

Eradicating Grey Squirrel from Anglesey: Lessons & Future Challenges



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*Honorary Visiting Research Fellow
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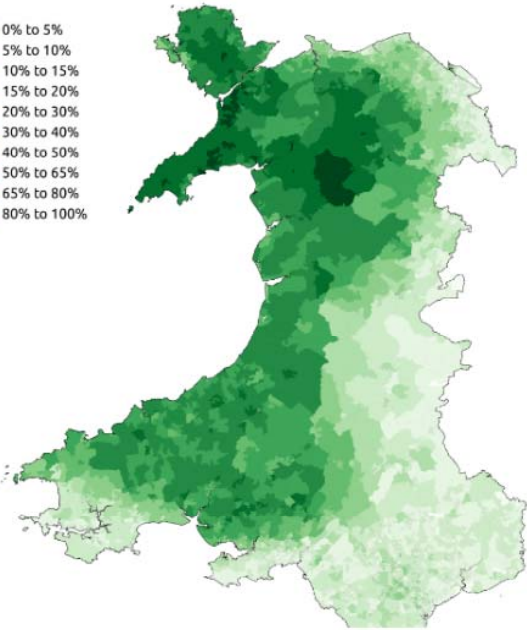


Conservation Action = Ecology + Funding + **Politics**

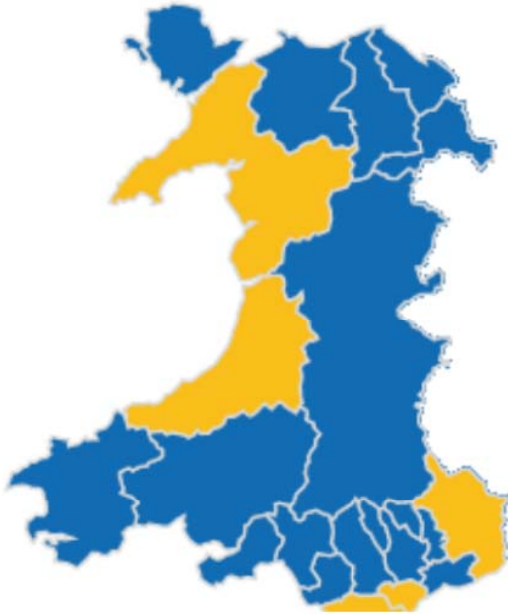




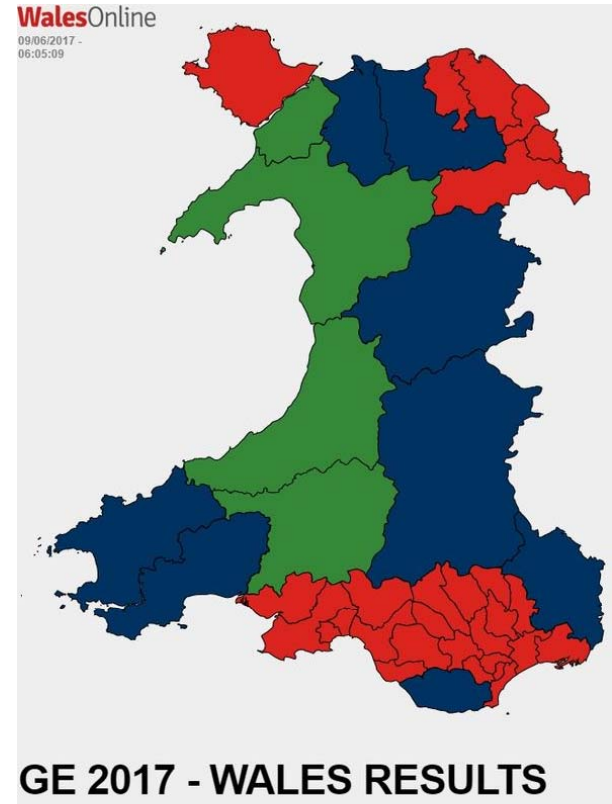
- 0% to 5%
- 5% to 10%
- 10% to 15%
- 15% to 20%
- 20% to 30%
- 30% to 40%
- 40% to 50%
- 50% to 65%
- 65% to 80%
- 80% to 100%



% Speaking Welsh



Brexit Vote Leave – Blue





YN Y TY HWN.

Anglesey

- 69,750 residents on Anglesey.
- 3,000 hectares of woodland and gardens.
- Island is 710km² with Holy Island an added 10km².
- Tourism valued at £250 Million per year.
- Agriculture & Nuclear Power Station (Wylfa B).
- Port of Holyhead links UK with Republic of Ireland.



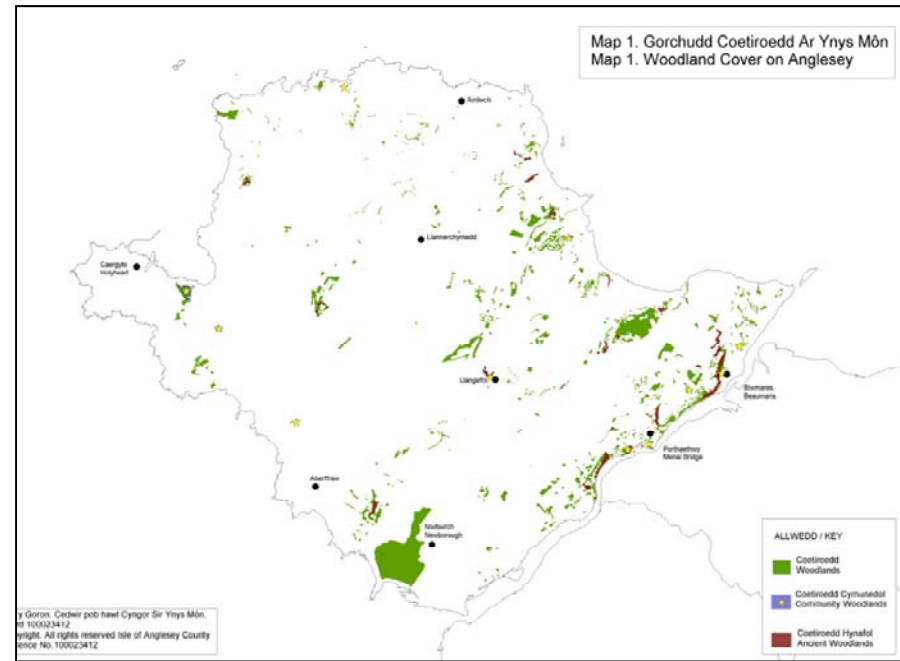
March of the grey squirrel

Flintshire and Denbighshire (1945-1952)

Caernarvonshire in the late 1950s

Anglesey 1966



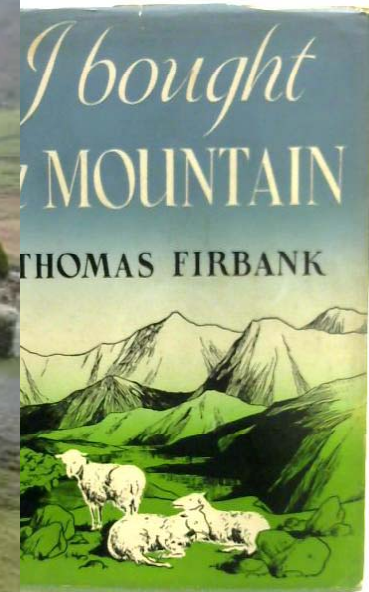


Grey squirrels first arrived on Anglesey in the mid 1960s and by 1998 the Eurasian red squirrel was almost extinct.

Eradication from 710km² island to a coastal boundary was completed in 2013

Schuchert et al. 2014 *Biological Invasions*; Jones et al. 2017 *Ecological Modelling*

Esmé (1910-1999)
& Peter Kirby (1911-2003)



Re

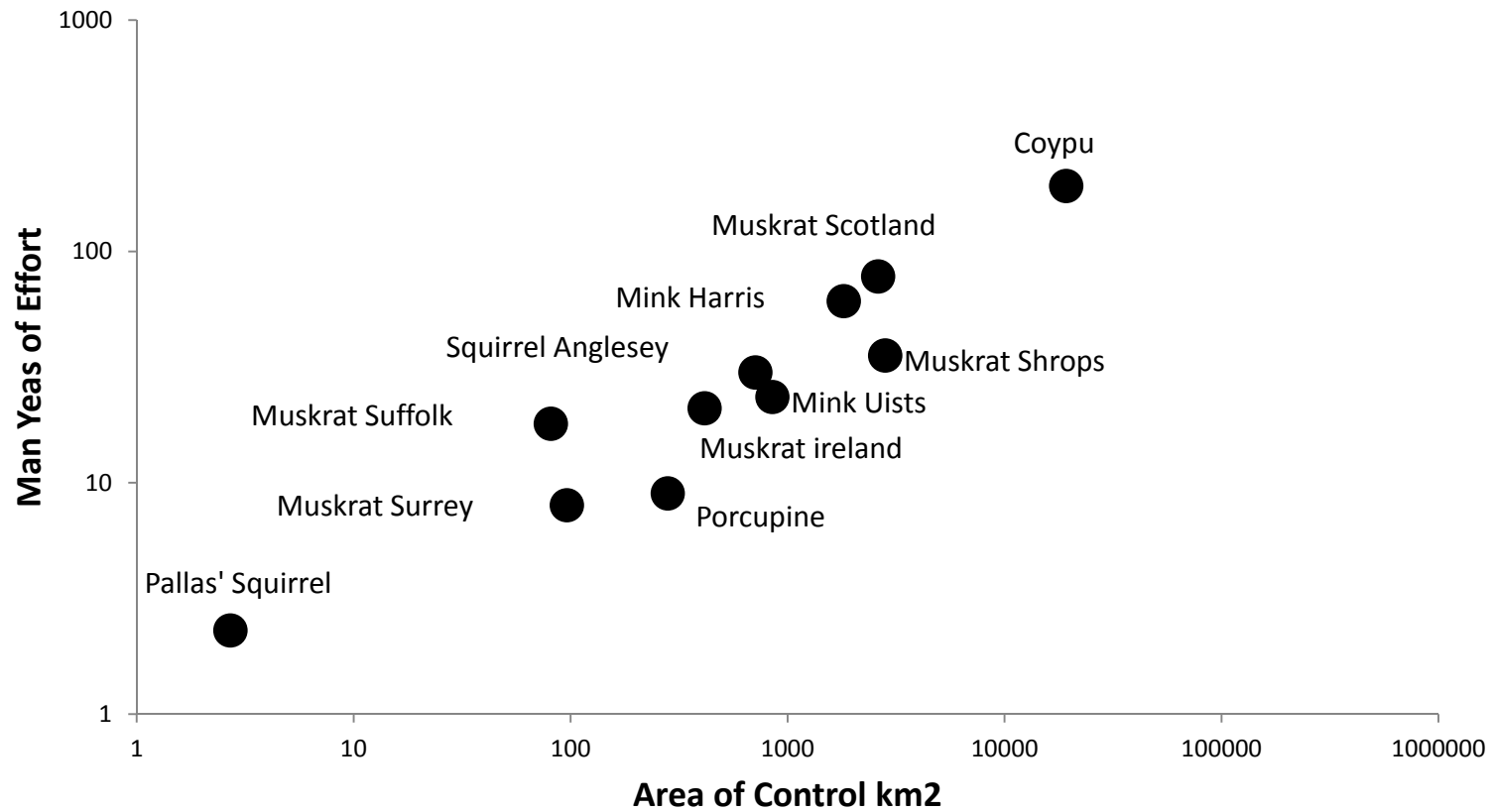
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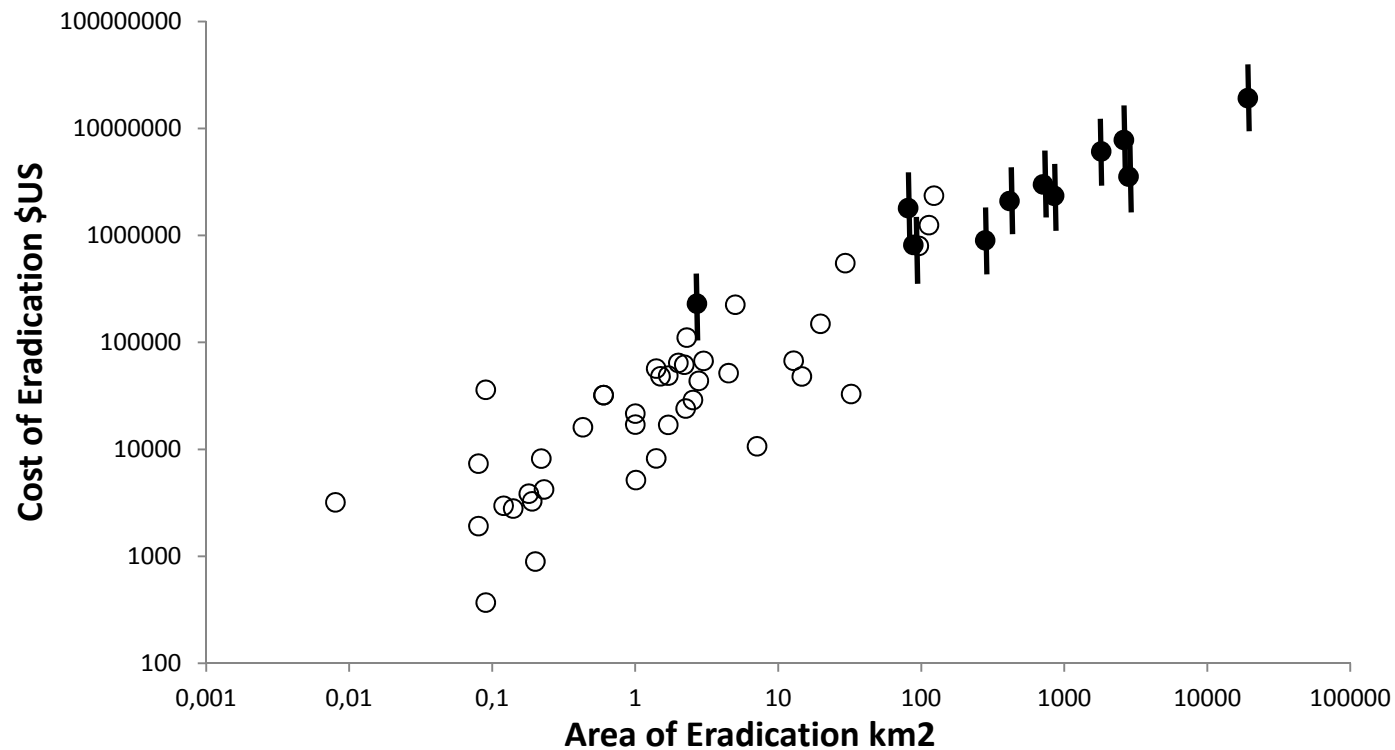
Short term funding from a diverse range of grant schemes.
Staff made redundant in 2010. Funding gap in 2011



Effort for Success



Large-scale eradications follow the same cost-area relationship as do smaller island programmes



Range assumes cost per man-year of \$50-\$200k

Island data from Martins et al (2006).



Land Access

- Sport
- Farm
- Public
- **State**
- Gard
- Scrub
- Hedge



© Chris Balcombe



80% vs 120% trap effort

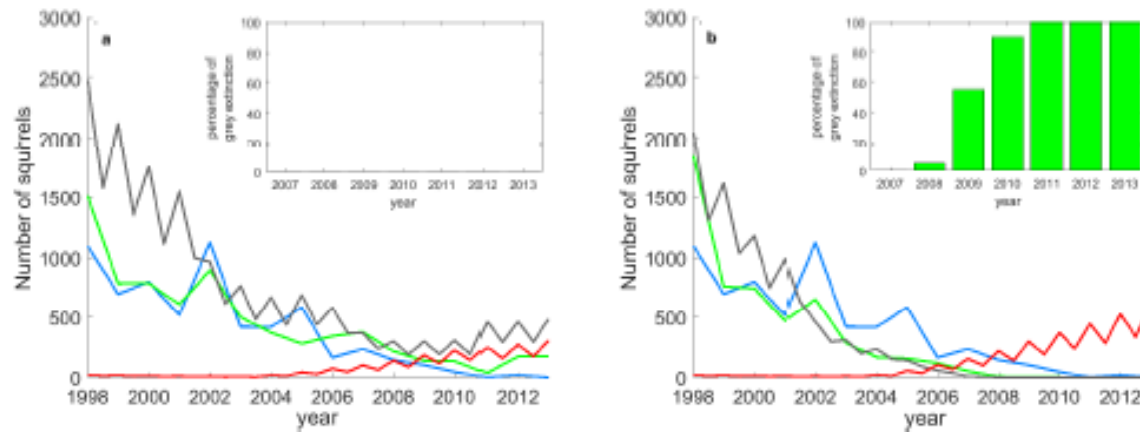


Fig. 7 Increased and decreased trapping competence with (a) 80% of trap effort and (b) 120% of trap effort. The blue line shows that actual number of grey squirrels caught. The other lines show averages over 20 model realisations for the number caught in the model (green line), the abundance of grey squirrels (grey line) and red squirrels (red line) on Anglesey. The inset panels show the percentage of runs in which greys squirrels have become extinct by the specified year

The long read

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Last Updated: Wednesday, 15 August 2007, 14:00 GMT 15:00 UK

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'Shop a squirrel' line aids cull

People on Anglesey have been urged to call a phone line to report sightings of grey squirrels as part of a cull.



Conservation experts want to make Anglesey a haven for red squirrels

A conservation project on the island is looking to increase numbers of red squirrels which are often pushed out by their grey counterparts.

The greys are being humanely culled to boost red numbers which have increased from 40 to 200 over the last 10 years.

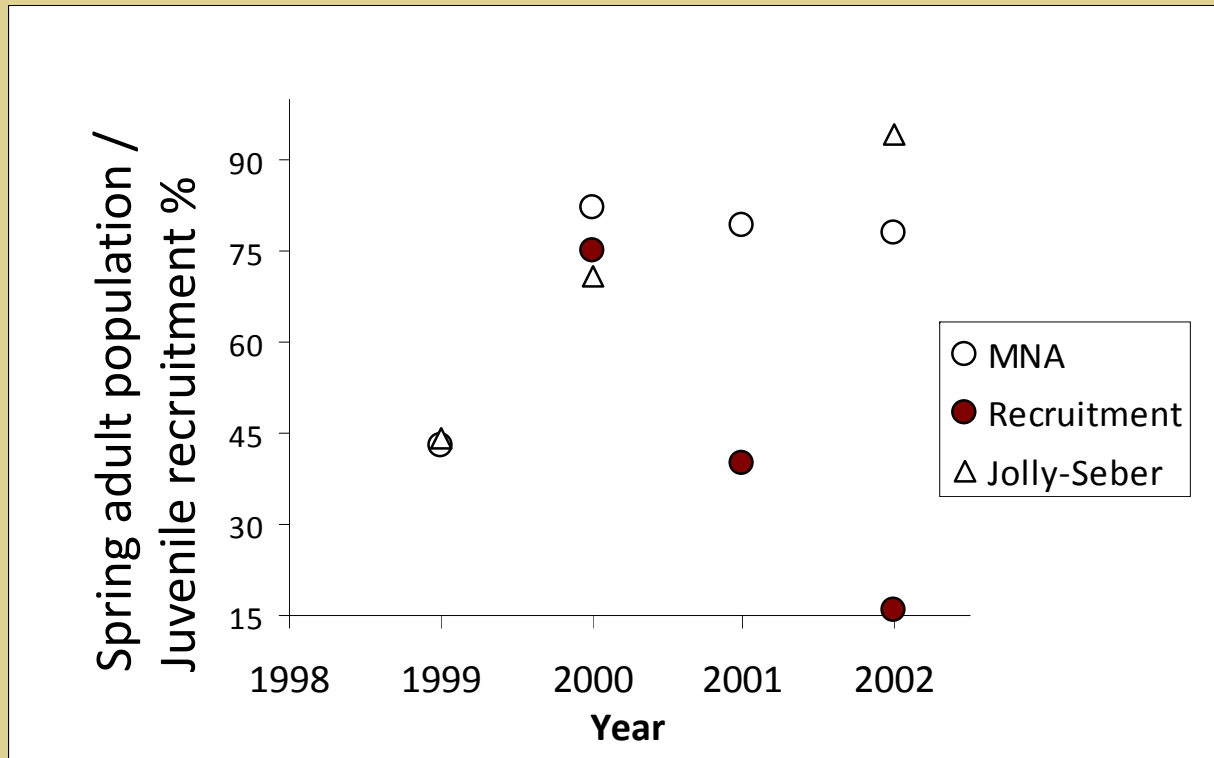
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April 6, 20

Shuttleworth (2017) - *The Conversation*



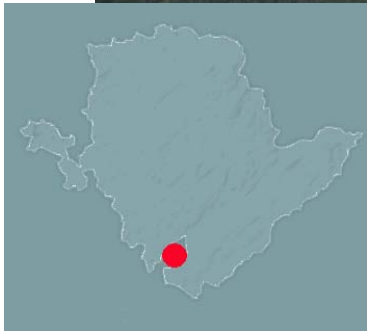
Red squirrel response to grey culling



Shuttleworth 2003 *Biologist*



Newborough forest reintroduction 2004-2007



- 550 hectare coastal pine plantation.
- Red squirrel extinct c. 1997.
- Long term housing of captive pairs and subsequent autumn soft release of offspring.



Table 1.1 Summary of captive breeding and release in 2004

Cumulative no. of adults in captivity	12	Number of adults released	3
Percentage of adults survived to 1st Jan	67%	Number of young born in wild	7
Number of young born in captivity	16	Number of juveniles released	13
Proportion of all released adults which survived to 1st of Jan 05	67%	Number of litters produced	7
Proportion of captive born juveniles known to have died by 1st Jan 05	19%	Number of young weaned per adult	1.9

2005 Disease outbreak in Newborough forest enclosures

IZVG number: 05-0551

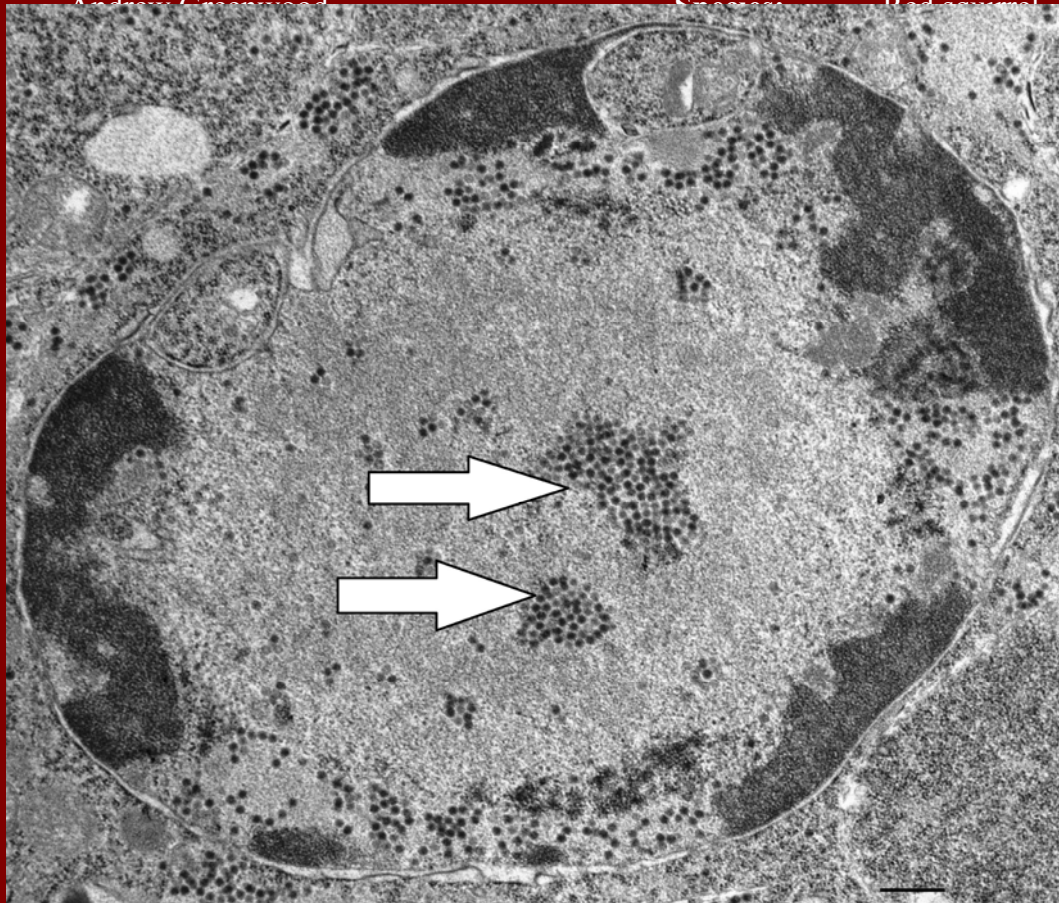
Owner: Welsh Mountain Zoo

Vet submitting sample:

Animal ID: juvenile

Andrew Greenwood

Species: Red squirrel



is
juvenile

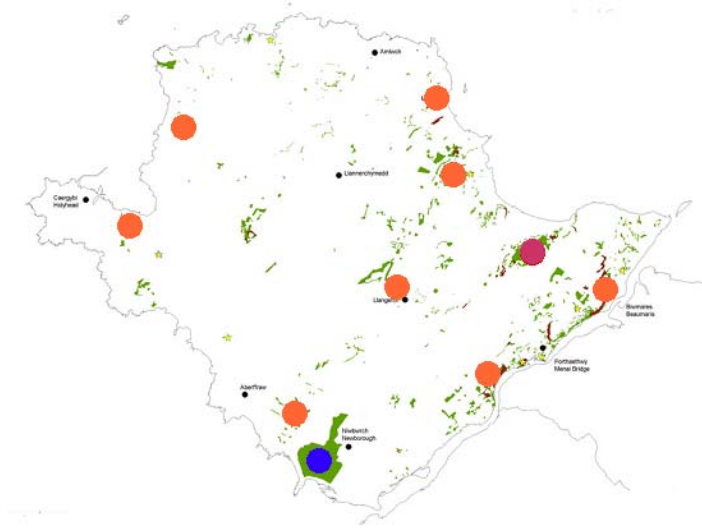
50) in
ntly.

(Left) Micrograph of adenovirus particles (arrowed) detected in an ultra-thin section of enterocytes from a red squirrel large intestine.

echinus pinguis) in England (Houston and others 2006). However, relatively little is known about other infectious agents which are much more marked, with the intestine uniformly purple and the catarrhal tent bloodstained. Individual serotypes

Duff et al (2007) Veterinary Record

Red Squirrel Reintroduction 2004-2012



Implications of findings

- Newborough reintroduction was ultimately a success.
- Pre-movement screening **ONLY** allows **pathological cases** to be detected and **NOT asymptomatic infection**.
- Detecting 'Subclinical' infection is confounded as **blood is not a good source material**.
- In 2006, we moved away from in situ breeding and released animals housed for 3 weeks.
- Successfully carried out nine further translocations on Anglesey.

Adenovirus infection & inter-location movements

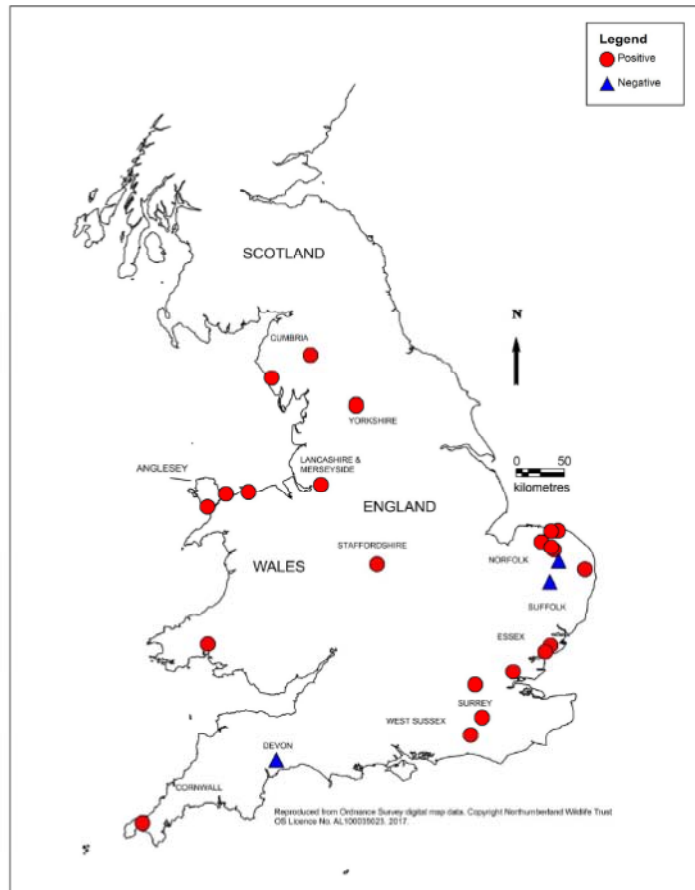


Table 3

ADV-associated cases in red squirrels detected at recipient study collections following receipt of stock from other captive study collections.

Collection	Donor collection	ADV infection	Stock receipt	ADV year
A	Q	Yes	2005	2005
B	Q	Yes	2005	2005
E	N	Yes	2006	2006
H	R	Yes	2009	2009
J	H	Yes	2013	2013
L	H	Yes	2011	2011
N	I	Yes	2011	2011
S	I	Yes	2013	2013
U	I	Yes	2014	2015
V	I	Yes	2013	2013
X	I	Yes	2015	2015
Z	I	Yes	2015	2016

Original investigation

The implications of significant adenovirus infection in UK captive red squirrel (*Sciurus vulgaris*) collections: How histological screening can aid applied conservation management

David J. Everest^{a,*}, Craig M. Shuttleworth^b, Sylvia S. Grierson^a, Akbar Dastjerdi^a, Mark F. Stidworthy^c, J. Paul Duff^d, Robert J. Higgins^e, Aileen Mill^f, Julian Chantrey^g

A non-invasive platform for tomorrow's surveillance

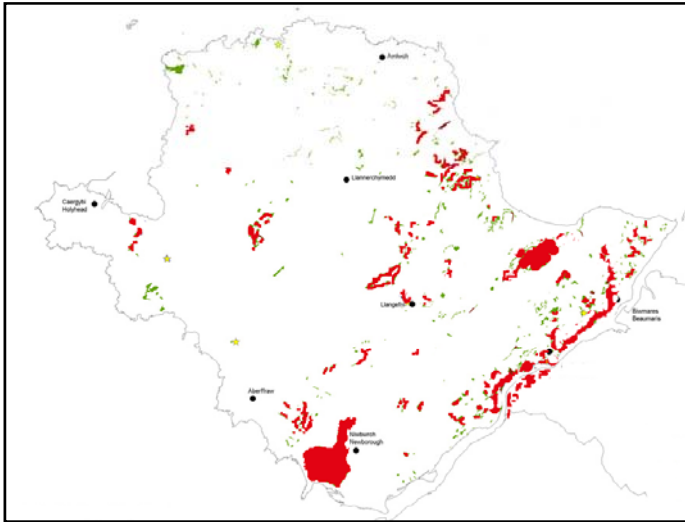


and supports **IUCN** guidelines.

Everest et al. (under review) *Ecohealth*



Animal &
Plant Health
Agency

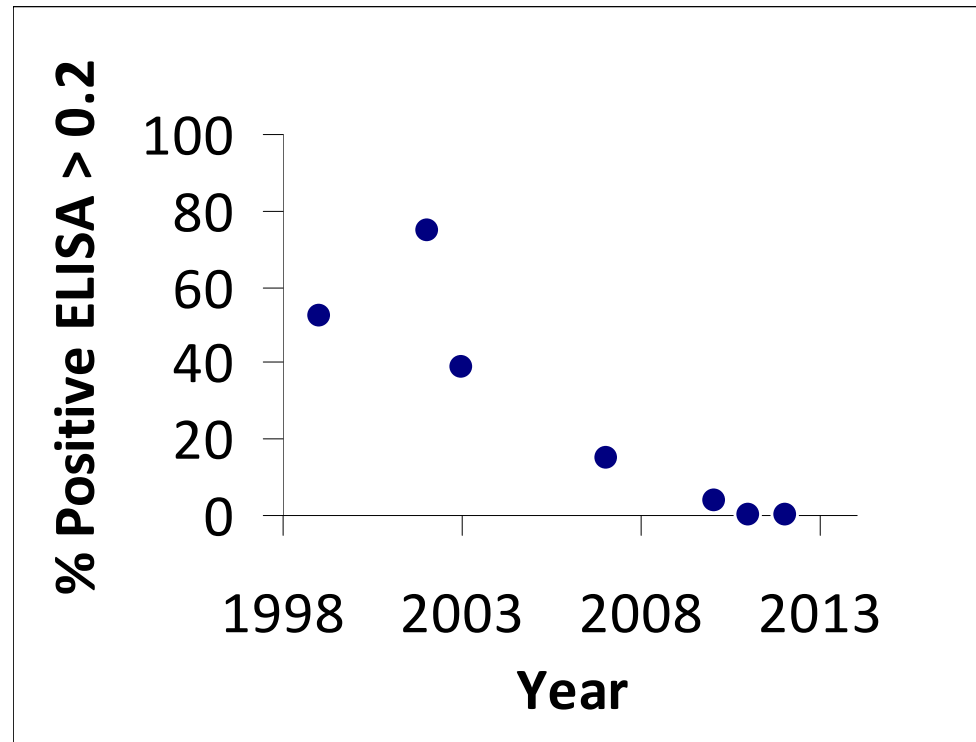


Island red squirrel genetic diversity: A rich and diverse population has been established

	1	2	3	4	5	Ang1	WMZ1	
Beaumaris						Male		
Holy Island		Male		Male			Male	
Plas Newydd								
Pentraeth								
Newborough								
	Males released and which will not pass on blood line							
	Haplotypes that have moved into locations where we did not introduced them							
	Remaining haplotypes							

Red Squirrel population increased from 40 to 800 animals

SQPV (Pox) ELISA results within a culled grey population (1998-2012)



You'll have to wait...



Squirrelepox virus



Staphylococcus aureus associated exudative dermatitis



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Mainland Gwynedd



SQPV outbreak autumn 2017 in North Wales



WILDLIFE DISEASE

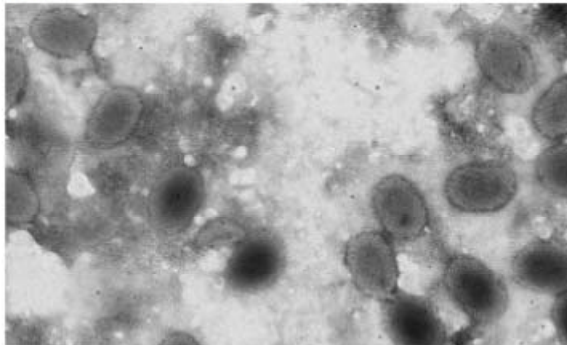
Confirmation of squirrelpox in Welsh red squirrels

WE wish to report the first laboratory confirmed cases of disease caused by squirrelpox virus (SQPV) in wild red squirrels (*Sciurus vulgaris*) from Wales.

Following a long-term grey squirrel (*Sciurus carolinensis*) management and control programme on the island of Anglesey, north Wales, a series of red squirrel translocations from a number of British captive red squirrel collections between 2004 and 2013



Fig 1: Red squirrel (*Sciurus vulgaris*), with facial lesions resembling those of squirrelpox, found dead in Treborth Botanical Gardens, mainland Wales



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Camera traps proved invaluable but image pixilation on



Fears of Anglesey and Gwynedd red squirrel virus outbreak

© 6 October 2017



People are being asked to keep a look out for sick squirrels on Anglesey and in Gwynedd.

It comes after a red squirrel was found to have died from squirrel pox virus in Treborth Botanic Garden, Bangor.



There has been a confirmed case of Squirrel Pox virus in Bangor, and following advice from the Red Squirrel Trust Wales we have temporarily stopped feeding the squirrels. This is to discourage them from congregating in one area, and potentially transmitting the disease among the red squirrel population. If you see a squirrel displaying signs of being unwell (Squirrel pox symptoms - blistering around the eyes, mouth, hands, feet and ears) please contact 07966 150847 or e-mail Mail@redsquirrels.info.

1. Squirrelpox outbreaks can be isolated and involve few individuals.
2. In contrast, Chantrey et al. (2014) report decimation of the Formby population in 2008 outbreak.
3. The public and media are sympathetic to the preventing squirrelpox.
4. During the outbreak there was no protest or public complaint regarding grey squirrel culling.
5. Intervention was reactive and **we will never know whether in other circumstances the outbreak would have intensified and spread to Anglesey.**

A decade of conflict 2003-2013



Target squirrel

- 8 August 2011
“opened discussion” JG/06667/11
- 24 Sept 2011
work with the
- 31 Decem 2011
plan agreed” JG/06987/12



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Solution – Direct dialogue with NRW Management

FCW merged with other bodies to become NRW – Natural Resources Wales

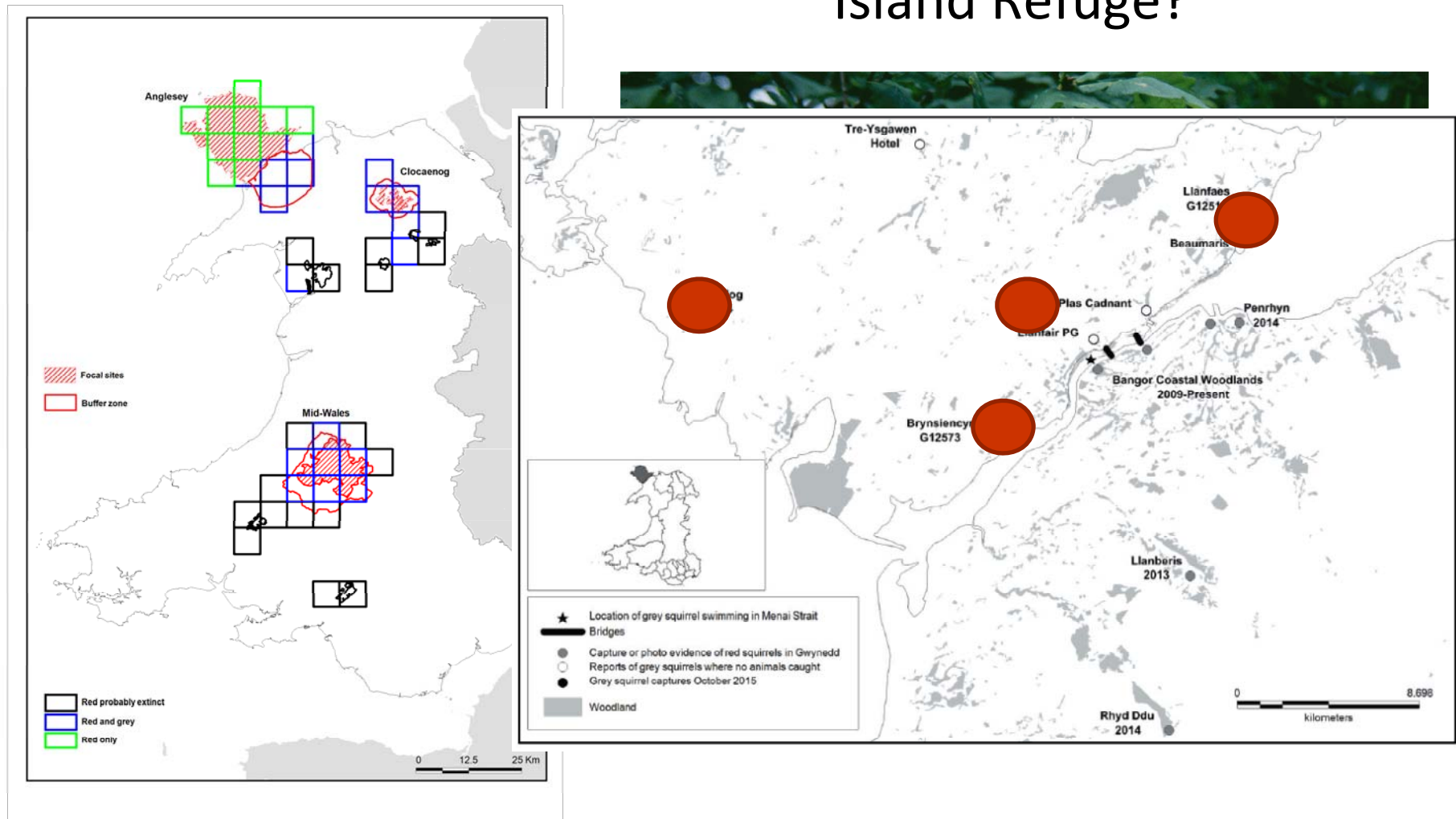
The **EU** Regulation (1143/2014) on **invasive alien** (non-native) **species** entered into force on 1 January 2015





Anglesey is not an island it is a Peninsula

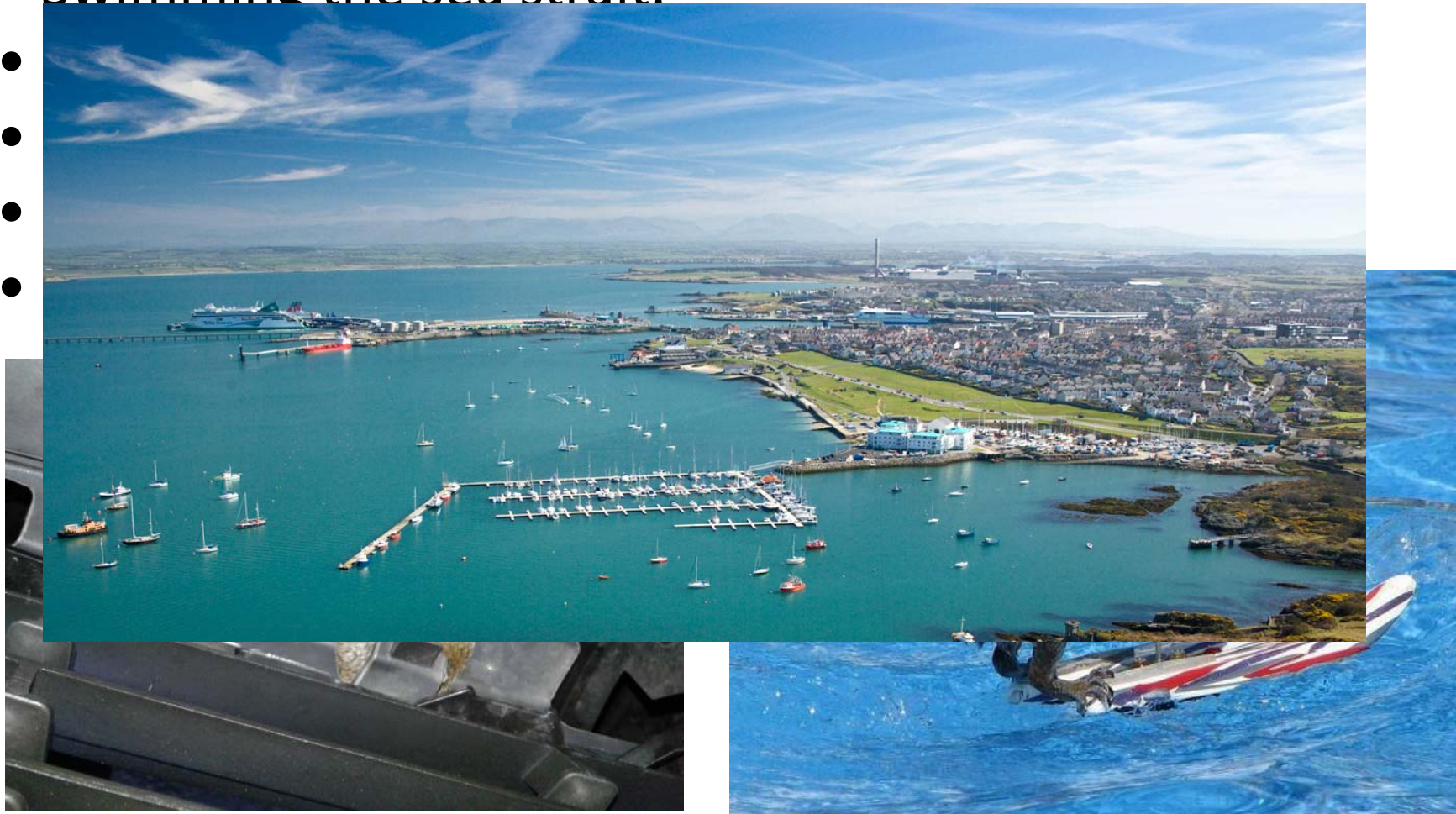
Island Refuge?



Halliwell et al. 2015 In Shuttleworth, Lurz & Hayward (eds)
Shuttleworth et al. 2016 In Shuttleworth, Lurz & Gurnell (eds)

Reinvasion Routes

- Natural dispersal over the bridges.
- Swimming the sea strait.



Early Warning

- Created a network of 190 garden & woodlands feeding stations.
- Empower people with knowledge to be able to identify grey squirrels and **other invader IAS**.



Y WIWER GOCH yw'r unig rywogaeth o wiwer y coed sy'n frodorol i Brydain a bu'n yma ers diwedd oes yr Ia ddiwethaf, rhyw 10,000 o flynyddoedd yn ôl. Roedd gwiwerod coch yn arfer byw ar hyd ac ar led Ynysoedd Prydain. Wrth i'w cynefin coetiroi gael eu clirio'n gynyddol ac amaethyddiaeth, trefi a ffyrdd yn eu disodli, roedd niferoedd y gwiwerod yn gostwng i lefelau is. Arhosodd y boblogaeth genedlaethol yn eang nes i'r wiwer llwyd ddwyreiniol gael ei chyflwyno, rhywogaeth fwy sy'n wreiddiol o Ogledd America. Mae gwiwerod llwyd bellach wedi cymryd lle'r wiwer goch mewn llawer man ym Mhrydain.

Uchod y wiwer goch yw'r unig wiwer frodorol gelf yn Ynysoedd Prydain

Mae gwiwerod coch yn treulio hyd at 70% o'r dydd yn y coed ac maent wedi eu haddasu ar gyfer byw bywyd yn dringo ymhlith y canghennau uchaf. Mae'n anfall oithriadol o haelni, gyda chynffon hir i helpu ei gydbwysedd a choesau hir i neidio ar draws bylchau bach rhwng canopiau coed gyferbyn. Gyda thraed mawr a chrafangau hir ar bob bys troed tenau, mae ganddynt afael



Mae Gwiwerod Coch Angen ein Cymorth



Hoffech rhoi cymorth i rywogaeth brodorol sydd ar fin difodiant?

Ymunwch â un o'n diwrnodau hyfforddi lle gallwch ddysgu sut i helpu eich gwiwerod coch lleol

Bydd cyflwyniad yn y bore, gyda sesiynnau ymarferol am unai cadwraeth gwiwerod coch neu rheolaeth gwiwerod llwyd mewn coedwig lleol i ddilyn yn y prynhawn

Cyflwynwyd gan Dr Craig Shuttleworth a Holly Peek

9.30 am on Saturday 18th February, Neuadd Goffa, Mynydd Llandygai, BANGOR, LL57 4LQ
LL57 4LQ

Cysylltwch i archebu eich lle wrth ebostio hollyredsquirrel@gmail.com
neu gyrrwch neges destyn/ffoniwch 07397953543



Evol

ment



Lessons & Challenges

- Successful eradication to a boundary.
- Community support for culling BUT red squirrel was put back into the landscape.
- Characteristics of local population were understood.
- Need for funding for rapid-reaction to IAS detection.
- Need to better understand invasion mechanisms.
- Partnership has illuminated viral epidemiology and led to pioneering method of detection.
- Empower communities with knowledge to manage IAS.



Theodore Roosevelt

It is not the critic who counts; not the man who points out how the strong man stumbles, or where the doer of deeds could have done them better. The credit belongs to the man who is actually in the arena, whose face is marred by dust and sweat and blood; who strives valiantly; who errs, who comes short again and again; who spends himself in a worthy cause; who at the best knows in the end the triumph of high achievement, and who at the worst, if he fails, at least fails while daring greatly, so that his place shall never be with those cold and timid souls who neither know victory nor defeat.

Paris, France on 23 April, 1910



Thanks & Acknowledgments

- Dave Everest (APHA)
- Paul Duff (APHA)
- Andrew Greenwood (IZVG)
- Liz Halliwell (Natural Resources Wales)
- Paul Holmes (APHA)
- Colin McInnes (Moredun Institute)
- Gerallt Llewelyn Jones (Menter Mon)
- Raj Jones
- Robert Kenward (CEH)
- Nick Jackson (ZSW)
- Directors of Red Squirrels Trust Wales
- The late Derek Yalden (Manchester University)



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