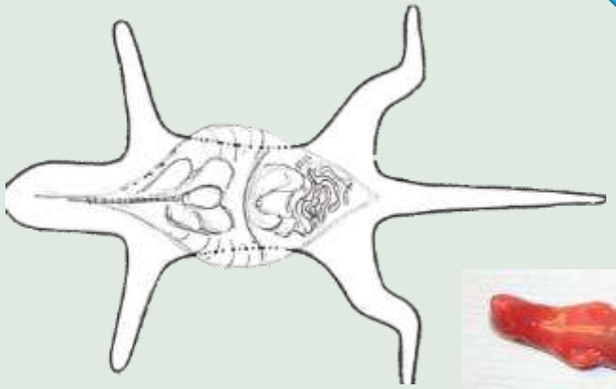
- Since 1992
- England, Wales – more recently, Scotland
- Initially 10/yr, now up to 250/year
- Total sample/data bank >3000 individuals

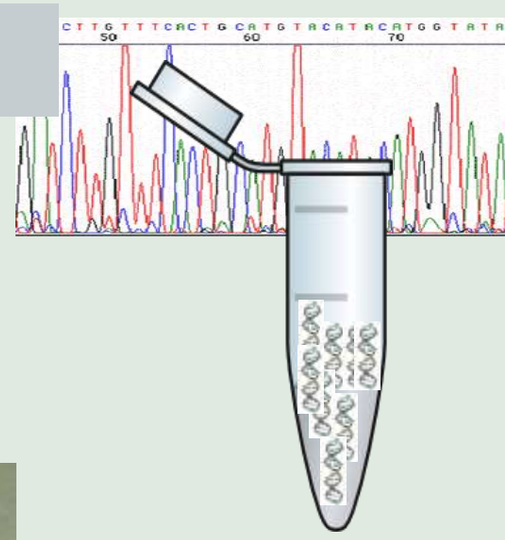


Procedure



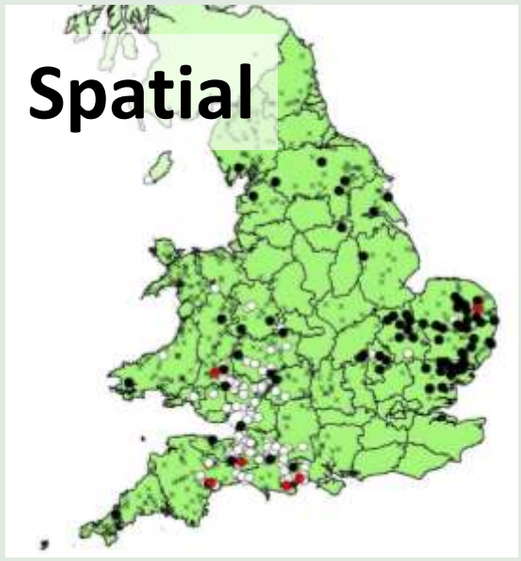




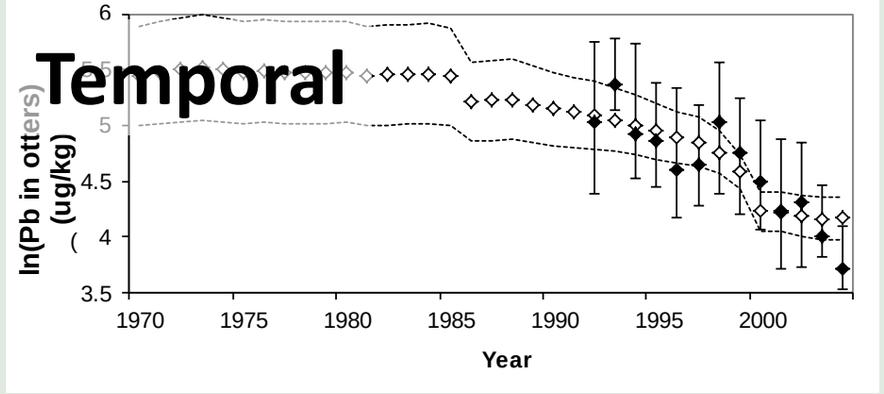


Carcass collection → Post mortem → Reporting / Archiving / Research

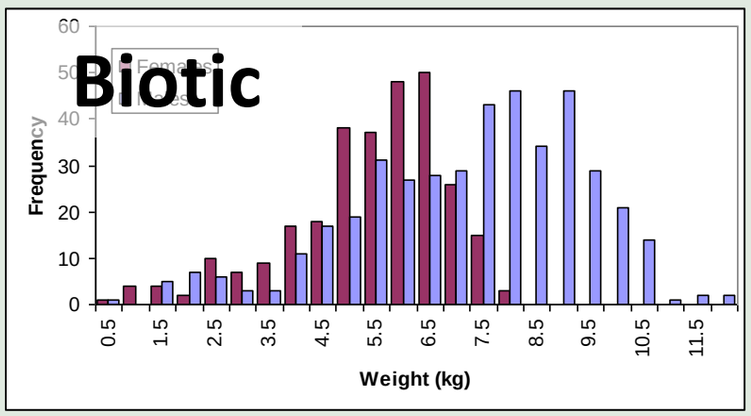
Research: Overarching themes



- Patterns across the UK – do they reflect the natural landscape, anthropogenic drivers, or other factors?



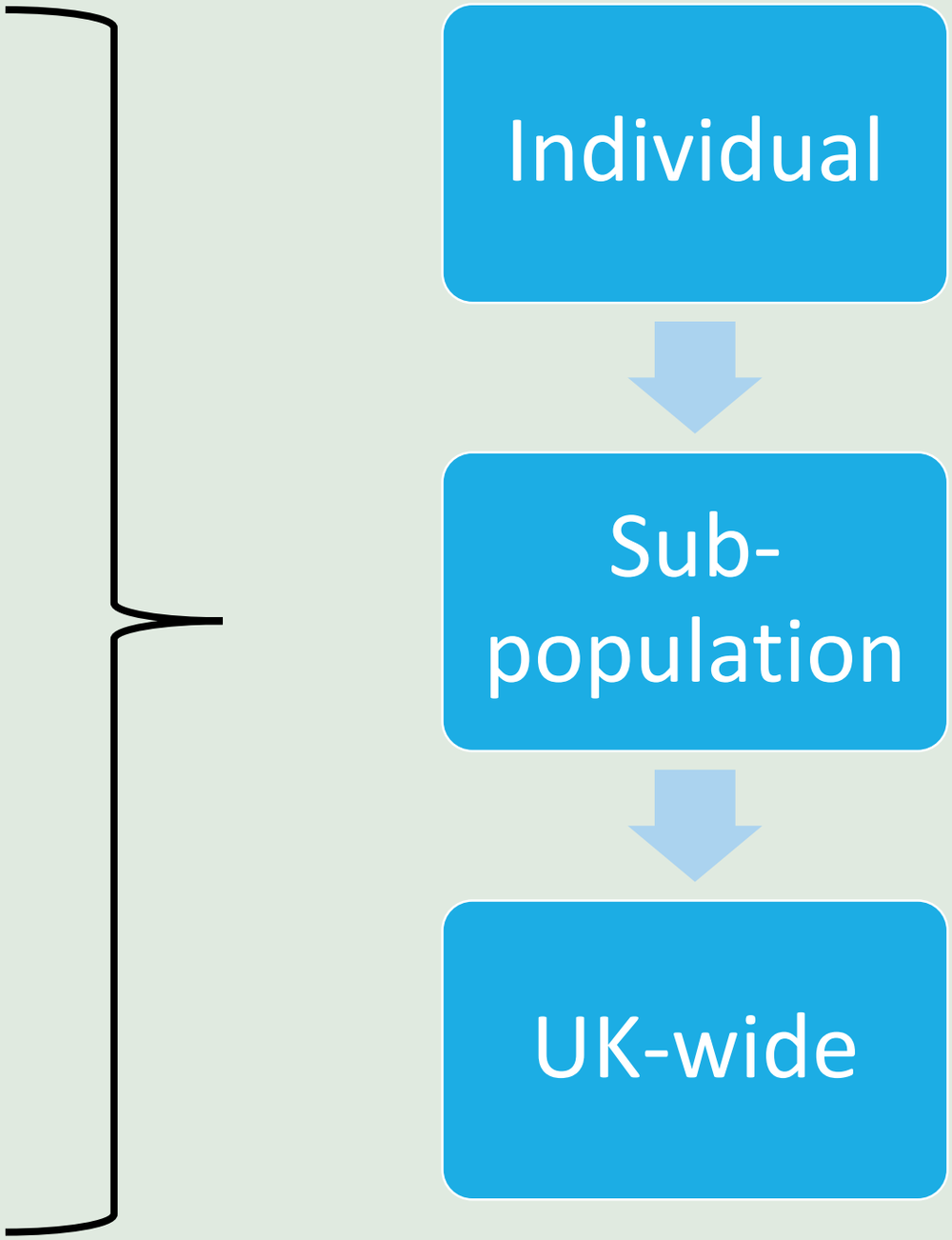
- Change over time? (25 yr time series)? Seasonal variation?



- Differences between groups e.g. by age, sex, reproductive status

Research: Range of disciplines and scales

- Basic biology
- Contaminants
- Genetics
- Chemical communication
- Parasitology
- Diet
- Health



https://www.cardiff.ac.uk/otter-project/research/publications

Research

Research themes

Map

Post mortem examination

Publications

Publications

Our researchers have produced a number of articles and monographs.

Selected publications

Sherrard-Smith, E. et al., 2016. Distribution and molecular phylogeny of biliary trematodes (Opisthorchiidae) infecting native Lutra lutra and alien Neovison vison across Europe. *Parasitology International* 65 (2), pp.163-170. (10.1016/j.parint.2015.11.007)

Kean, E. , Chadwick, E. A. and Muller, C. T. 2015. Scent signals individual identity and country of origin in otters. *Mammalian Biology* 80 (2), pp.99-105. (10.1016/j.mambio.2014.12.004)

Pountney, A. et al., 2015. High liver content of polybrominated diphenyl ether (PBDE) in otters (Lutra lutra) from England and Wales. *Chemosphere* 118 , pp.81-86. (10.1016/j.chemosphere.2014.06.051)

Sherrard-Smith, E. , Chadwick, E. A. and Cable, J. 2015. The impact of introduced hosts on parasite transmission: opisthorchiid infections in American mink (Neovison vison). *Biological Invasions* 17 (1), pp.115-122.

Publications archive

You can search Biosciences publications in Cardiff University's institutional repository.

Search our publications

Today's focus

1. Why have populations increased?

2. Do we need to control populations?

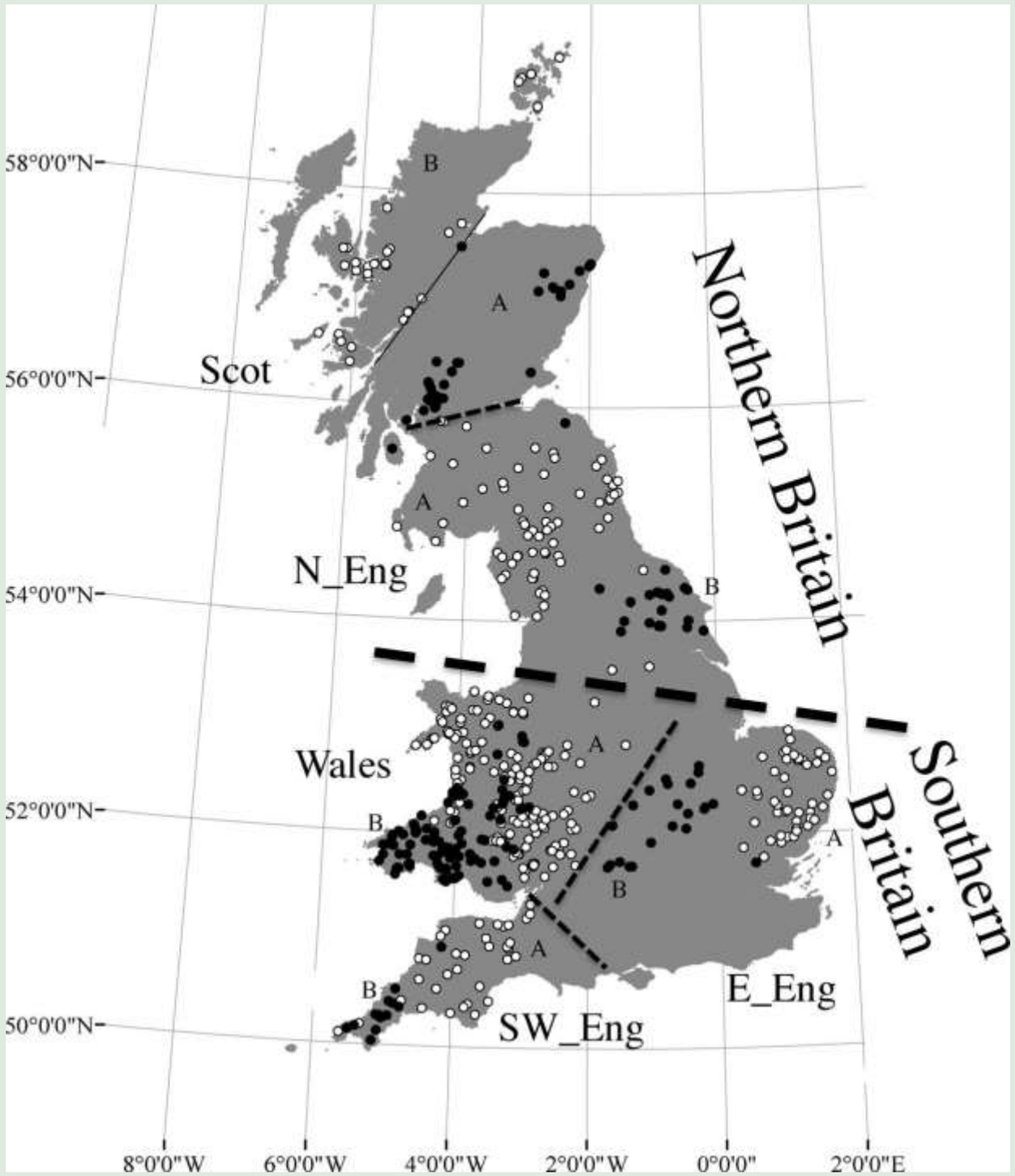
3. Is fish stocking contributing to the increase?

Population dynamics

- Numbers have increased
- Carcasses received: Initially 10/yr, now up to 250/year
- Spraint surveys show increased distribution

- Why?

Genetic evidence



Stanton et al, 2015. J of Mammalogy

Method: DNA, from muscle tissue

- Highly structured population – suggests gradual recovery from distinct remnant populations

Genetic evidence

Nia Thomas
CUOP PhD
student

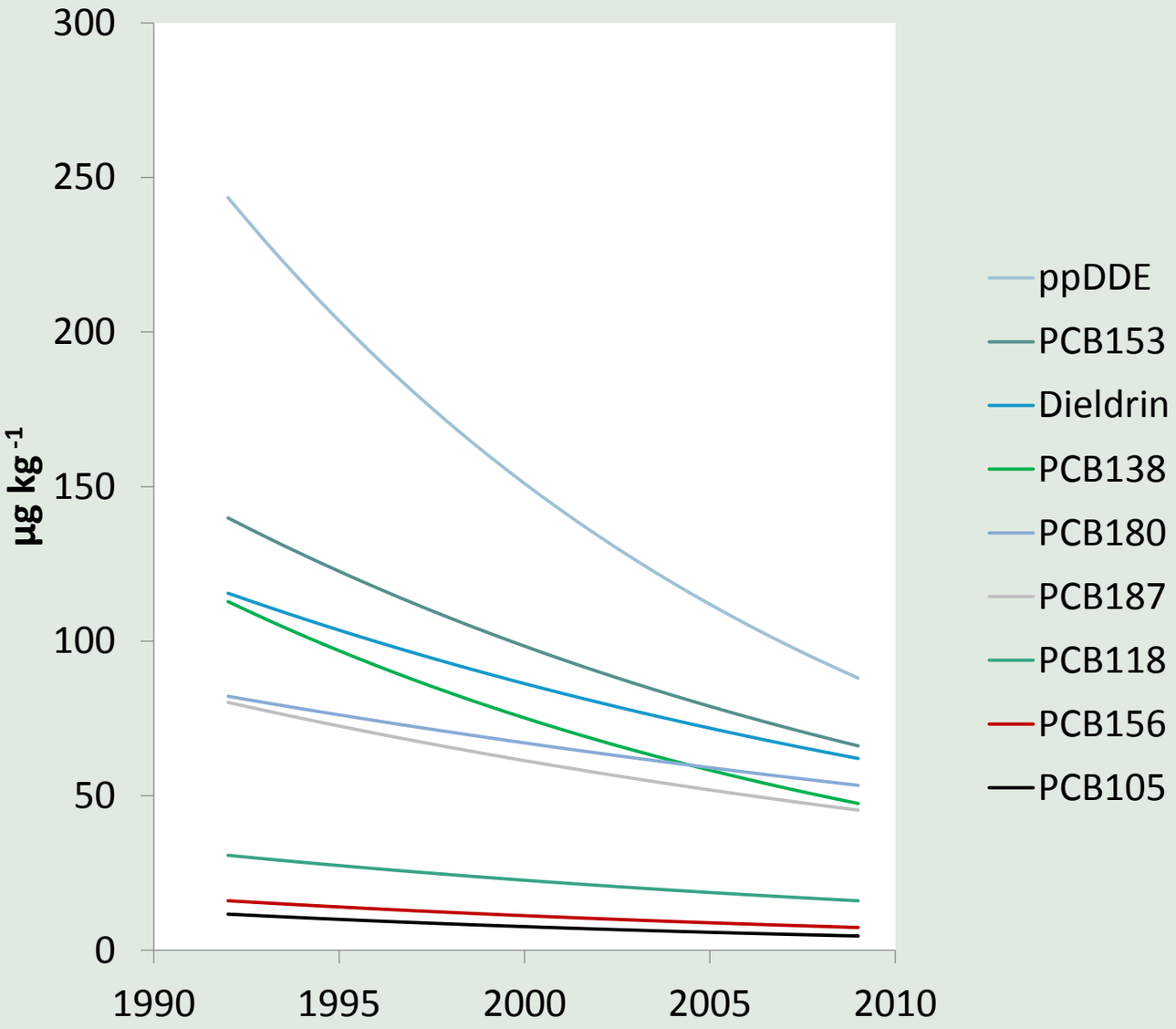
- Changes in genetic population structure across time

- DNA evidence (Hajkova et al 2006) previously suggested a distinct allele found in captive bred populations from Norfolk.

- This identifier (red dots) has NOT spread across the country

Hajkova et al 2006 J of Zoology.
doi:10.1111/j.1469-7998.2006.00259.x

Contaminant evidence



Kean & Chadwick 2012.

Method: Chemical analysis of liver tissue

- Clear decline in PBT chemicals (persistent, bioaccumulative, toxic)

<u>Contaminant release has driven population recovery</u>

Should we implement controls?

What are natural controls on populations?

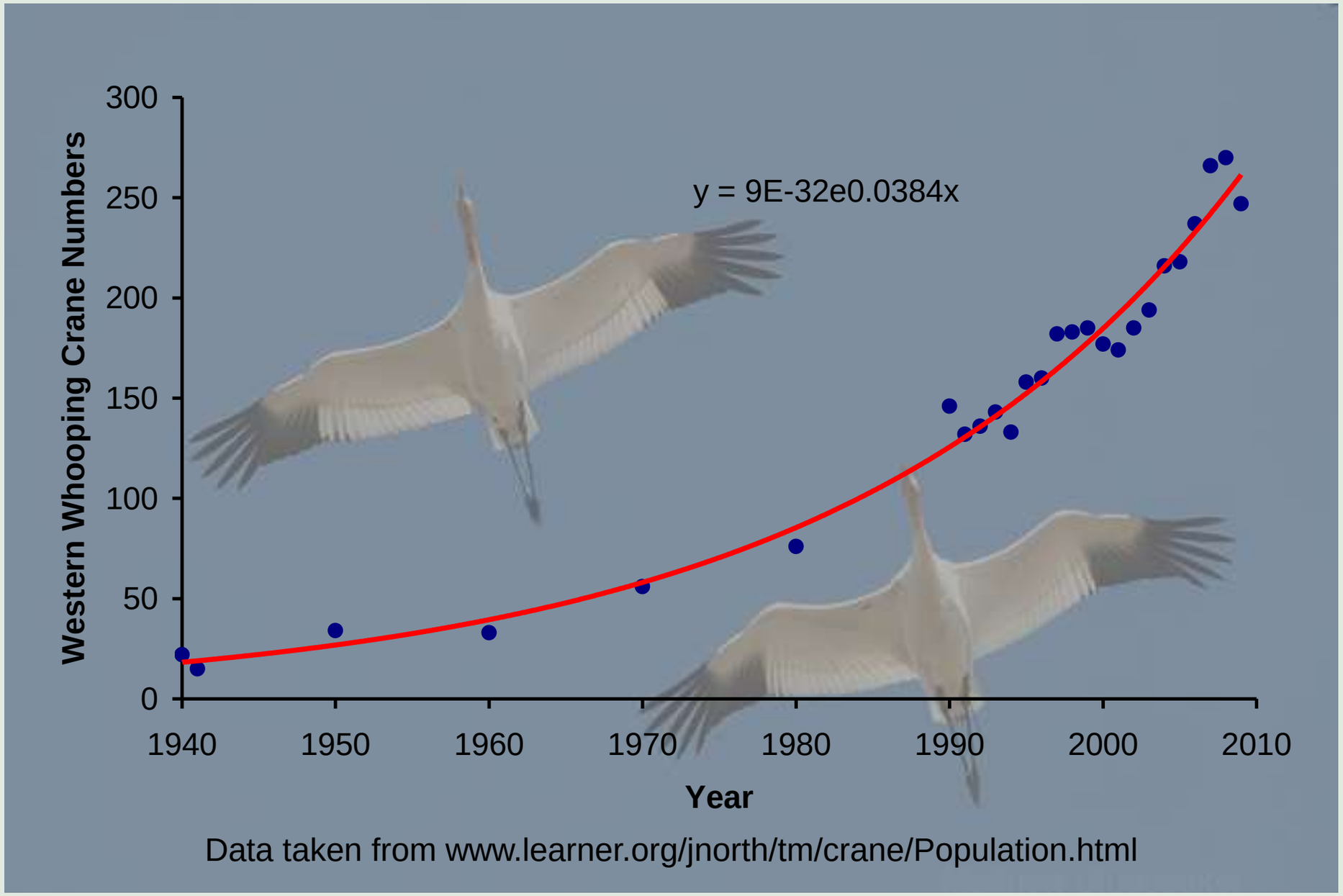
- Density dependent factors: e.g. competition drives changes in mortality and reproduction.
- Density *independent* factors: e.g. natural disasters – fire, flood – impact individuals regardless of density.

- Top down pressure: e.g. predators can control prey
- Bottom-up pressure: e.g. availability of food.

- Disease – also tends to be density dependent

Exponential growth?

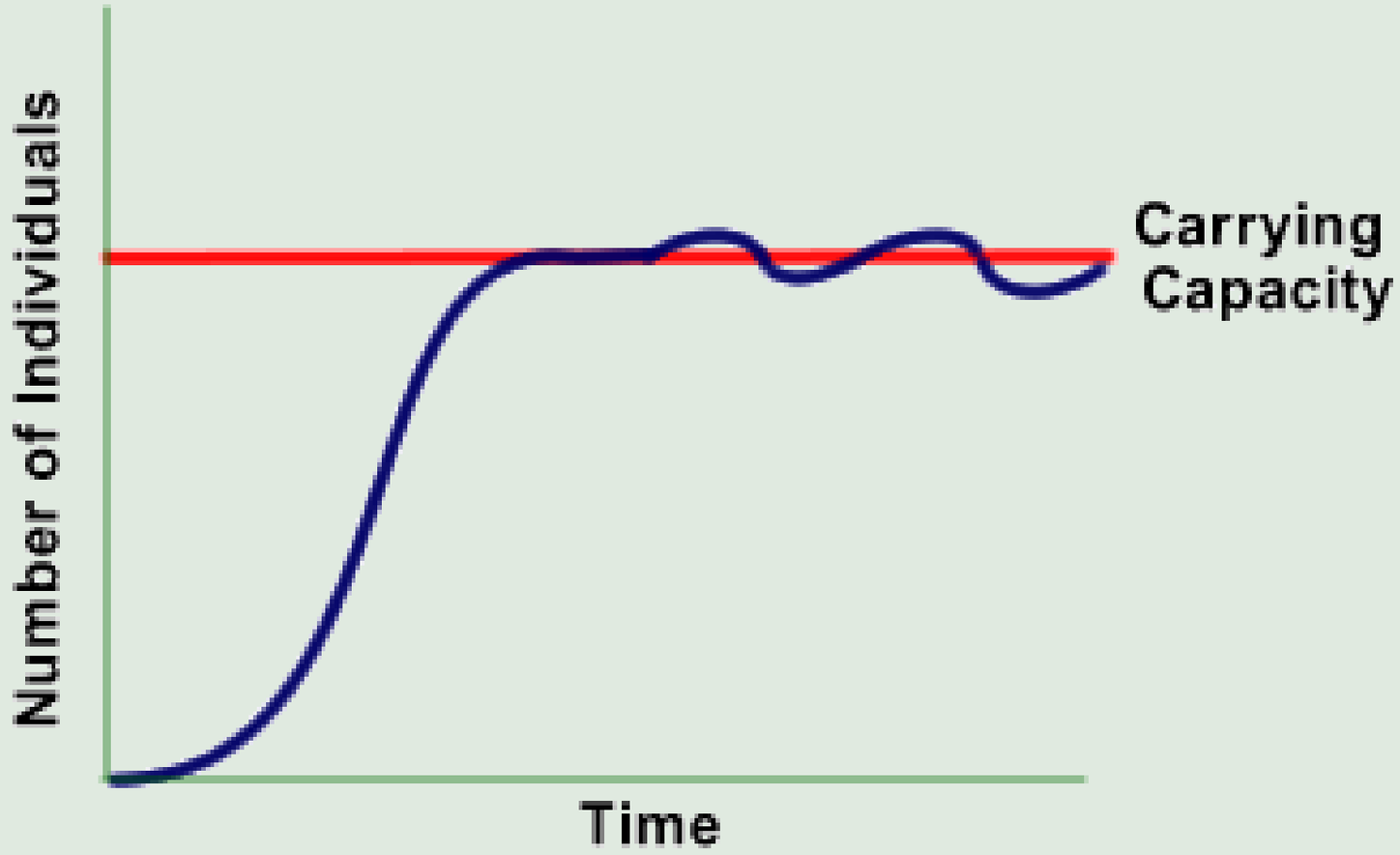
- Extremely rare in natural populations.
- Occurs sometimes in non-native invasive populations, and also during population recoveries

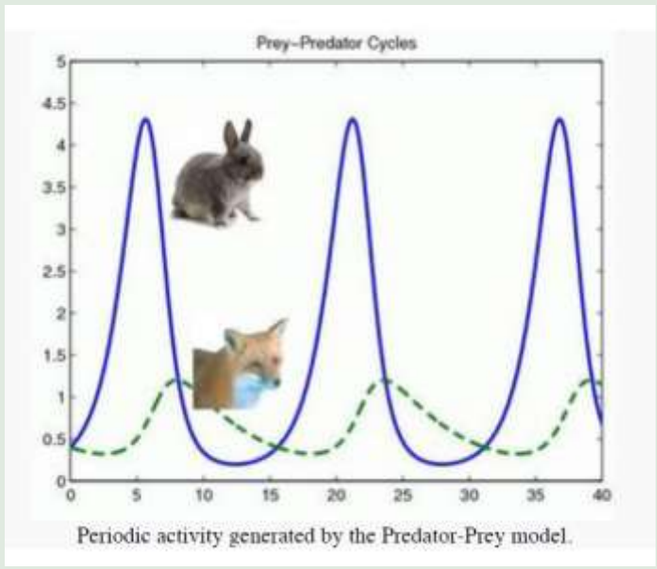


Data taken from www.learner.org/jnorth/tm/crane/Population.html

Carrying capacity

- May depend on food, refuge sites, ..
- Populations tend to fluctuate around carrying capacity – increased prey allows more predators, which drive down prey, which reduces predators… etc

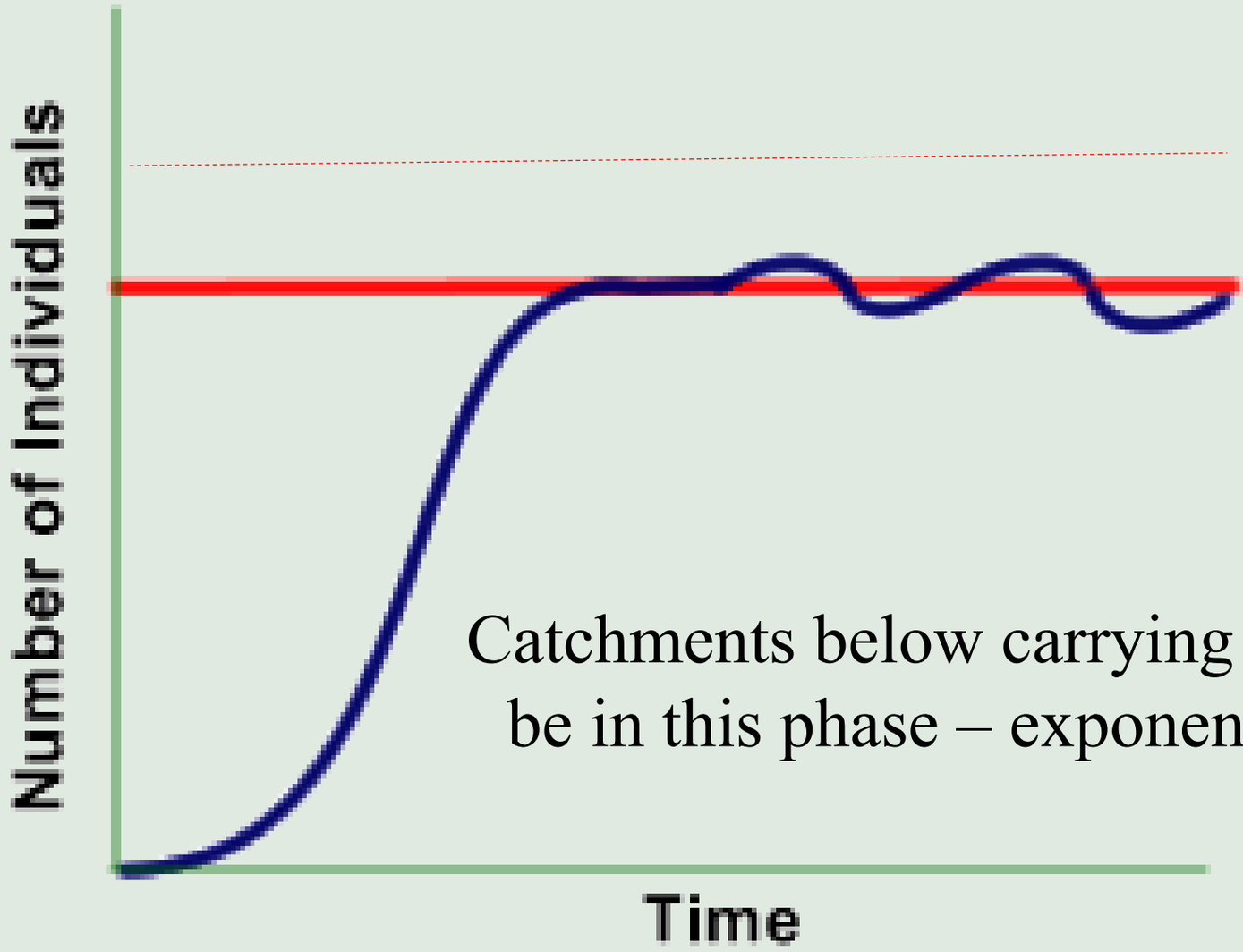




https://www.saylor.org/site/wp-content/uploads/2011/06/MA221-4.1.2.pdf

Where are otters on the curve?

- It depends! Some catchments may be reaching carrying capacity, others are far below.



Carrying capacity might be increased by provision of extra food?

Some catchments may be at carrying capacity

Catchments below carrying capacity may be in this phase – exponential increase

Are stocked fish elevating carrying capacity?

What do we know about otter diet?

- Traditional methods:

Hard parts analysis, typically from spraint

Application to stomach contents – link diet to the individual.

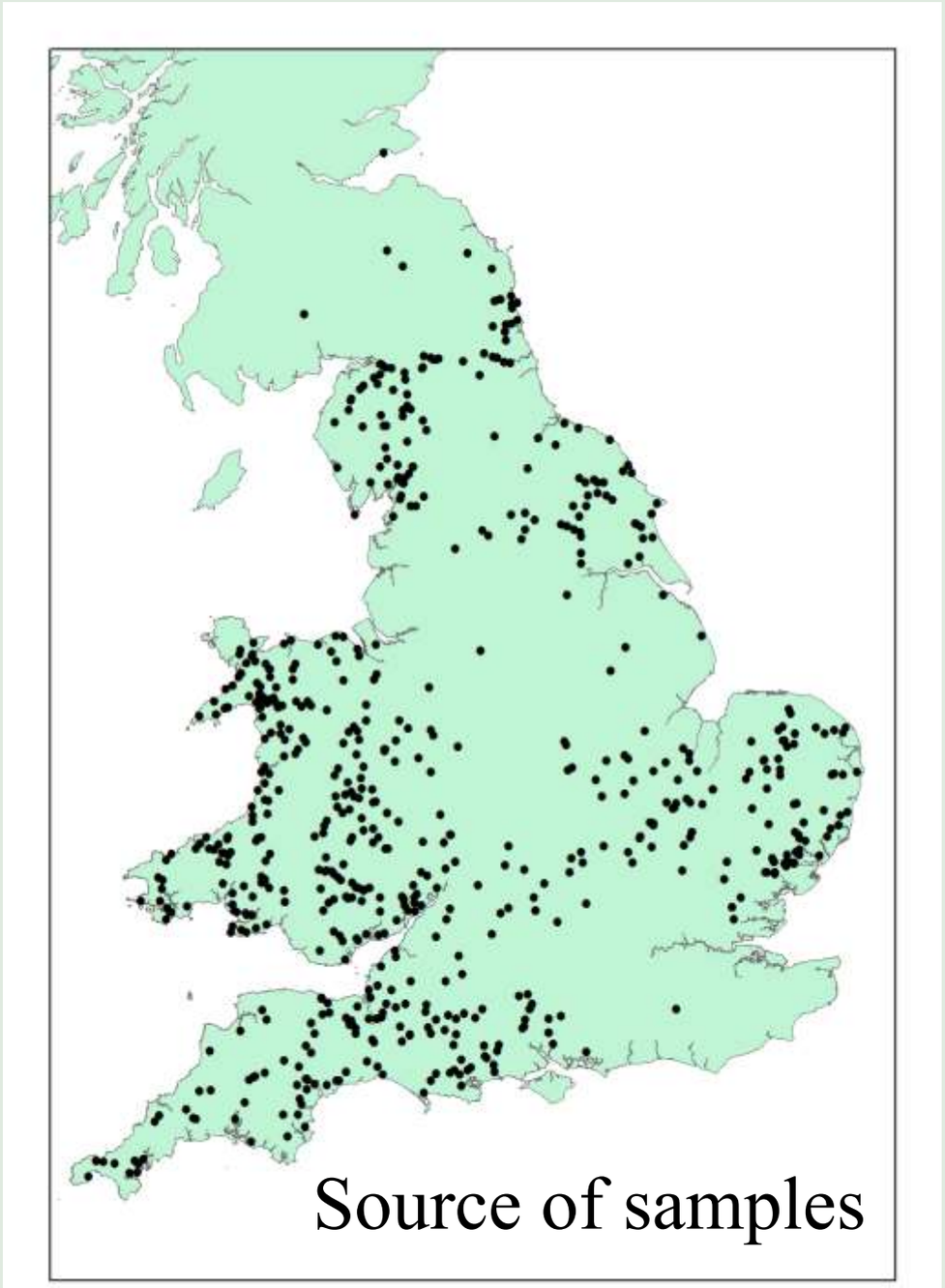
Stomach contents study, n=610 (1994-2010)

- 83% contained identifiable prey remains.

% of samples that contained… :

- 26% Bullhead
- 26% Cyprinid
- 25% Salmonid
- 20% Eel
- 13% Stickleback

Insect, bird, mammal, crustacean – all ca.5%


Source of samples

Moorhouse Gann et al. Unpublished Otter Project data

Limitations

- Cryptic prey e.g. Cyprinids

further IDd e.g. using jawbones: (of the 610)

Minnow (54), chub (12), roach (11), dace (4), carp (3), tench (2), barbel (2), common bream (2), rudd (1)

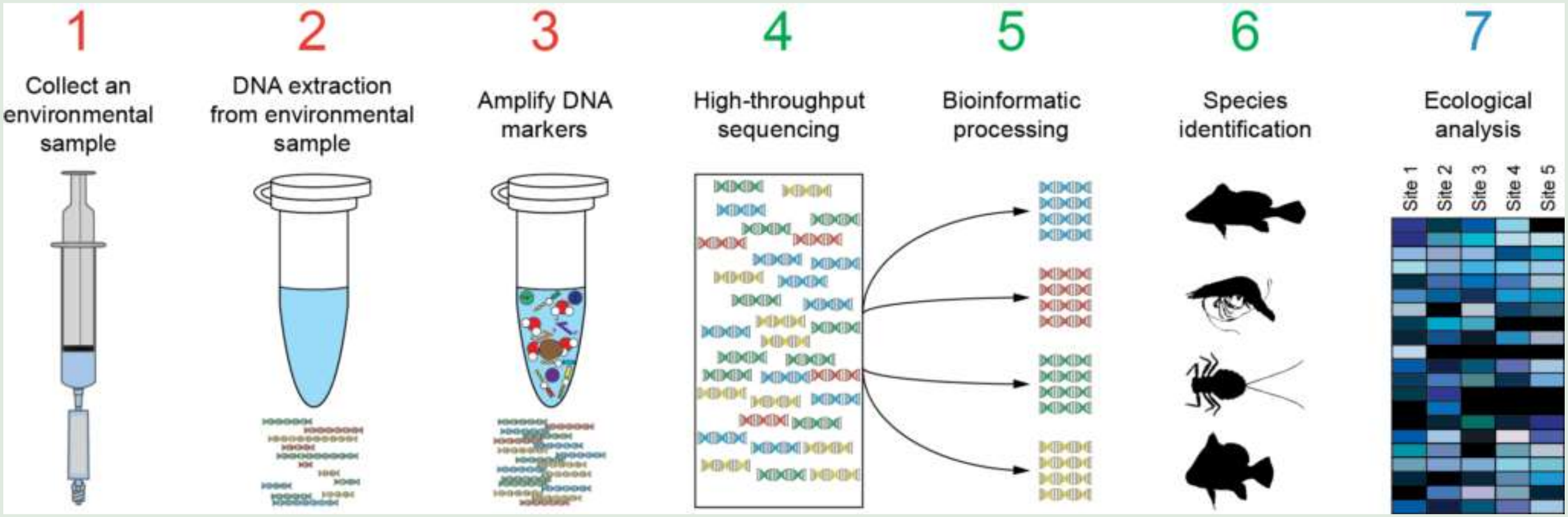
BUT:

- May not find a jaw bone
- Large fish – only flesh eaten? i.e. no hard parts
- Non-bony prey not picked up (e.g. lamprey?)

Is hard part analysis underestimating predation of certain species?

High throughput sequencing & metabarcoding

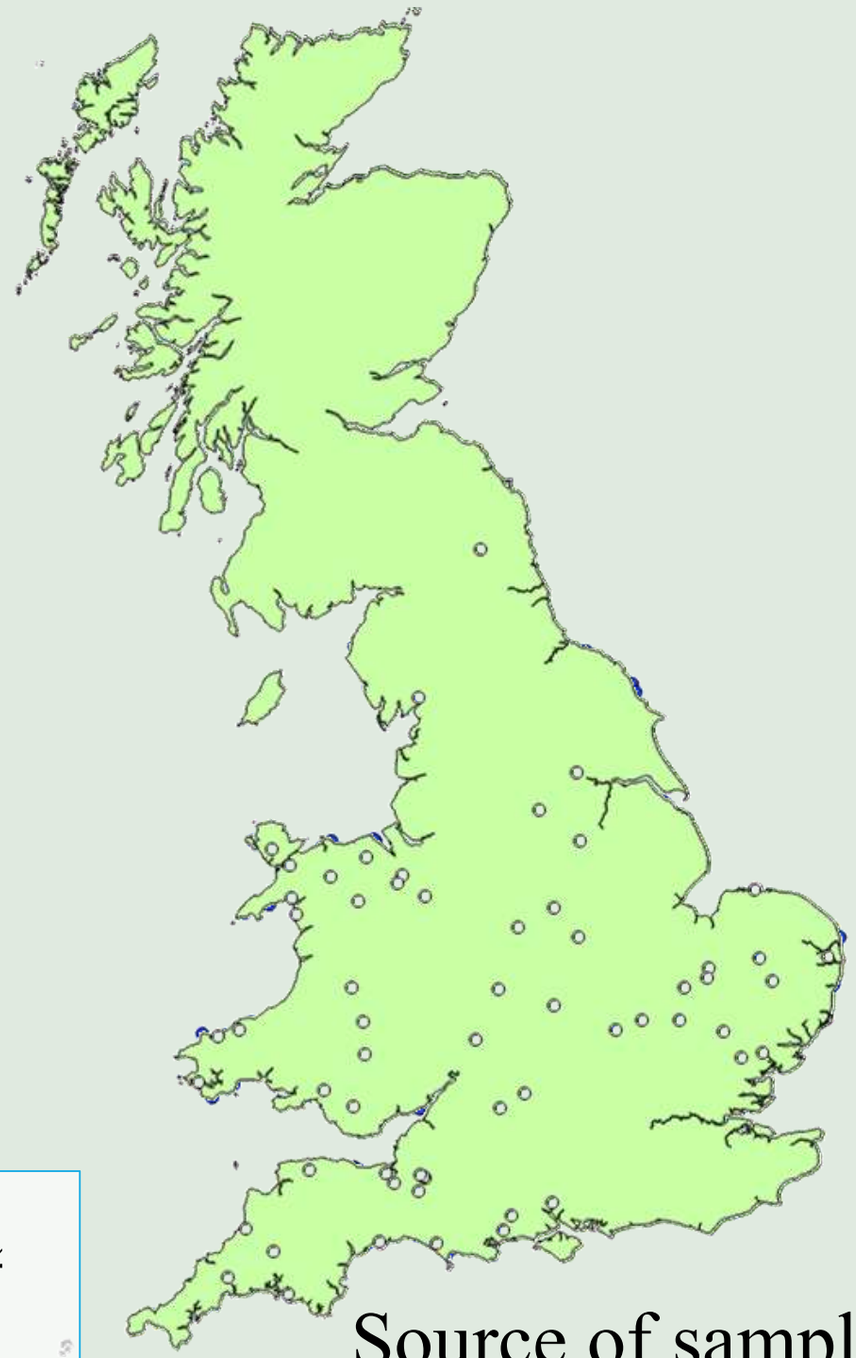
Lorna Drake
CUOP PhD
student



Otter faeces, n = 60 (2015-16)

- Trial period, n = 60 (white circles)
- Primer design and testing
- Initial results

	traditional	DNA
% of samples that contained… :		
• 26%	Bullhead	23%
• 26%	Cyprinid	30%
• 25%	Salmonid	17%
• 20%	Eel	7%
• 13%	Stickleback	3%



Source of samples

Not for circulation. Preliminary data from trial. Some further method improvements to be made

Species specifics… of the 60 otters

- Cyprinids (30%), included:

One with crucian carp

(also minnow, roach, gudgeon, rudd, bream, tench)*

*Further work on DNA barcode library may add to this list

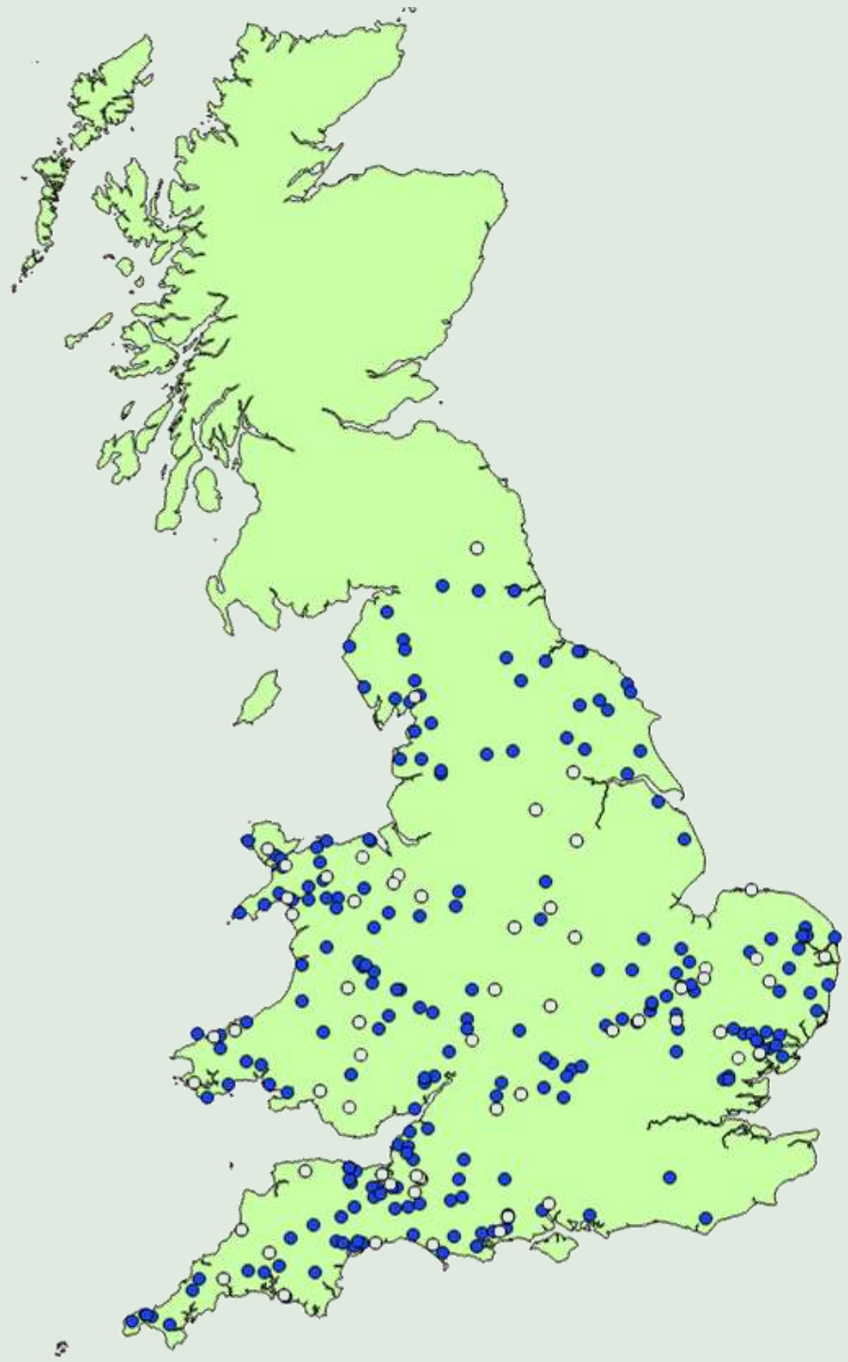
- Salmonids (17%), included:

One with rainbow trout

(also atlantic salmon, brown trout)

Next steps

- Full analysis, n = 300 (blue circles)



- Some further additions to the DNA barcode library required

Further analyses will look at

- Diet v sector of population (e.g. sex, age)
- Change over time (previous years)
- More species specific detail
- Generalist v. specialist individuals
- Direct comparison with hard parts from matched samples

Summary

- Captive breeding has not contributed massively to population expansion

- Rates of expansion not fully quantifiable; varies markedly between areas; controlled by carrying capacity.

- Work on diet is underway to help quantify the level of pressure on different fish species: key species such as carp do NOT appear to be heavily targeted

Wider implications

- Top of food chain - **indicator** of habitat quality, chemical pollutants, etc

- What's good for otters is good for fish..

- Charismatic – **flagship species**, useful for environmental education; also a valuable '**umbrella species**'

Acknowledgements:
The current team


PDRAs


PhD students



Masters / UG students





Funders & collaborators

Members of the public… and

Individual collaborators: M Bruford, J Cable, C Muller (Cardiff University), Andrew Kitchener (NMS) , G Scholey (EA), R Strachan (NRW), R Birtles (Salford), B Holt (ZSL), R Shore, Lee Walker (CEH), V Simpson (WVIC)