Impacts of climate change on upland birds

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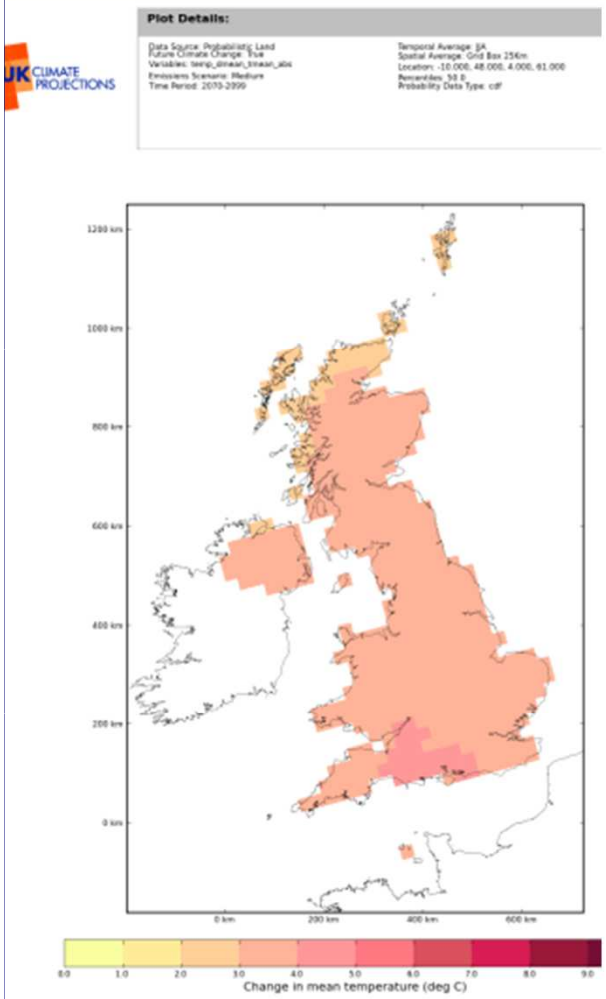
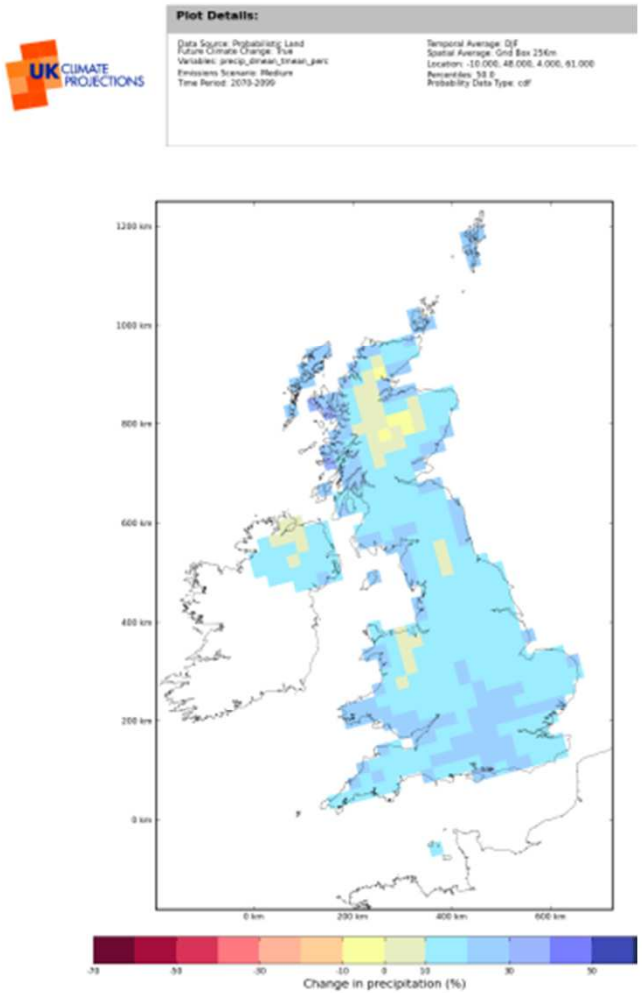
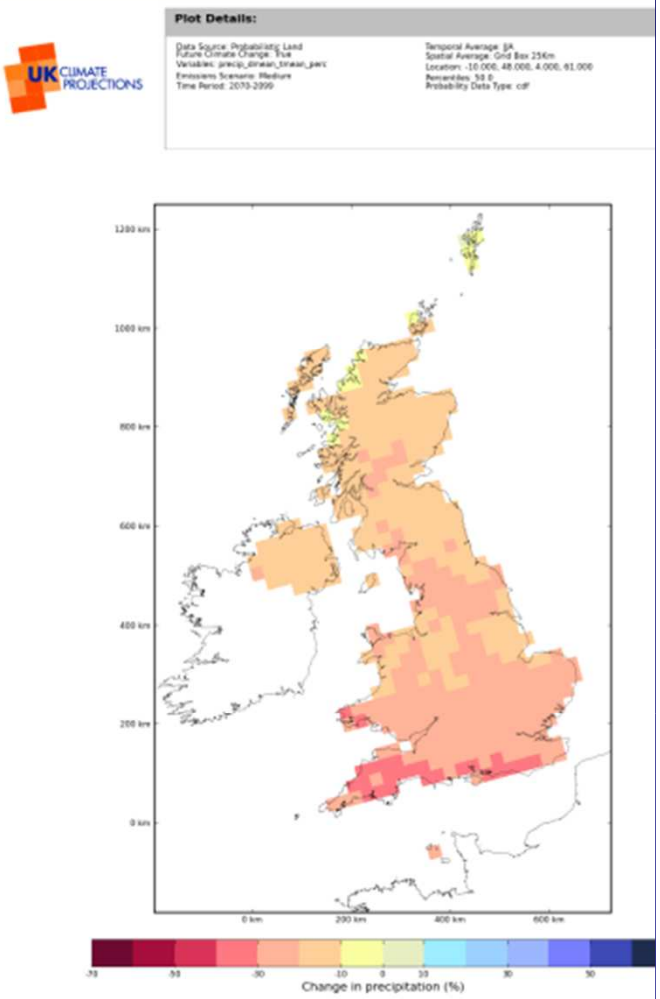
Principal ecologist – climate change

What is the likely severity of climate change?







Summer temp

Winter rain

Summer rain

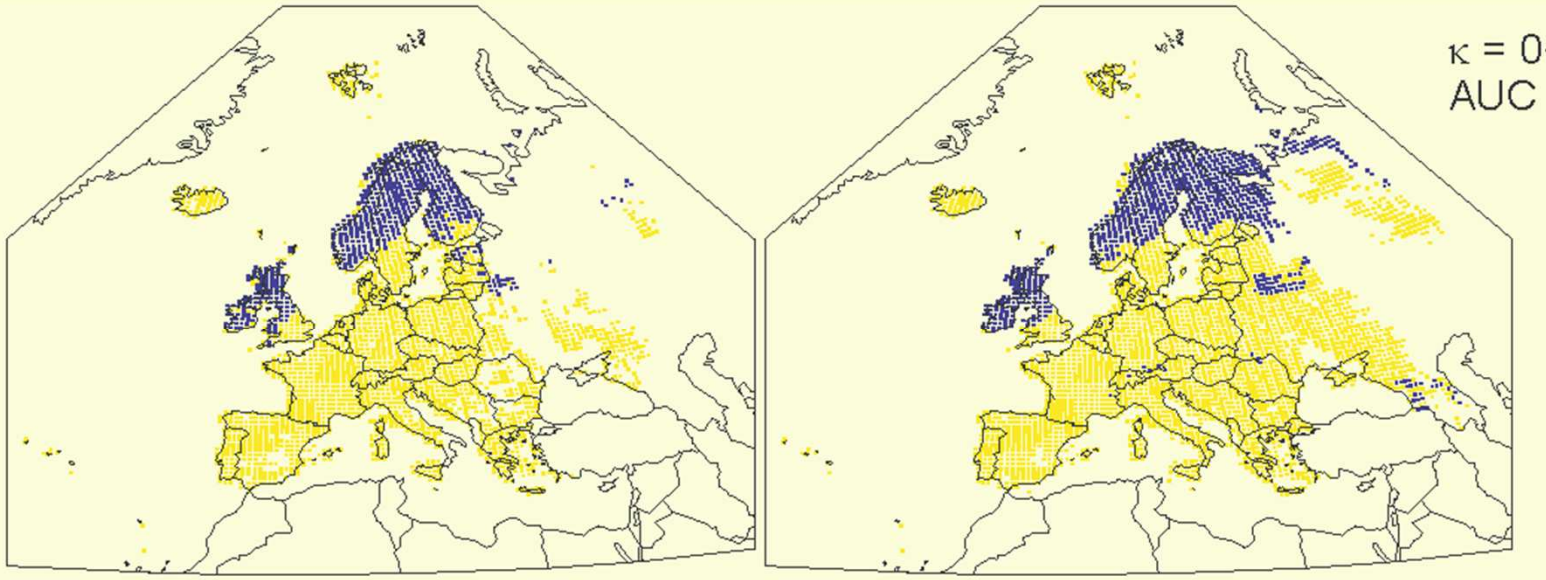
What are the likely impacts upon upland birds?

Predicted range changes

Observed population changes

Modelled population changes

What can be done?

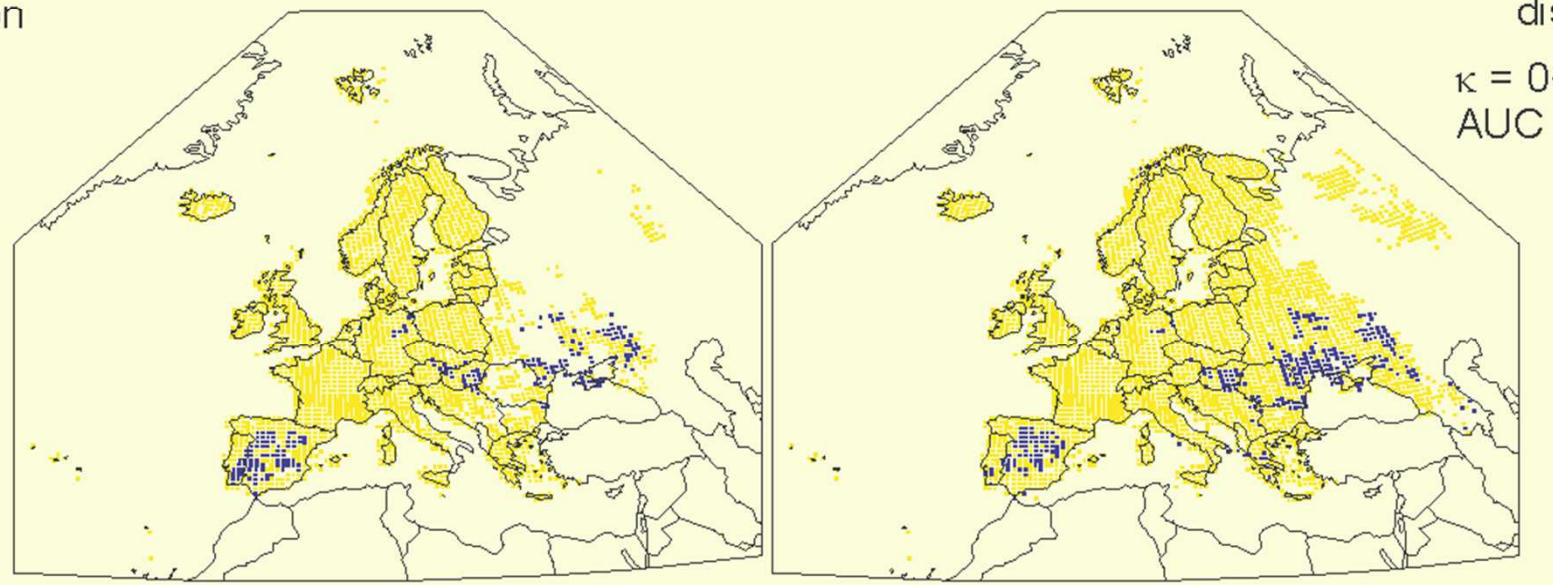


κ = 0·88
AUC = 0·991

Observed distribution

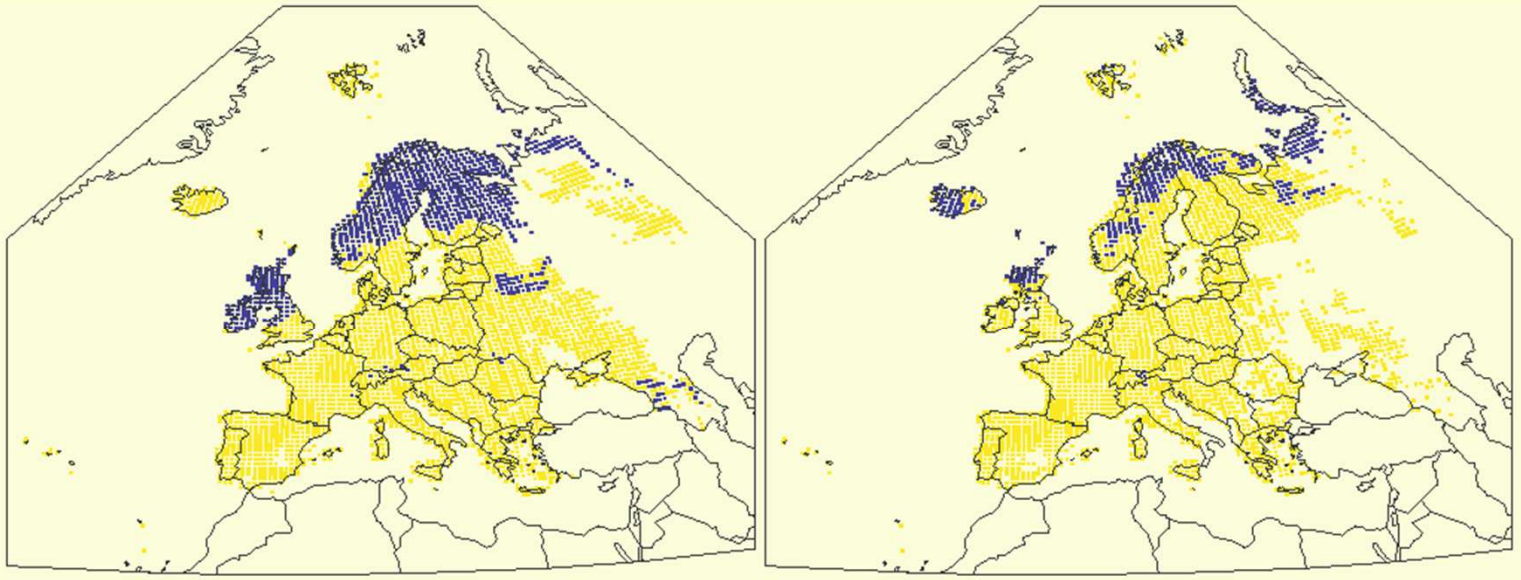
***Lagopus lagopus* — Willow Grouse (Red Grouse)**

Simulated distribution



κ = 0·77
AUC = 0·962

***Otis tarda* — Great Bustard**



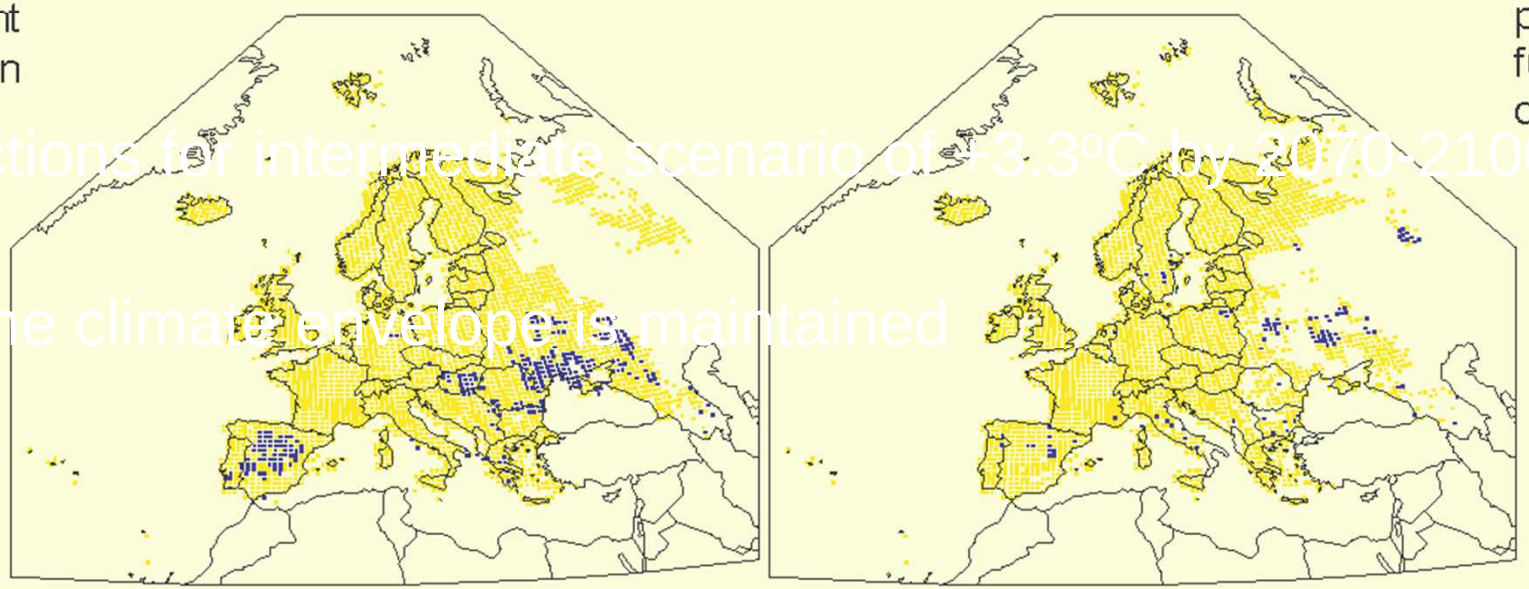
Simulated present distribution

***Lagopus lagopus* — Willow Grouse (Red Grouse)**

Simulated potential future distribution

Predictions for intermediate scenario of +3.3ºC by 2070-2100

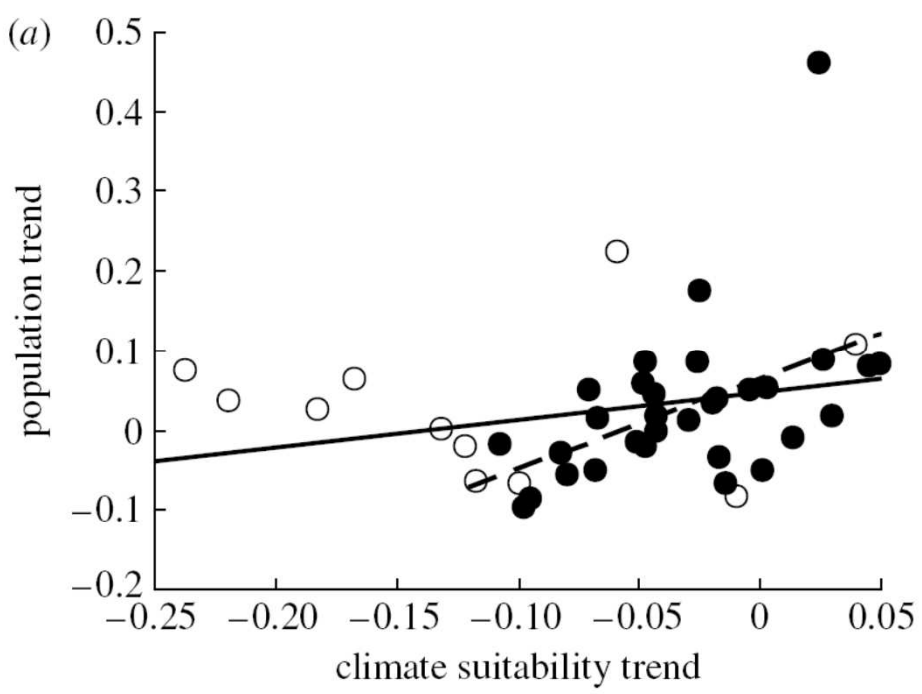
Assume climatic envelope is maintained

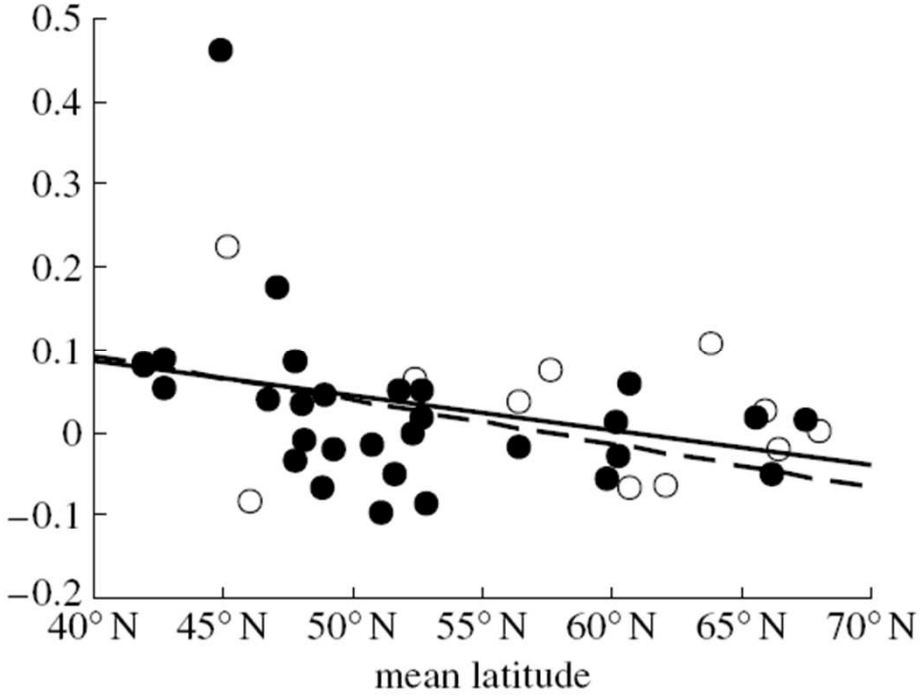


***Otis tarda* — Great Bustard**

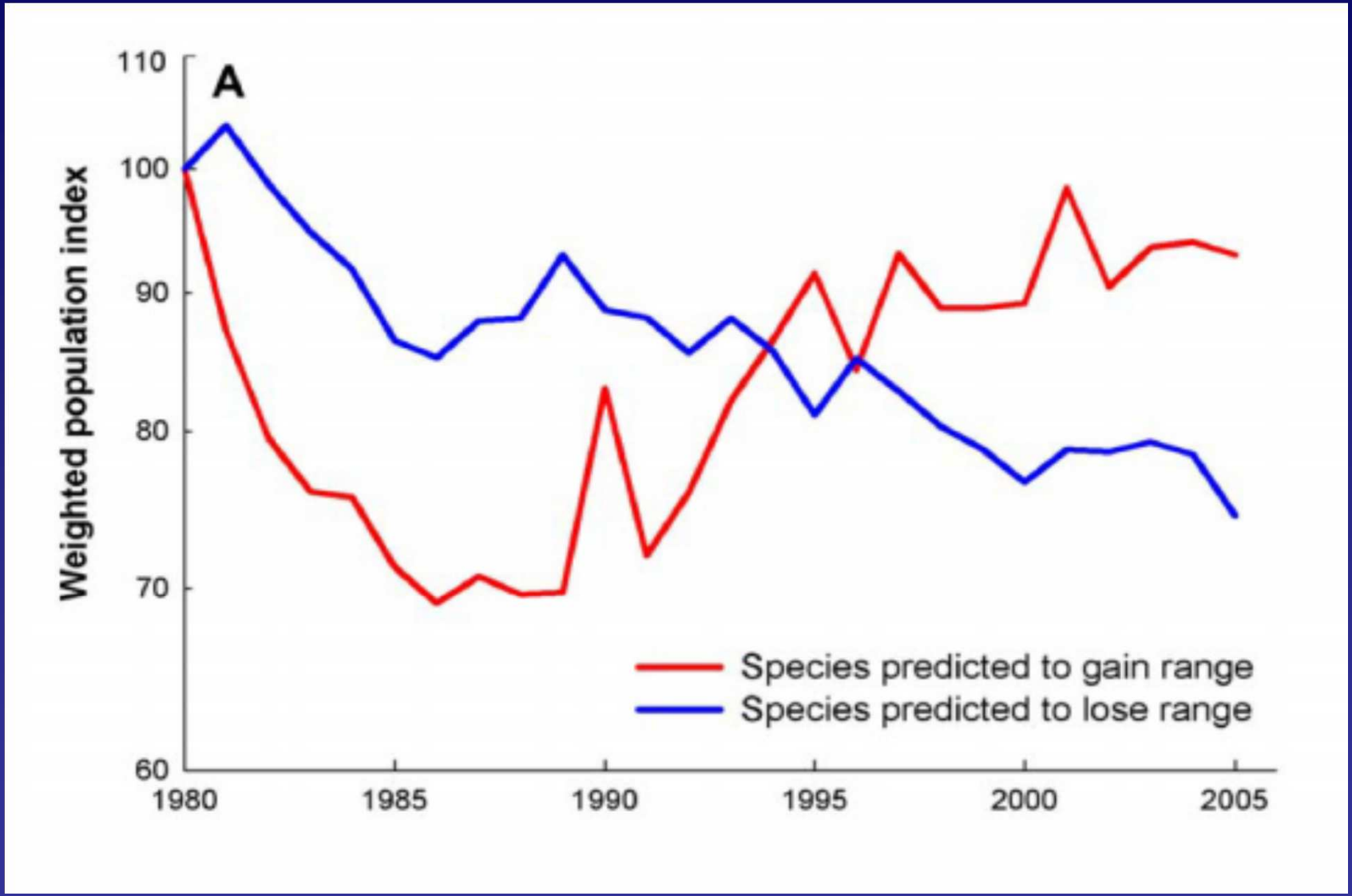
Do these predictions have any support?

Predictions from these models significantly correlate with recent population trends in UK (Green et al 2008).





…and across Europe (Gregory et al. 2009).

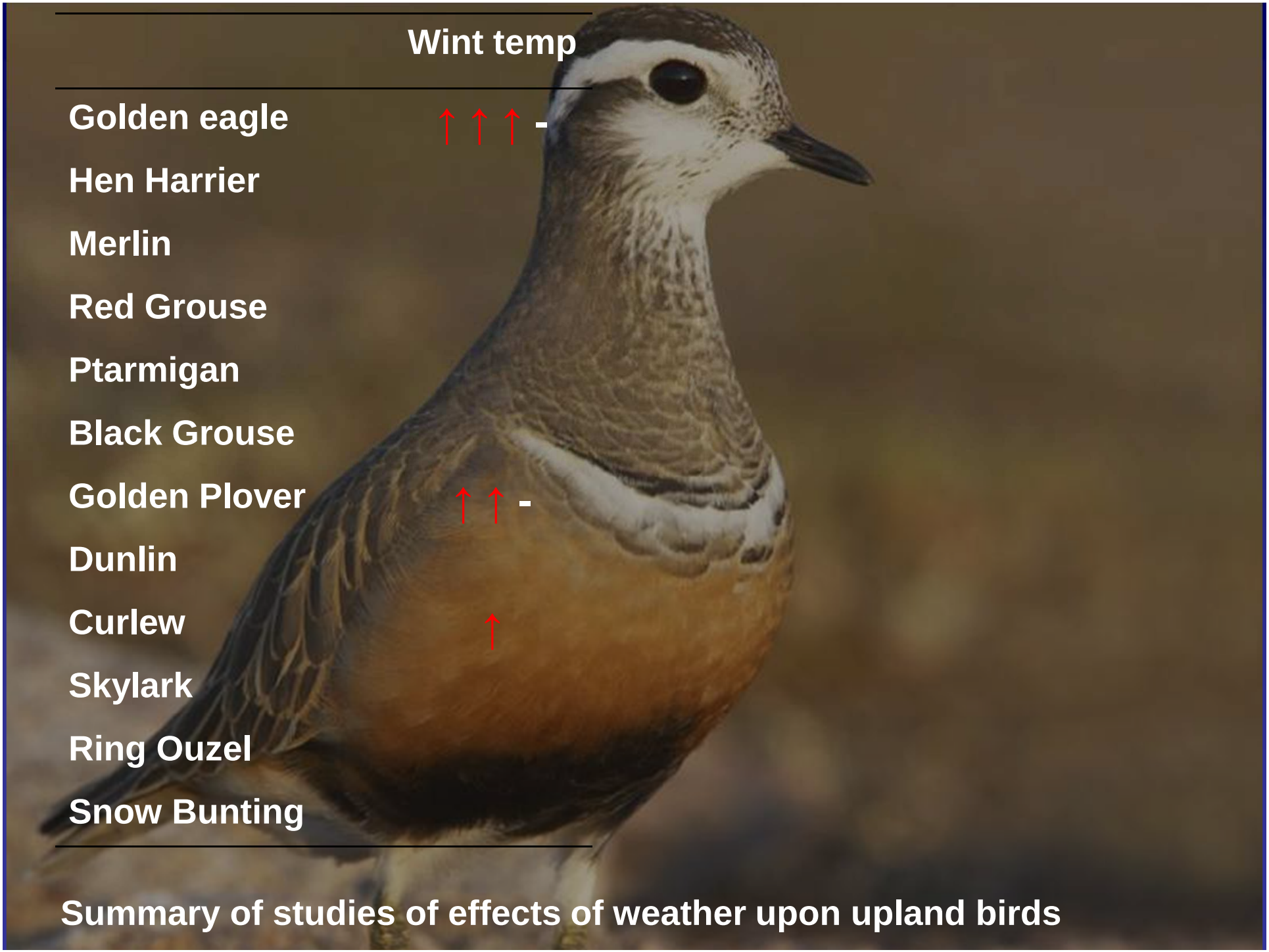


But for the UK uplands, hampered by lack of monitoring

Best evidence suggests many species apparently declining

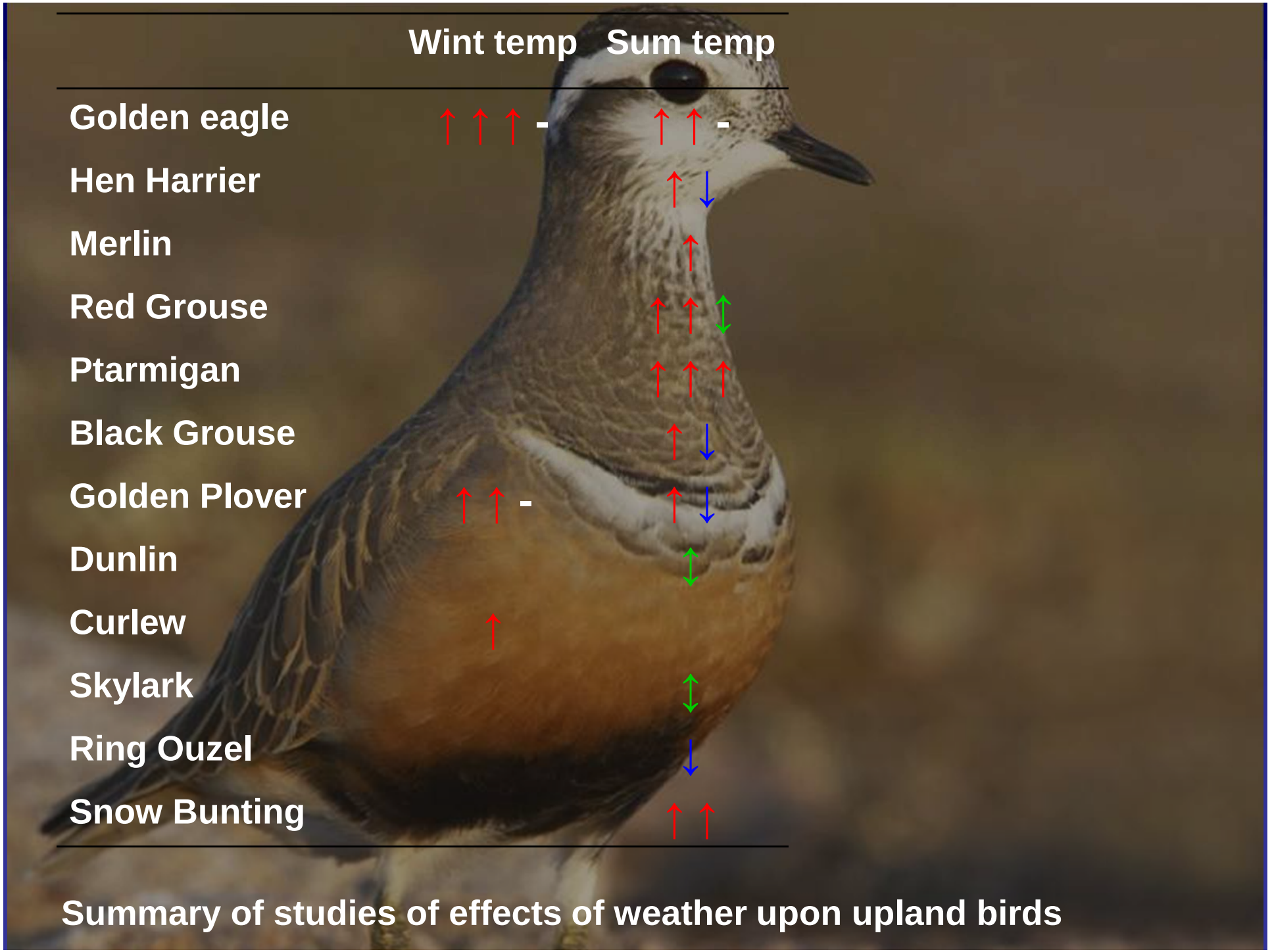
Others stable or increasing

Are these changes linked to climate?



	Wint temp
Golden eagle	↑ ↑ ↑ -
Hen Harrier	
Merlin	
Red Grouse	
Ptarmigan	
Black Grouse	
Golden Plover	↑ ↑ -
Dunlin	
Curlew	↑
Skylark	
Ring Ouzel	
Snow Bunting	

Summary of studies of effects of weather upon upland birds



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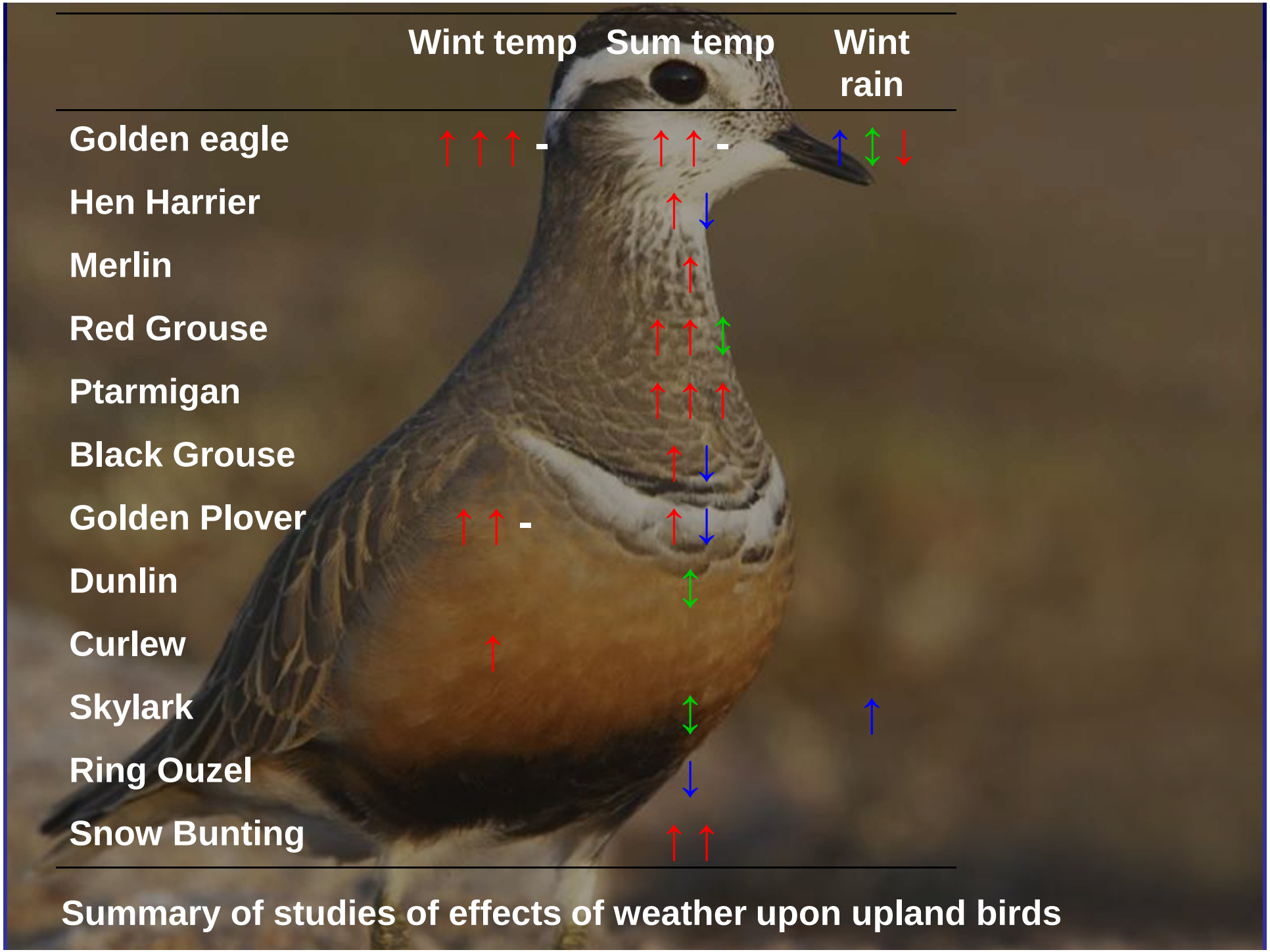
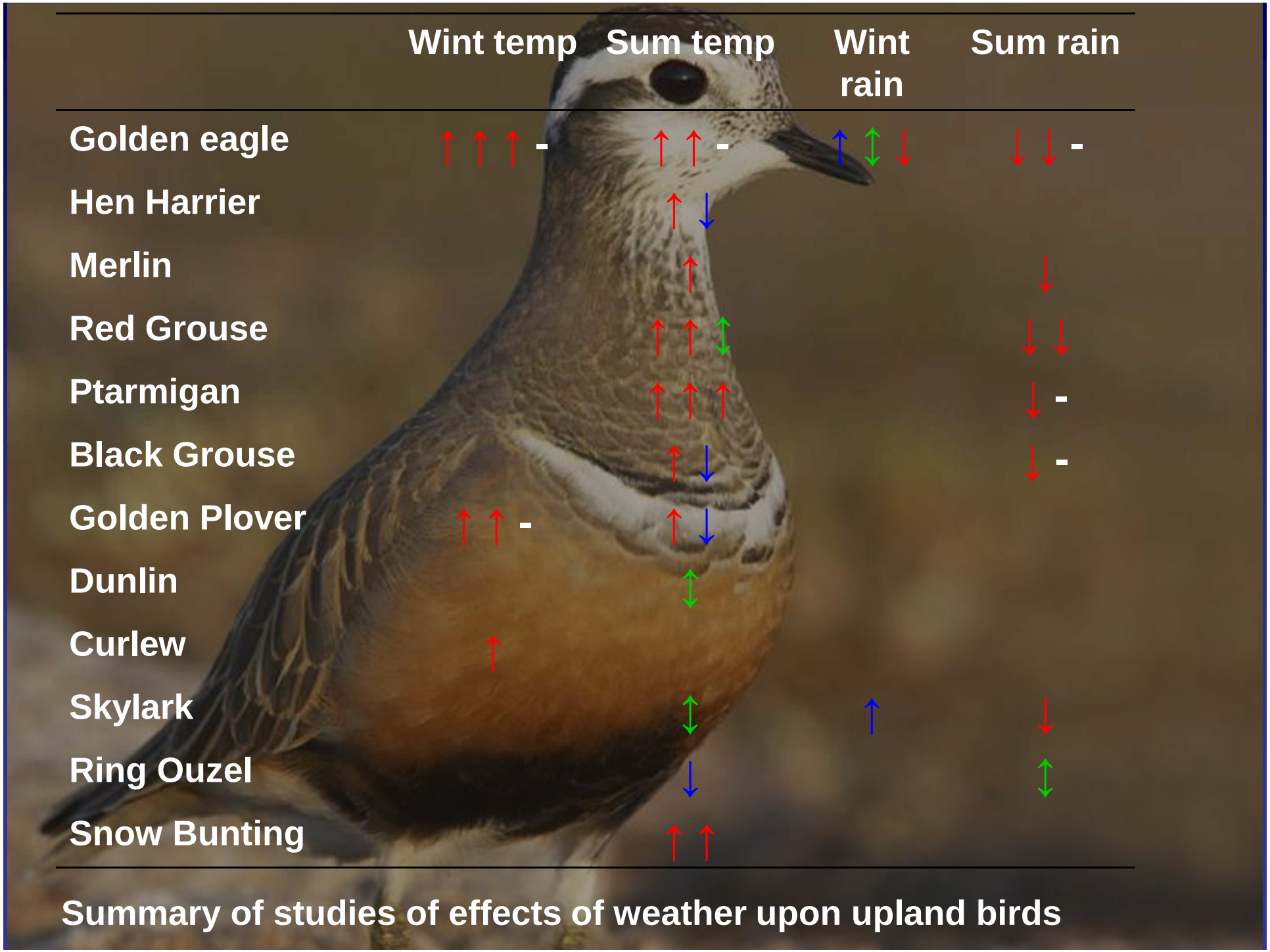
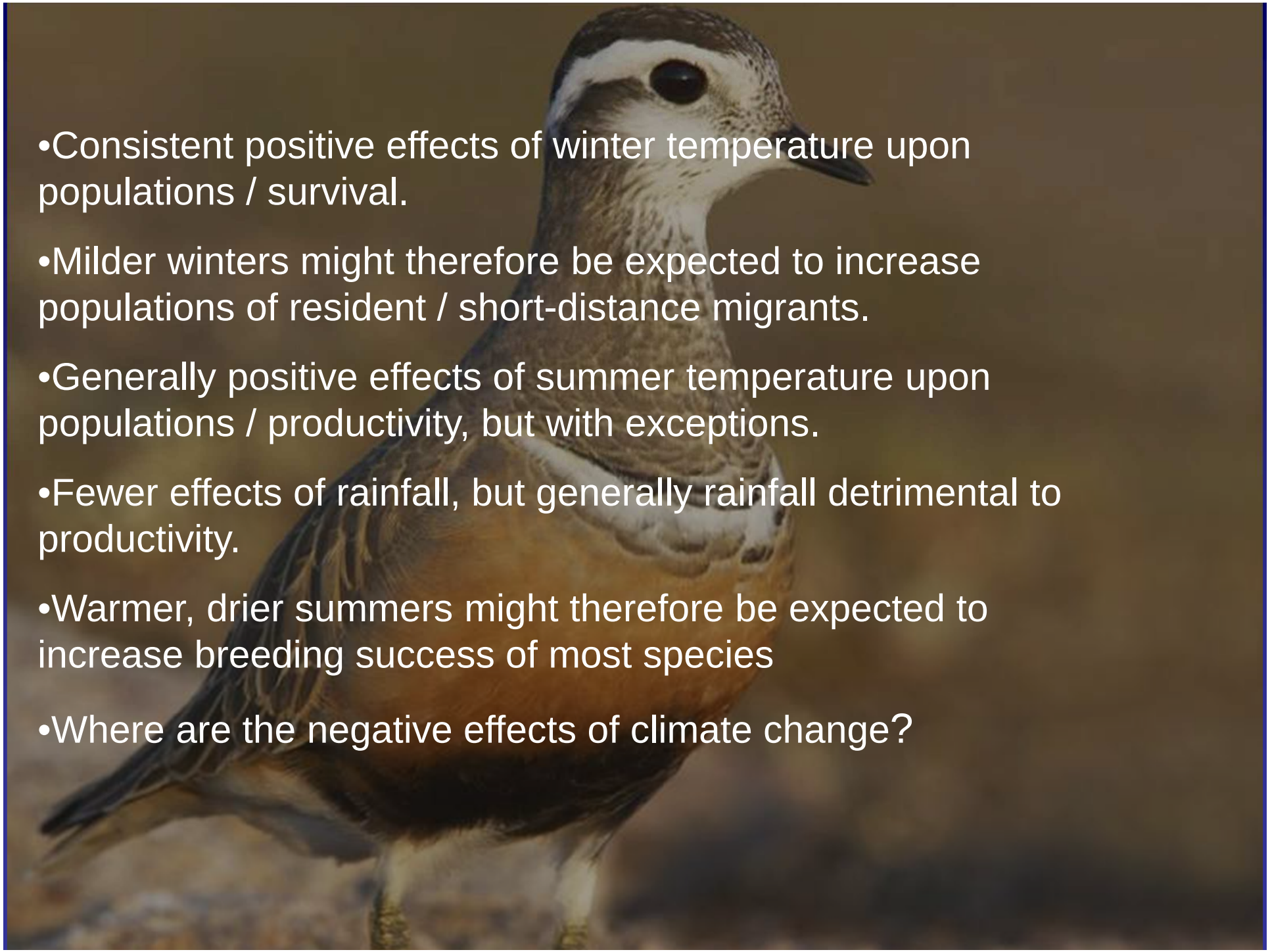


Summary of studies of effects of weather upon upland birds



	Wint temp	Sum temp	Wint rain	Sum rain
Golden eagle	↑↑↑ -	↑↑ -	↑↕↓	↓↓ -
Hen Harrier		↑↓		
Merlin		↑		↓
Red Grouse		↑↑↕		↓↓
Ptarmigan		↑↑↑		↓ -
Black Grouse		↑↓		↓ -
Golden Plover	↑↑ -	↑↓		
Dunlin		↕		
Curlew	↑			
Skylark		↕	↑	↓
Ring Ouzel		↓		↕
Snow Bunting		↑↑		

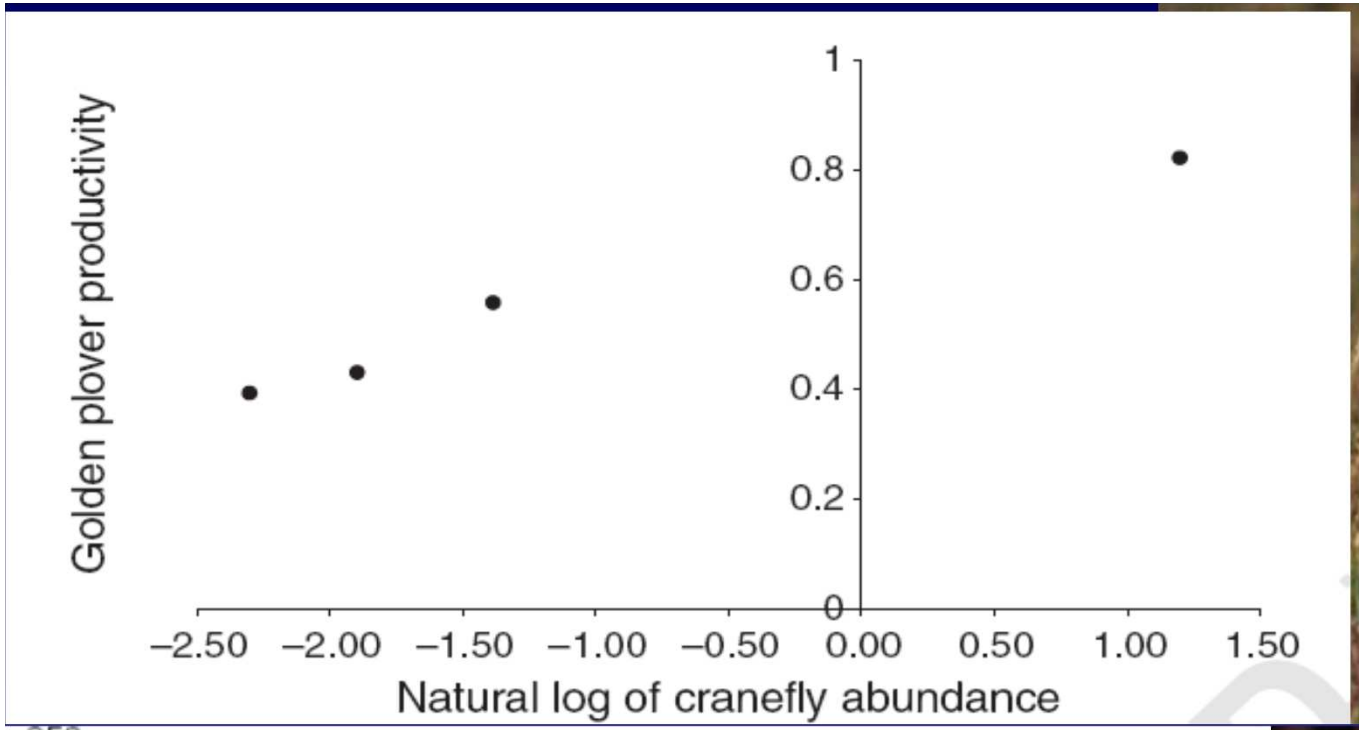
Summary of studies of effects of weather upon upland birds

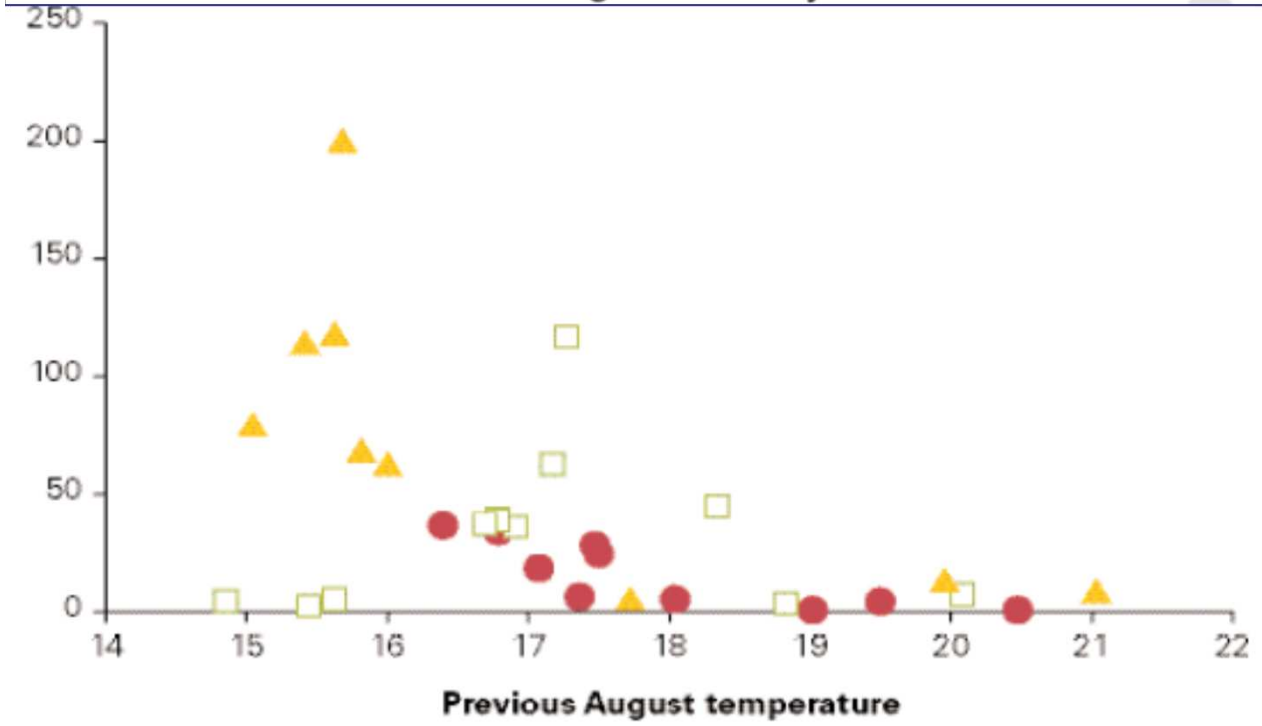


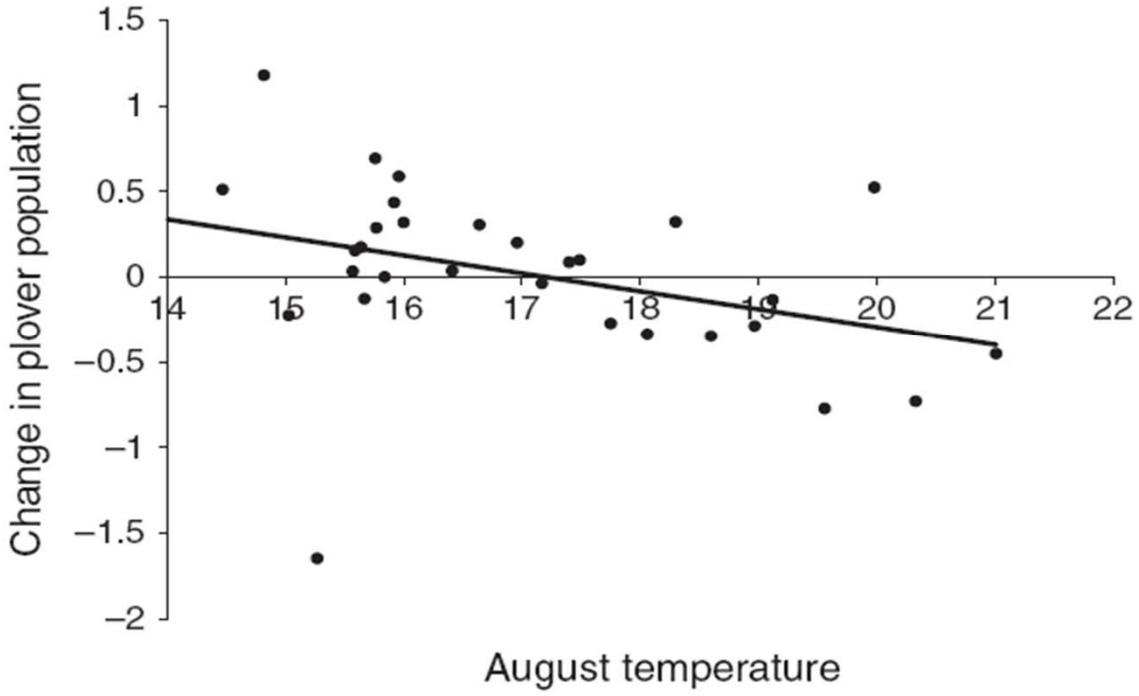
- Consistent positive effects of winter temperature upon populations / survival.
- Milder winters might therefore be expected to increase populations of resident / short-distance migrants.
- Generally positive effects of summer temperature upon populations / productivity, but with exceptions.
- Fewer effects of rainfall, but generally rainfall detrimental to productivity.
- Warmer, drier summers might therefore be expected to increase breeding success of most species
- Where are the negative effects of climate change?

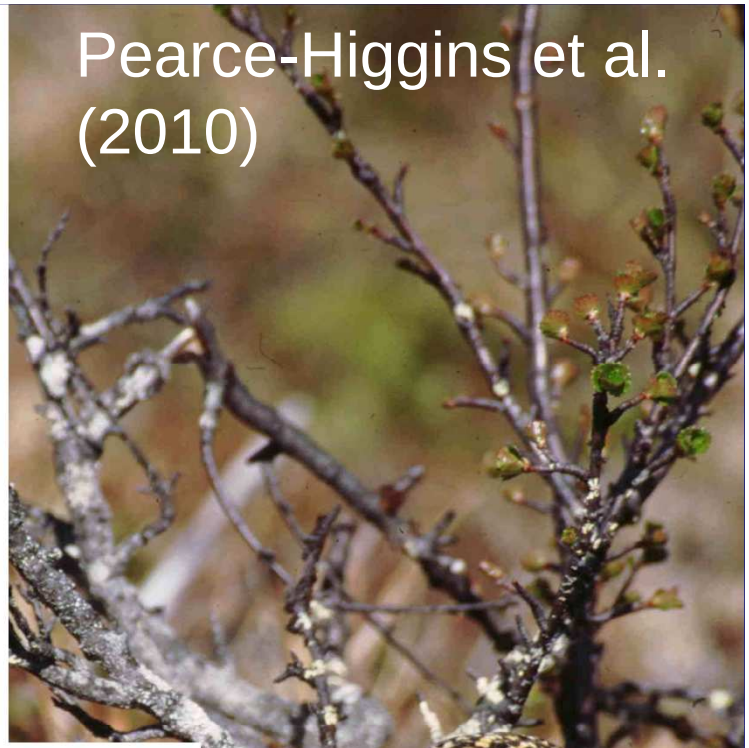
Golden plover

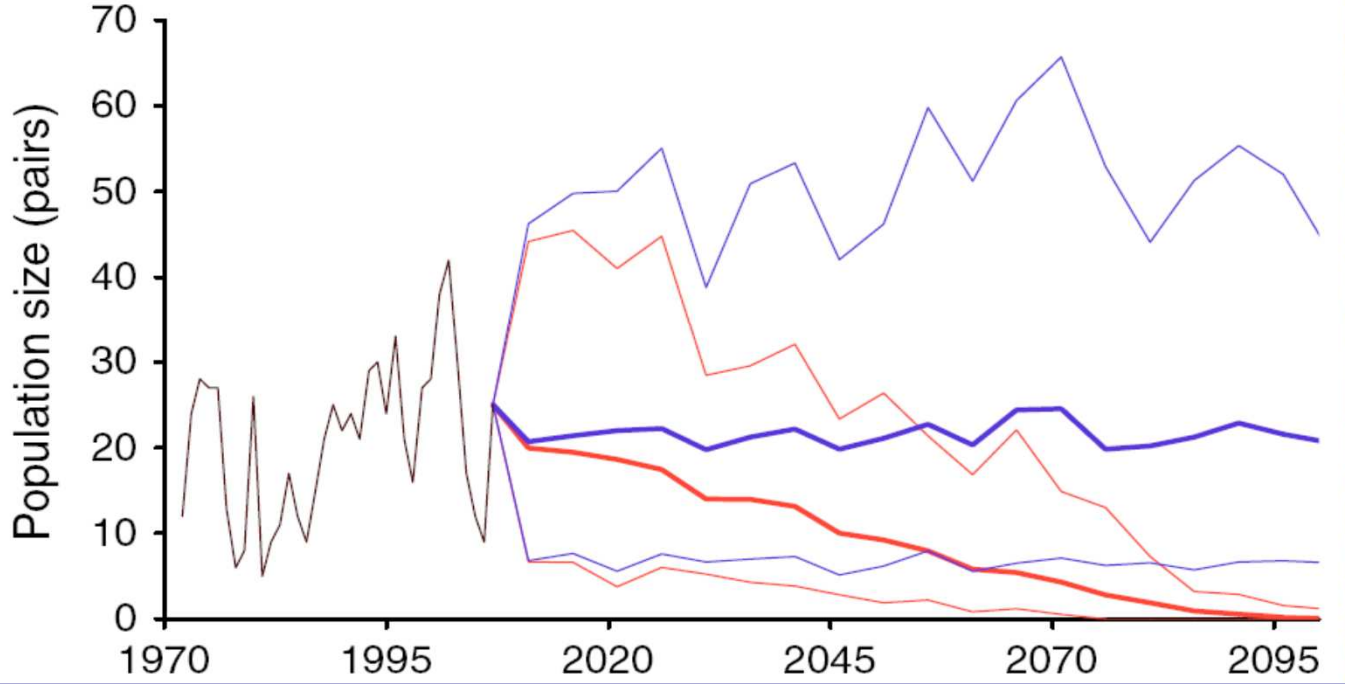
Pearce-Higgins & Yalden (2004)


Golden plover productivity
1
0.8
0.6
0.4
0.2
0
–2.50
–2.00
–1.50
–1.00
–0.50
0.00
0.50
1.00
1.50
Natural log of cranefly abundance


250
200
150
100
50
0
14
15
16
17
18
19
20
21
22
Previous August temperature

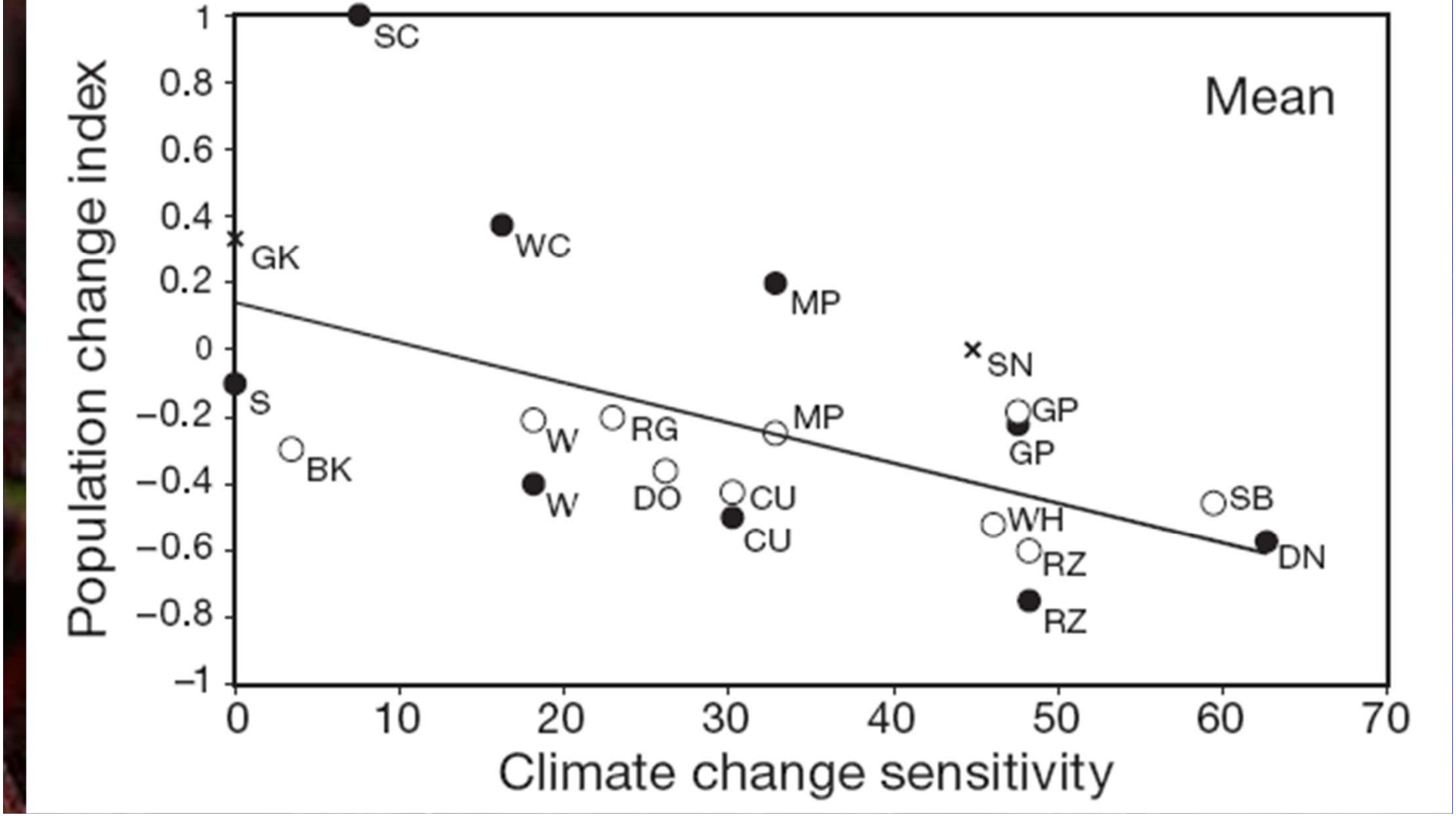

Change in plover population
1.5
1
0.5
0
−0.5
−1
−1.5
−2
14
15
16
17
18
19
20
21
22
August temperature


Pearce-Higgins et al. (2010)

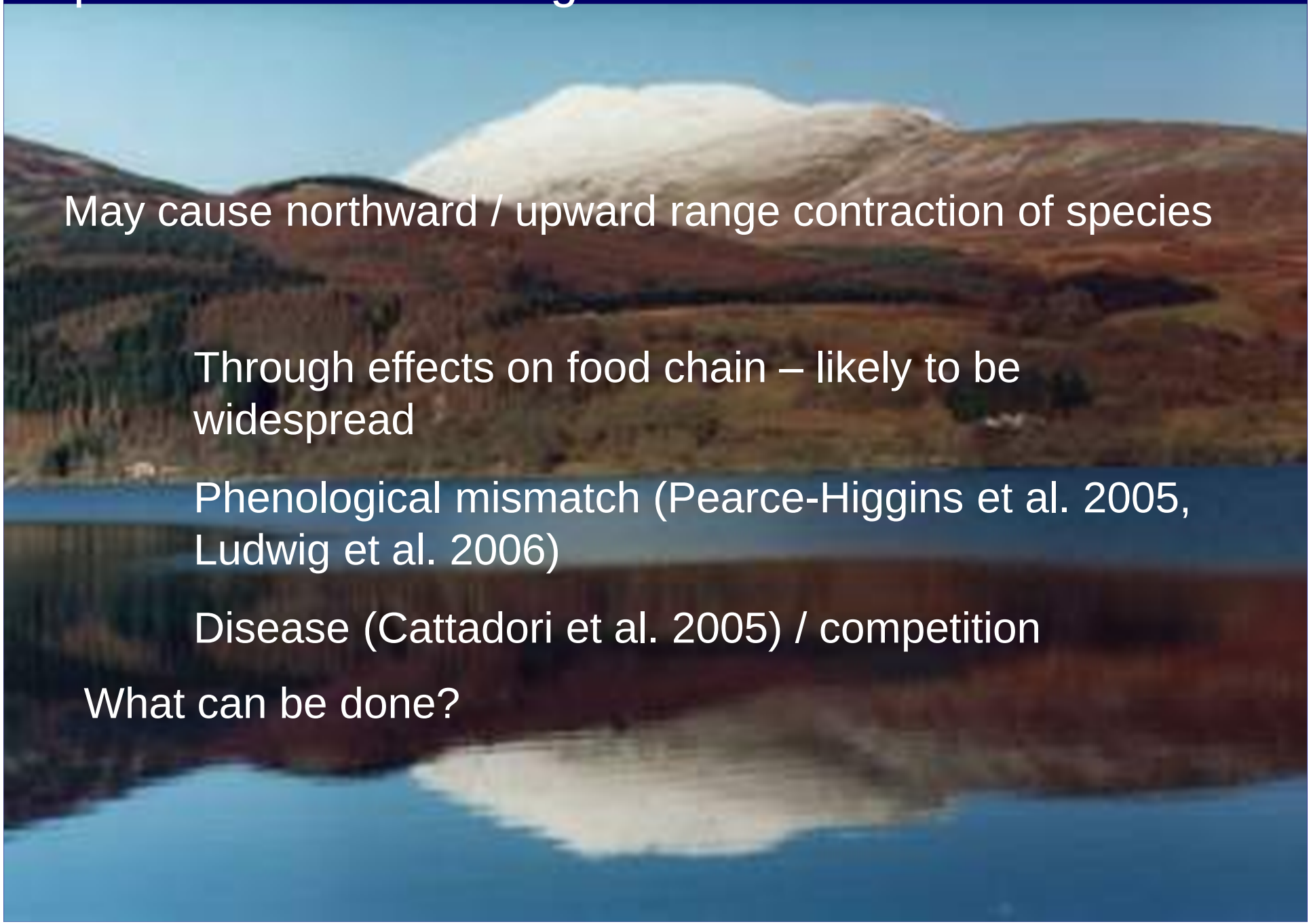

Population size (pairs)
70
60
50
40
30
20
10
0
1970
1995
2020
2045
2070
2095


Tipulids important for wide range of bird species therefore effects likely to be widespread.

Dietary composition may therefore be an indicator of likely climate change sensitivity (Pearce-Higgins in press)



Impacts of climate change



May cause northward / upward range contraction of species

Through effects on food chain – likely to be widespread

Phenological mismatch (Pearce-Higgins et al. 2005, Ludwig et al. 2006)

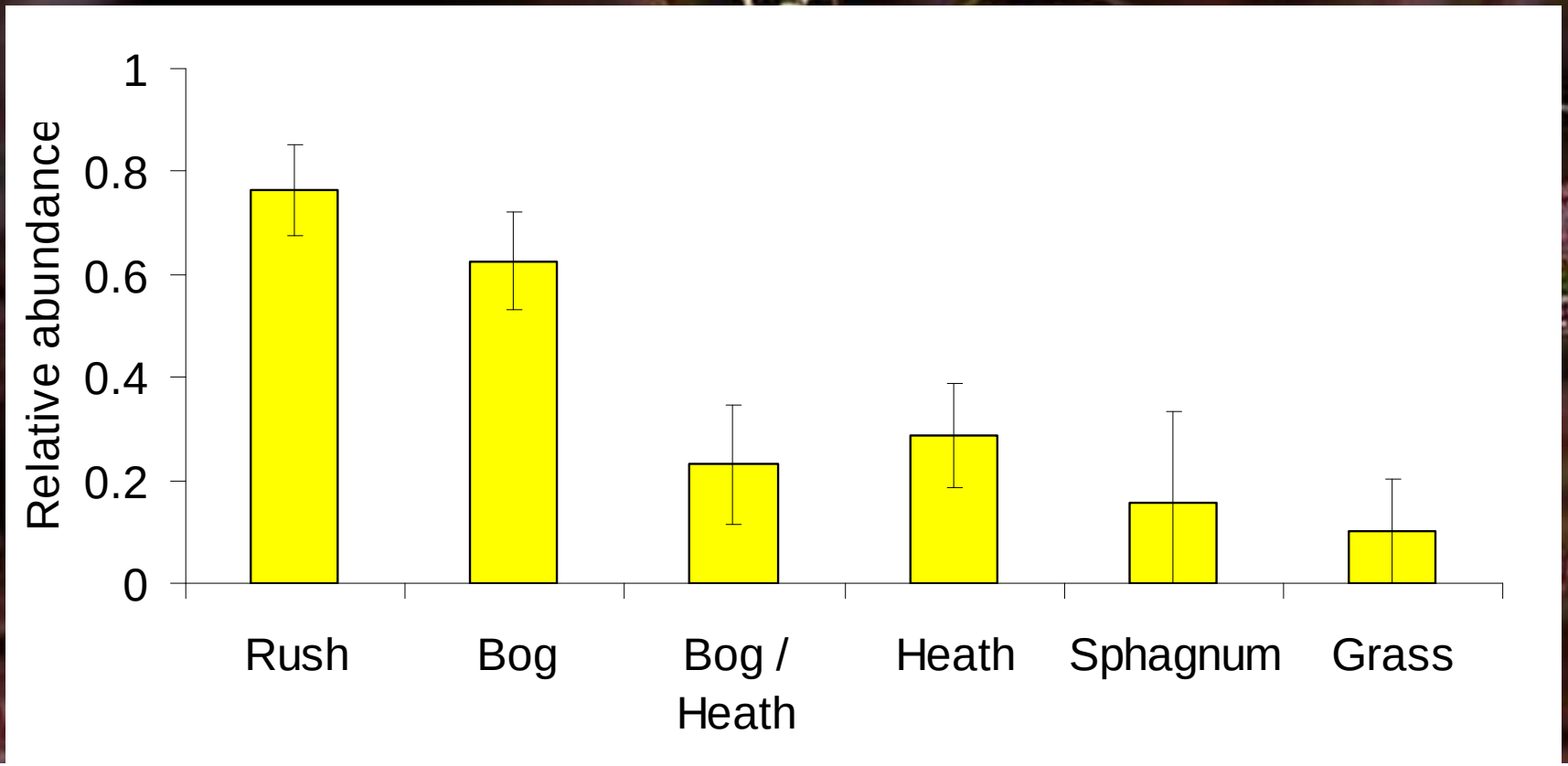
Disease (Cattadori et al. 2005) / competition

What can be done?

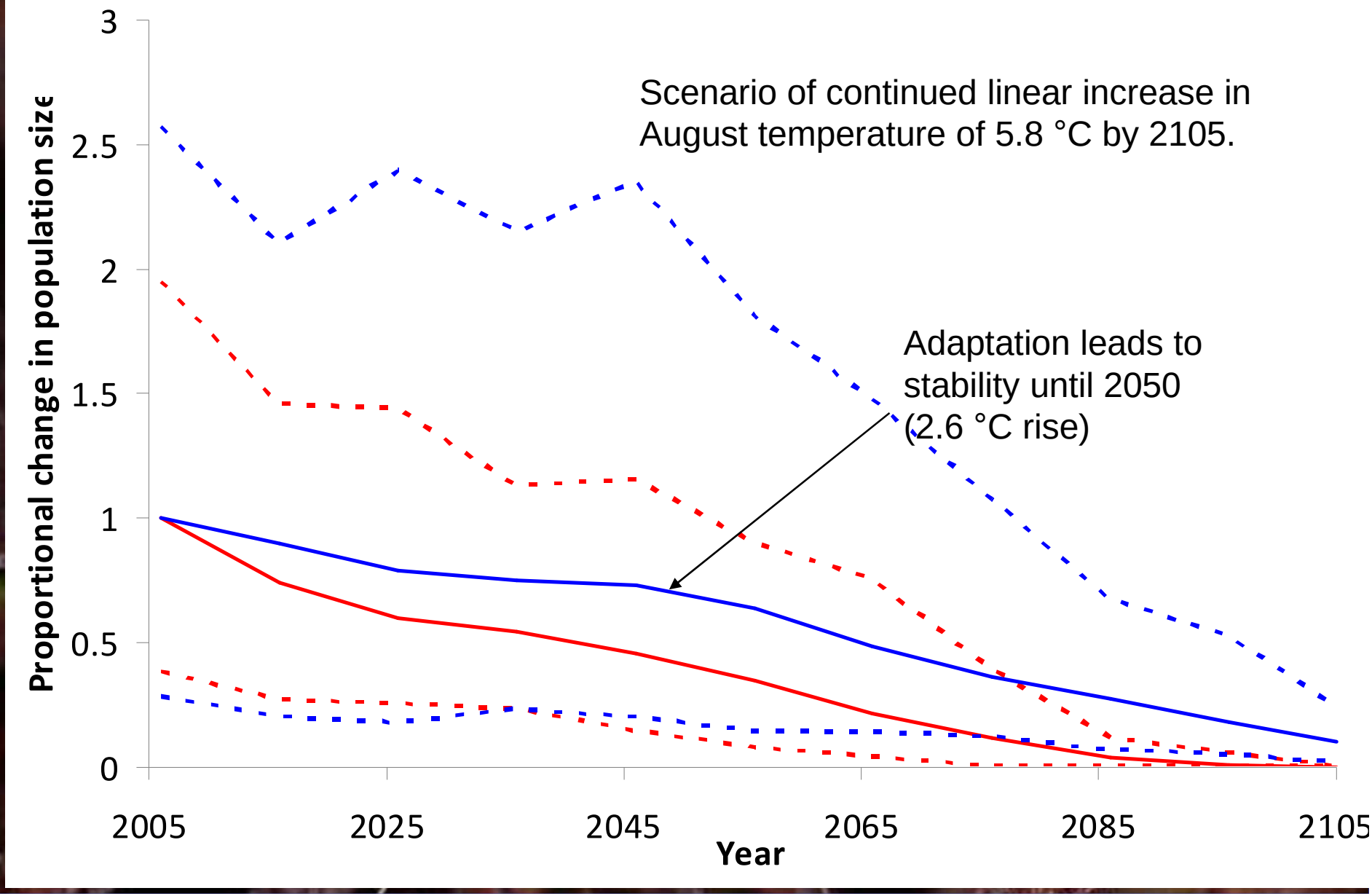
Management

Adaptive management of individual sites has potential to increase resilience of vulnerable populations to change.

Known variation in cranefly abundance in relation to habitat suggests habitat management may increase cranefly populations and might protect against climate effects

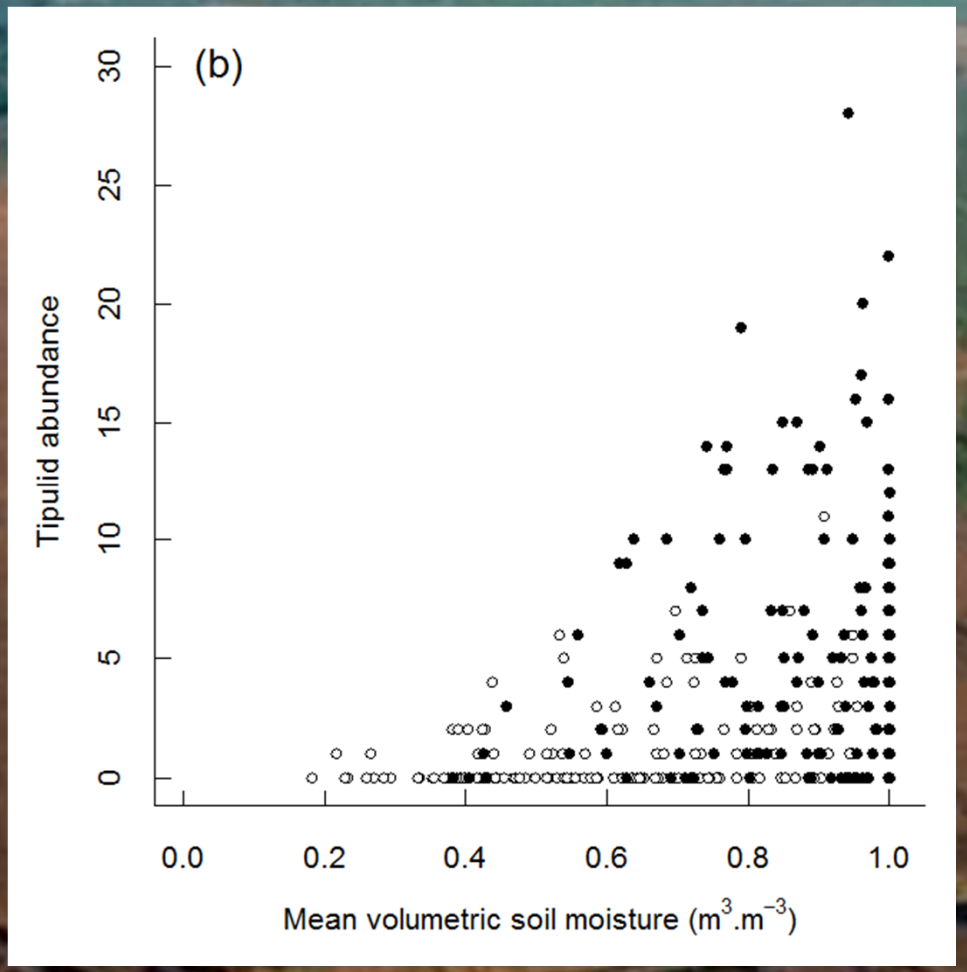


Management


Scenario of continued linear increase in August temperature of 5.8 °C by 2105.
Adaptation leads to stability until 2050 (2.6 °C rise)
Proportional change in population size
3
2.5
2
1.5
1
0.5
0
2005
2025
2045
2065
2085
2105
Year

Management

Ongoing research is currently testing whether the blocking of drainage ditches across peatlands raises water levels, and increases the abundance of craneflies, and their resilience to drought.



Conclusions

Upland birds vulnerable to climate change.

Lack of monitoring hampers assessment of extent of problem but…

Increasing evidence for climate-related declines in some species.

Conservation action needs to adapt to this

Conclusions

Work on golden plovers / craneflies provides theoretical basis for peatland restoration / grip blocking.

Increasing cranefly abundance and reducing nest-predation may reduce vulnerability to increasing temperature.

Site-based management may reduce impacts on vulnerable upland species, enabling populations to be maintained in increasingly unfavourable climates.

Science is essential to the management of change, but must be well resourced, with long-term studies (e.g. UBBS).

Acknowledgements

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