Living in the arctic spring: physiological and behavioral responses to extreme events and unpredictability.

Team Bird

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Team Migration

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Team Squirrel

Brian Barnes, Loren Buck, Cory Williams

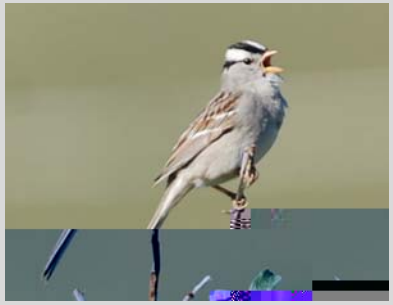
Major life history stages for coping with extreme environments

Endure

e.g. Musk Ox, voles, ptarmigan

Migrate

e.g. fish, caribou, birds



Hibernate

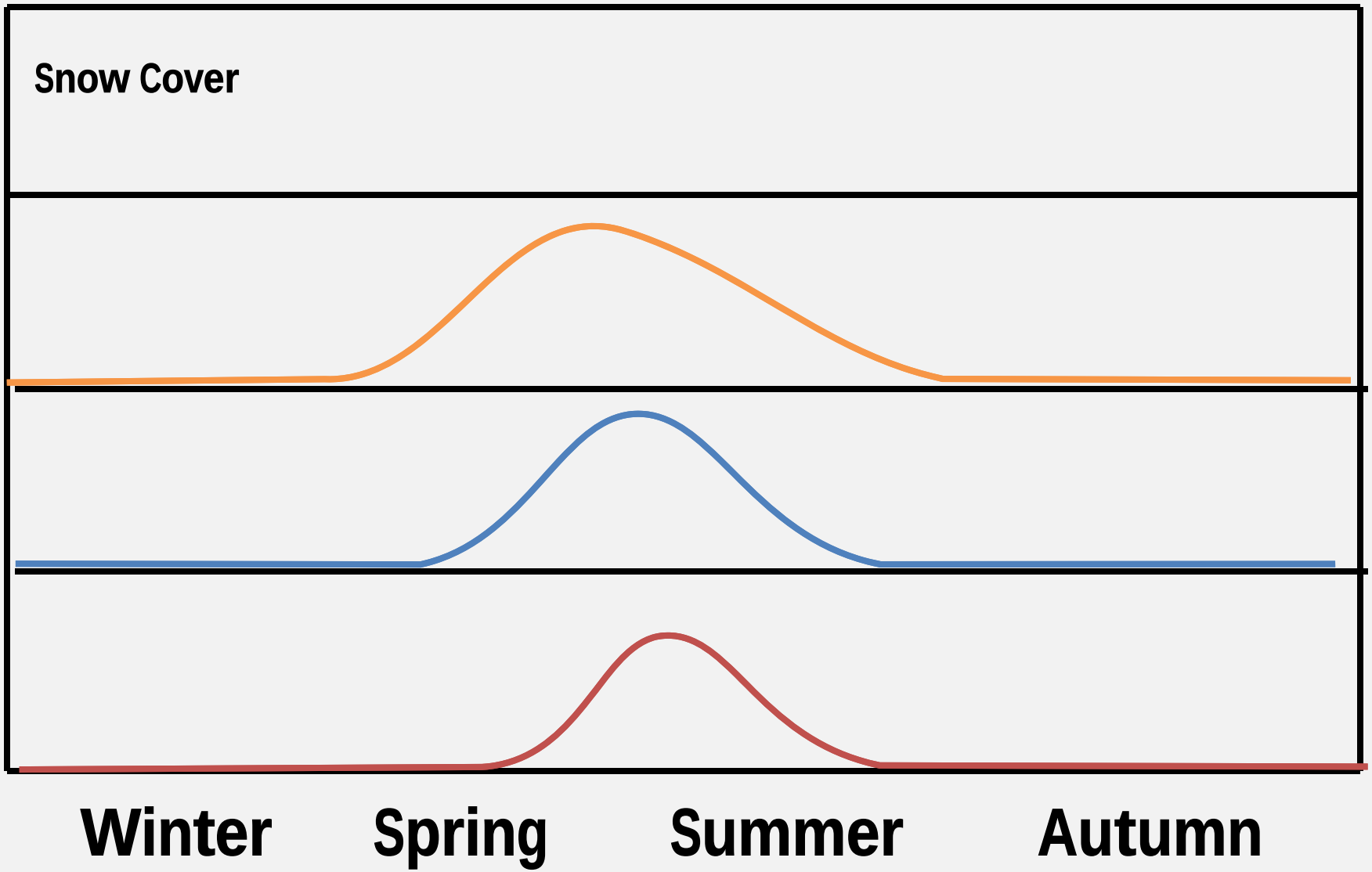
e.g. mammals such as ground squirrels and bears

Why Migrate to Higher Latitudes?

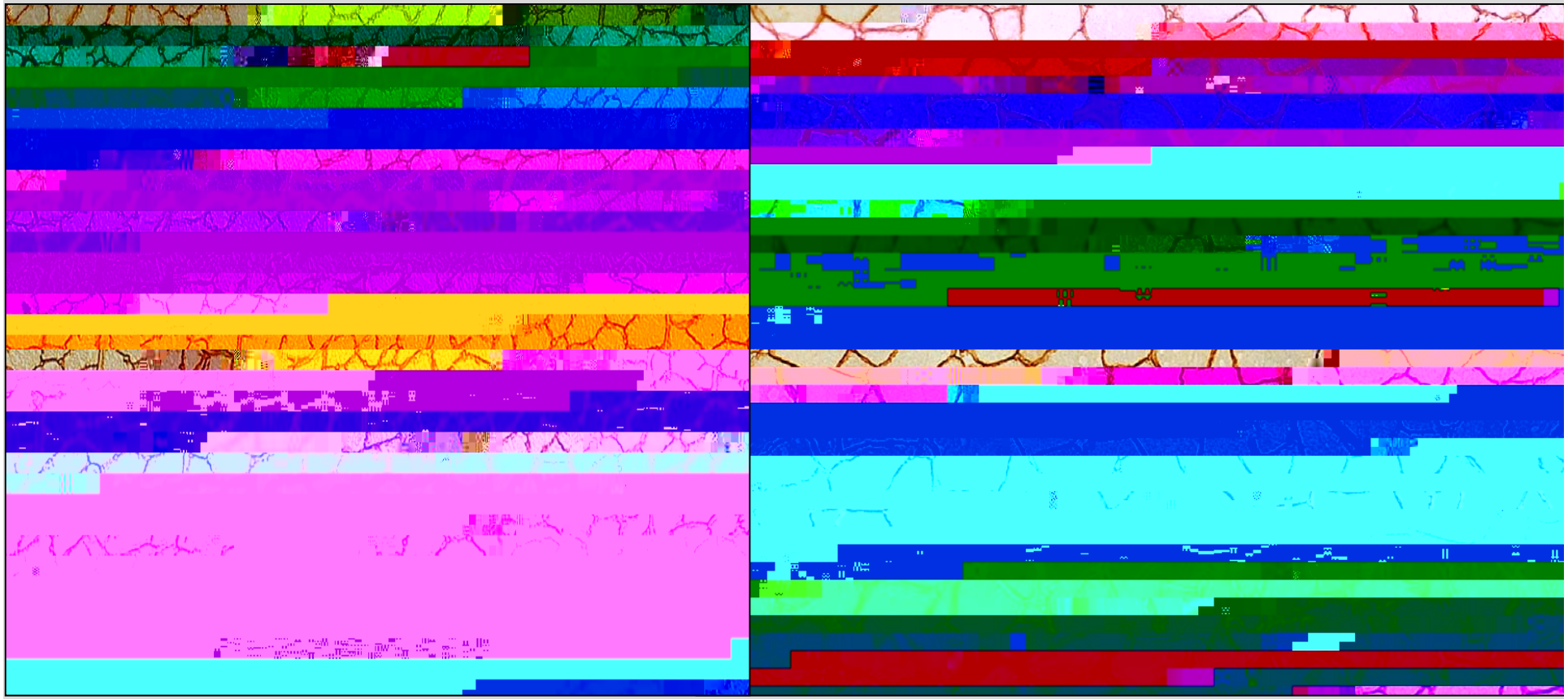
- Reduced predation
- Longer days to feed offspring
- Reduced parasites
- Decreased interspecies competition
- Predictable seasonal increase in food resources
- Will these all be affected by climate change?

Must cope with extreme weather in spring

Trophic Cascade



Skeletal muscle fiber size: immunocytochemistry for laminin protein in plasma membrane of muscle fibers



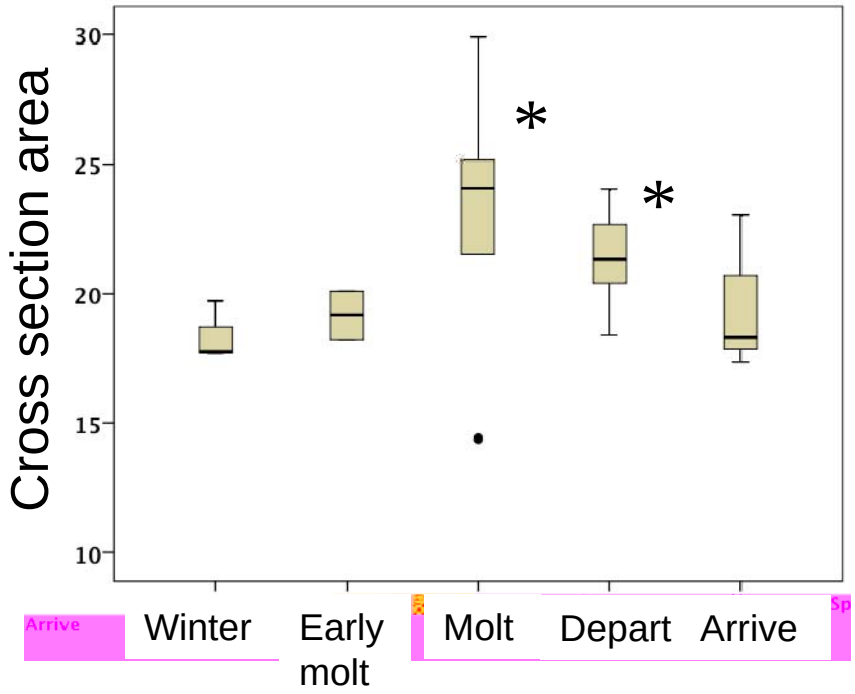
Flight (pectoralis) muscle

Gastrocnemius

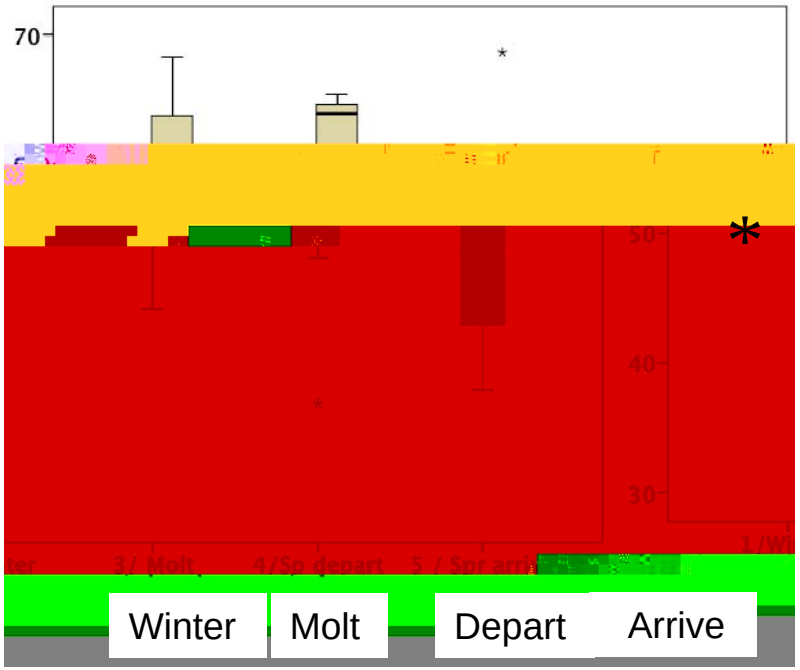
(Slides by D. Campion)

Changes in skeletal muscle fiber size

Flight muscle (Pectoralis)



Gastrocnemius



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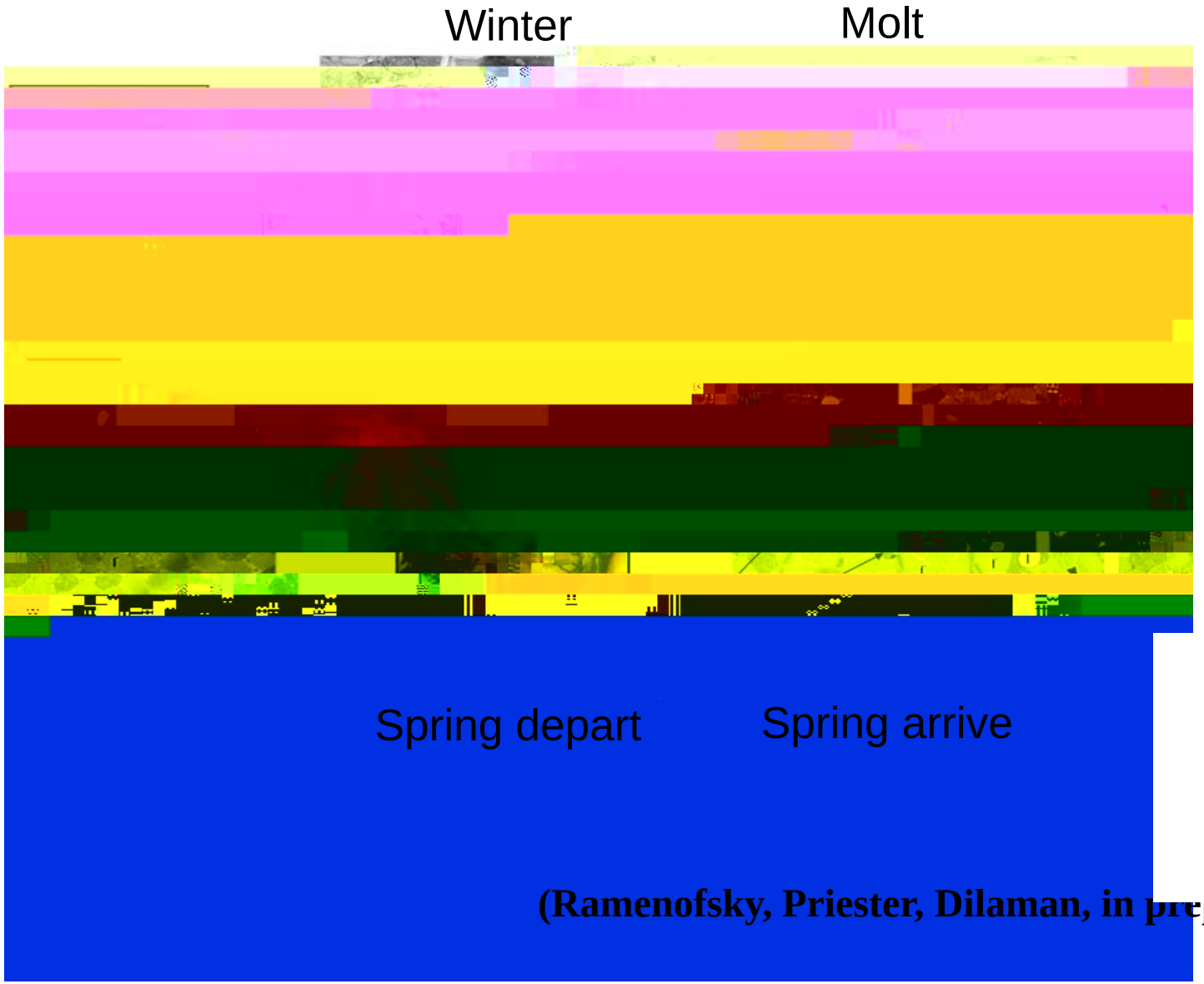
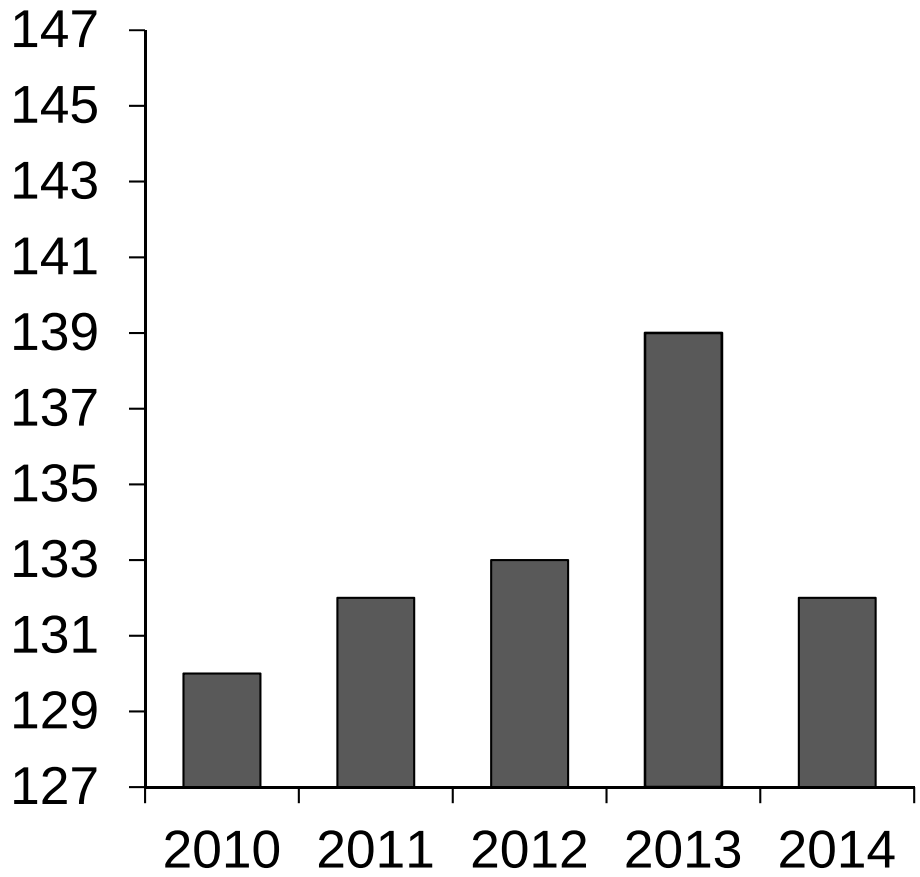
Flight muscle color in relation to deposition of lipid droplets in Gambels White-crowned Sparrow



(Ramenofsky, Priester, Dilaman, in prep)

2013: 12 day delay in snowmelt & onset of warmth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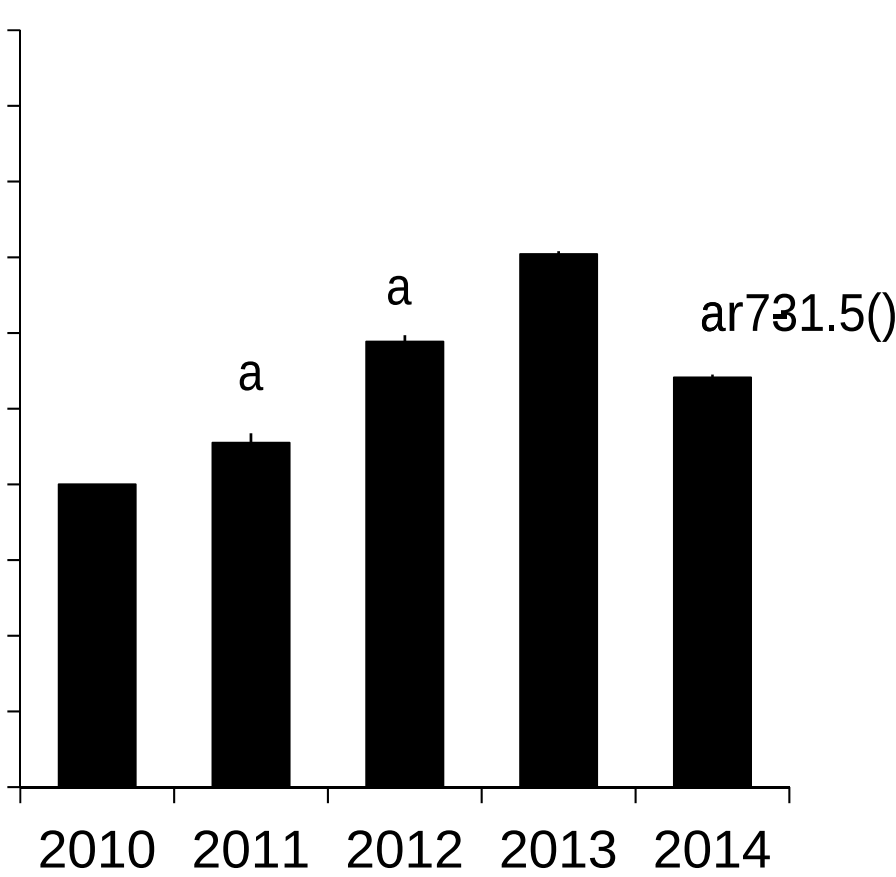
2010
2011
2012
2013
2014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Reproductive success

Lapland longspur

	2012	2013	2014
% fledged	89.92	79.68	54.93
% dead natural	8.47	13.33	29.44

White-crowned sparrow

2012	2013	2014
100.00	100.00	83.44
0.00	0.00	15.26

Timing in onset of spring, conditions can be extreme but arthropod & songbird phenology ‘catch up’

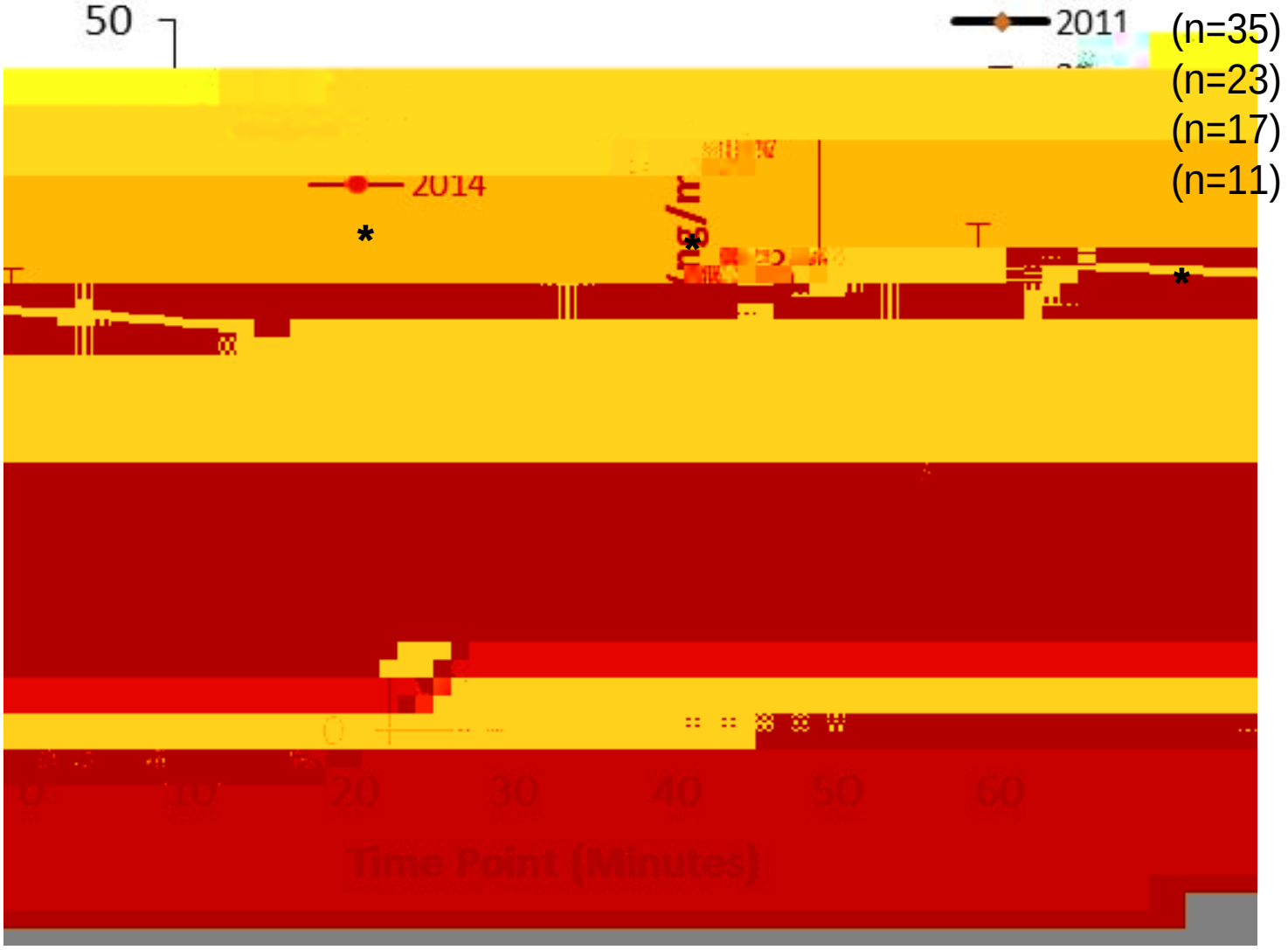
Environmental conditions just prior to & during hatch/ fledge are critical

Transitions from arrival biology to onset of nesting and feeding young are all subject to weather perturbations.

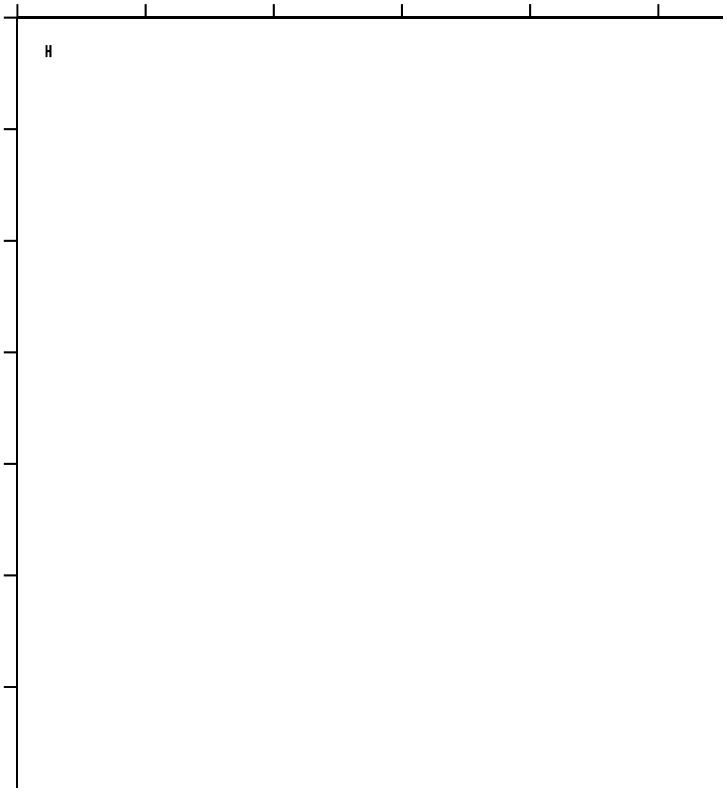
Short term effects of elevated glucocorticoids in response to extremes at arrival and during nesting

1. **Suppress "unnecessary" physiological and behavioral functions.**
2. **Activate facultative behavioral patterns that promote survival (i.e. temporary emergency behavior – The Emergency Life History Stage).**
3. **Increase gluconeogenesis: lipid metabolism and deamination.**
4. **Avoid the long-term effects of stress-induced high levels of glucocorticoids.**

Lapland longspur - Arrival on Breeding Grounds



Krause et al. in review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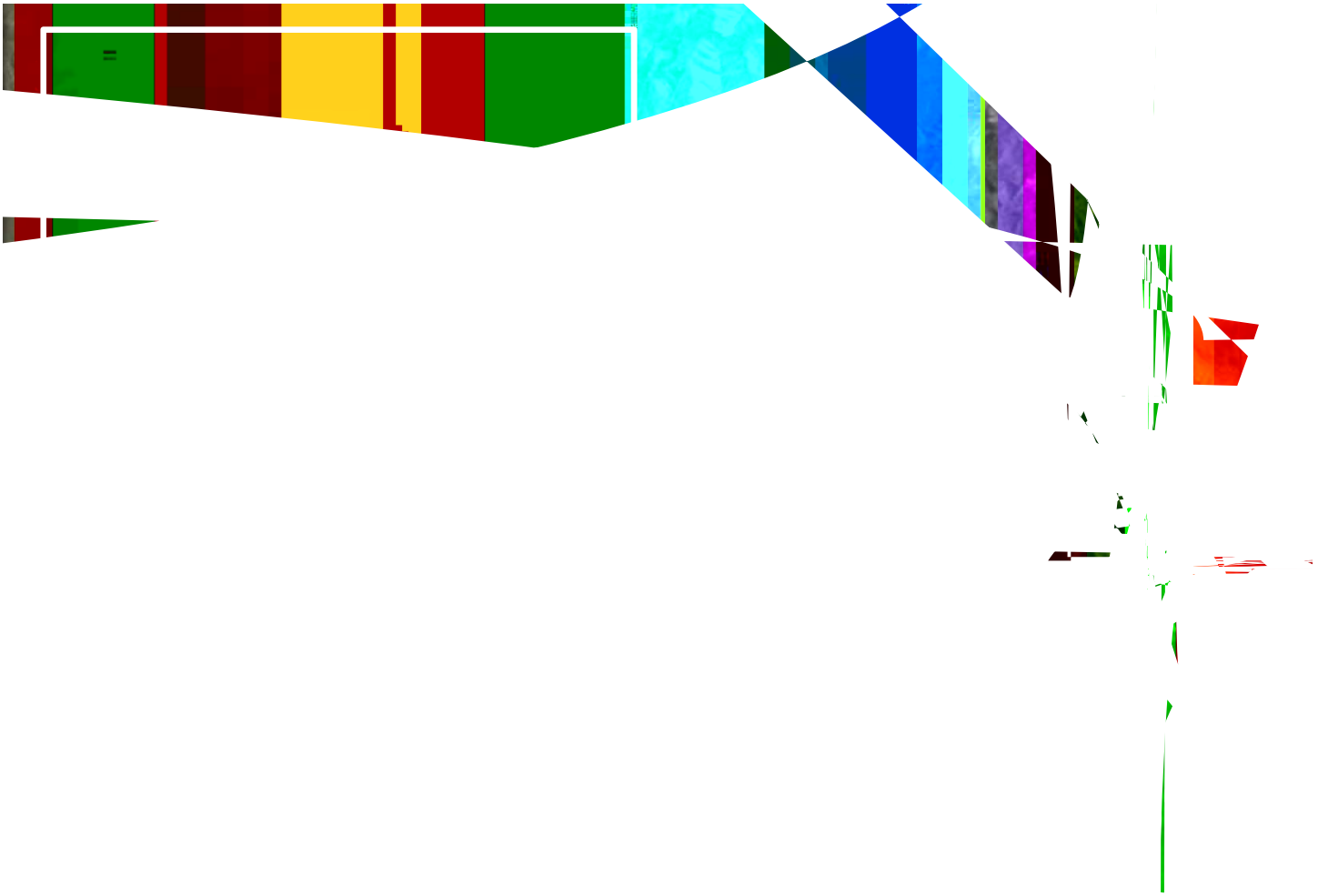

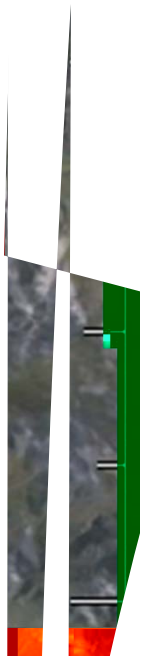

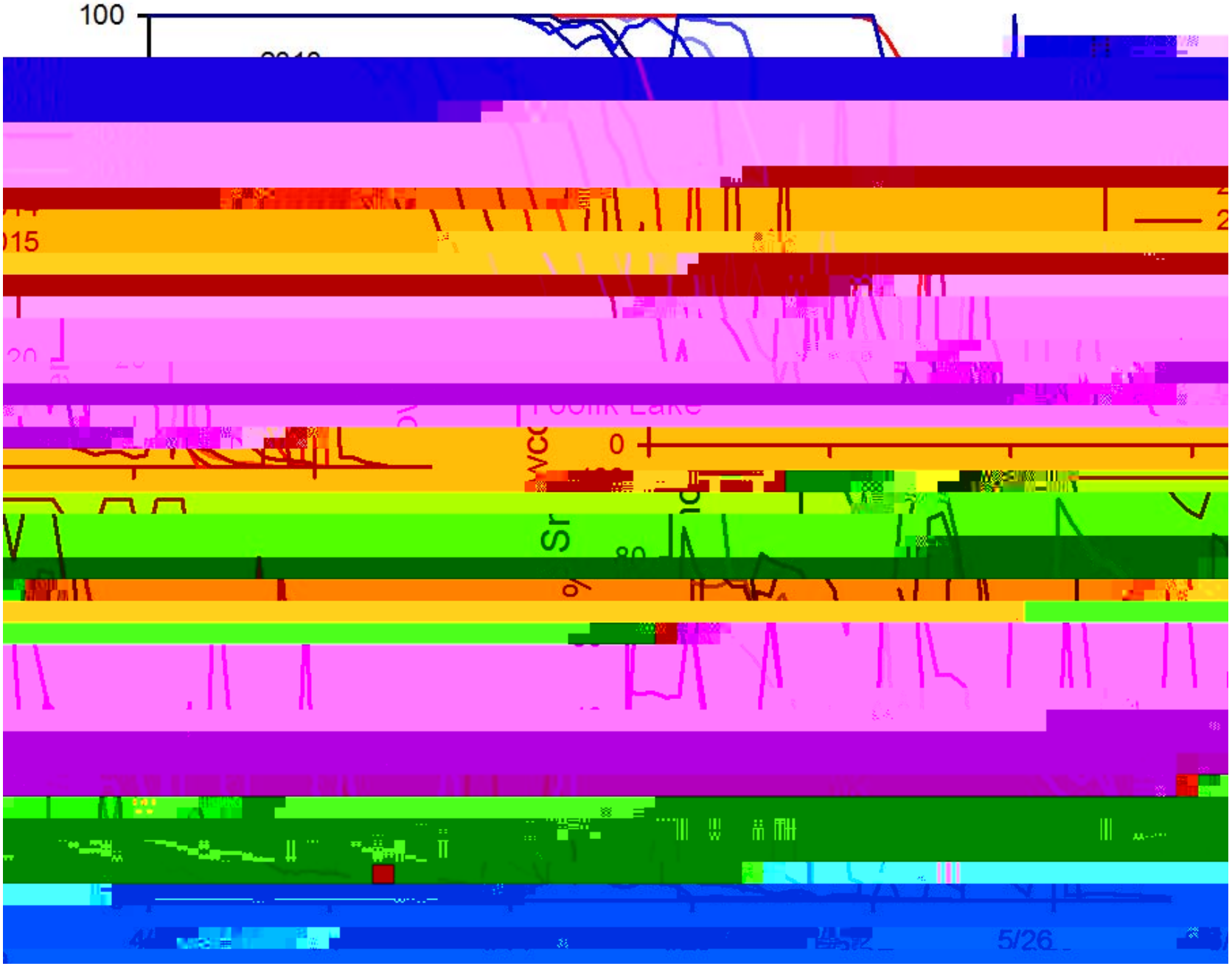
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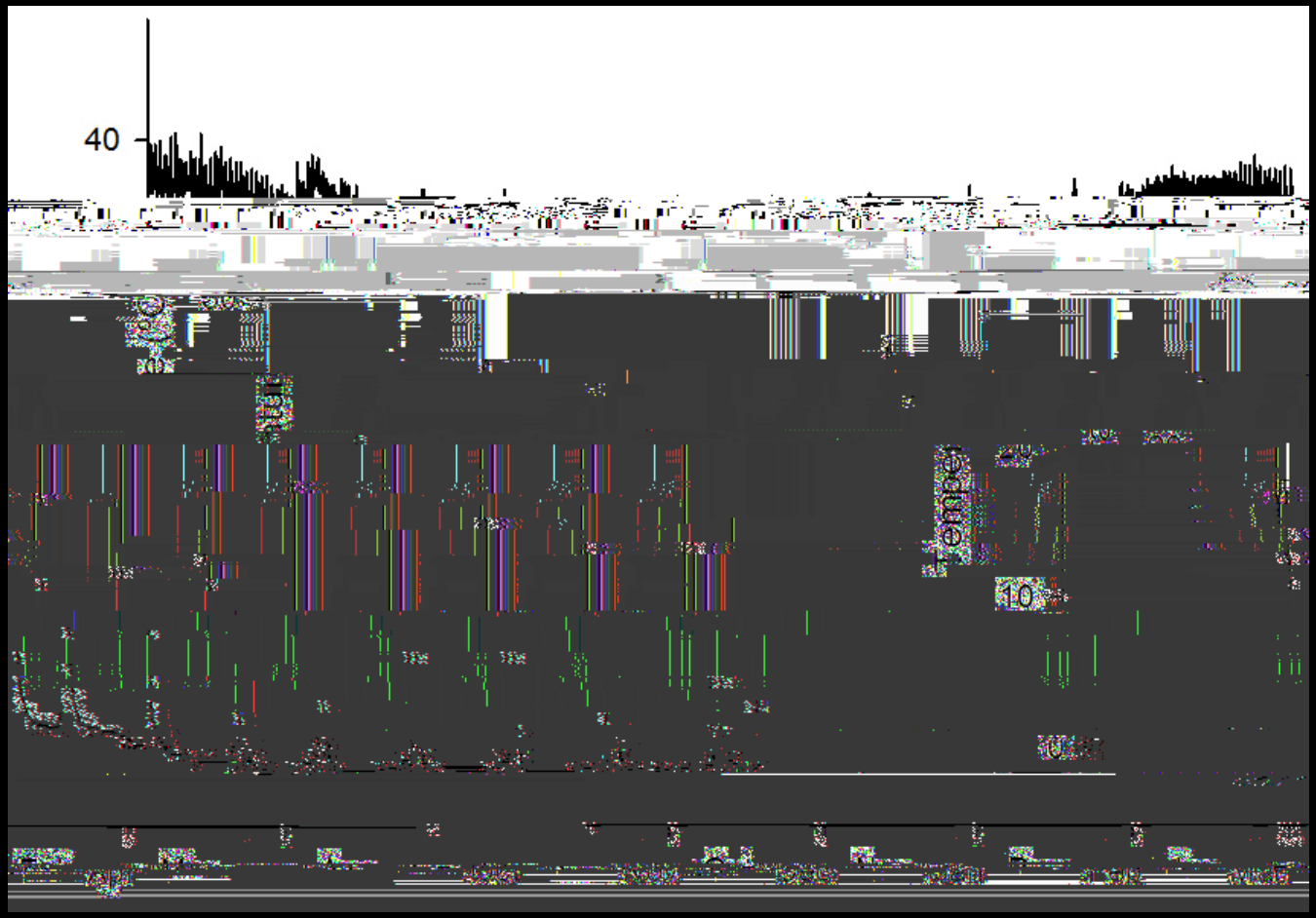
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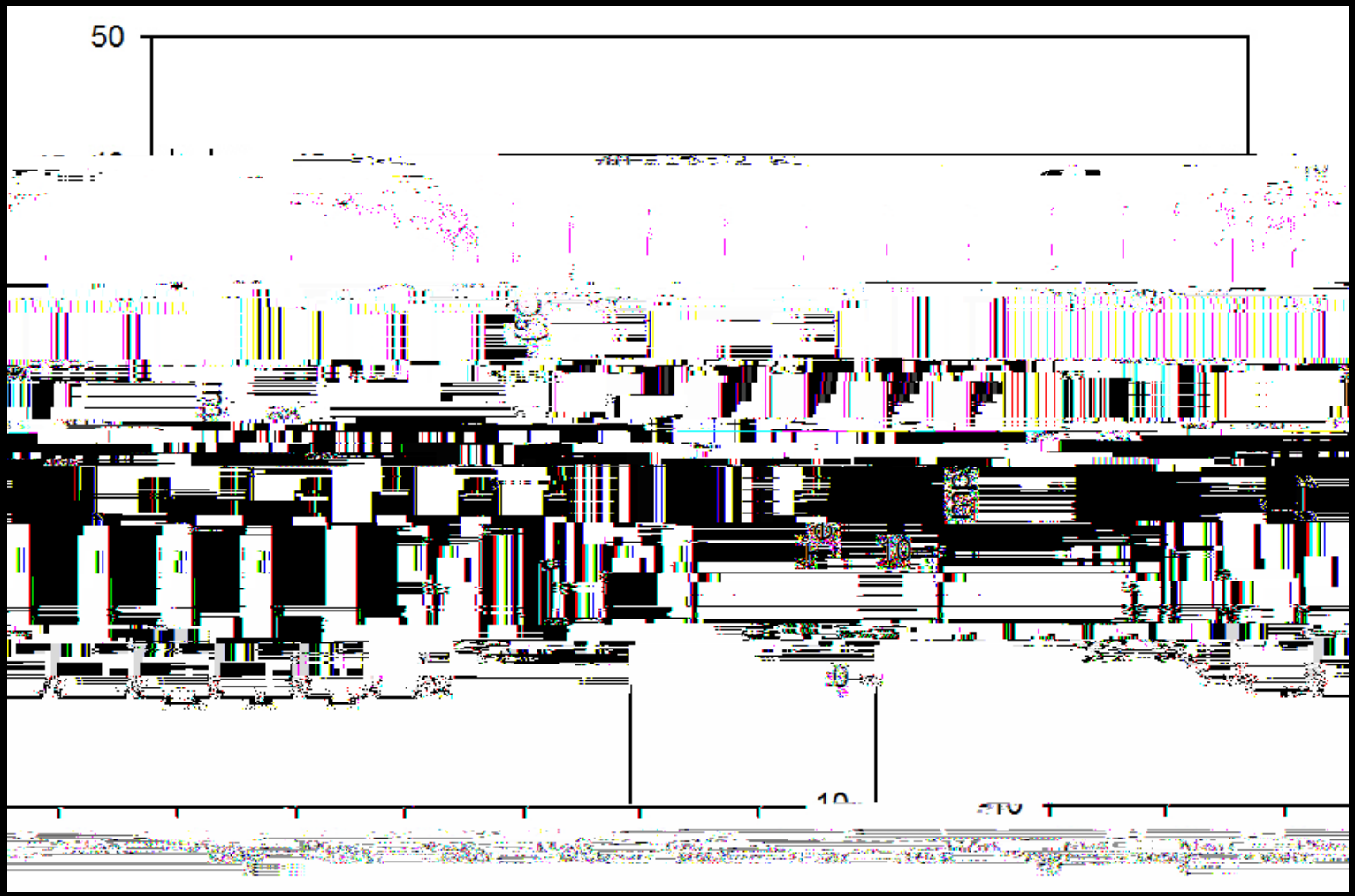
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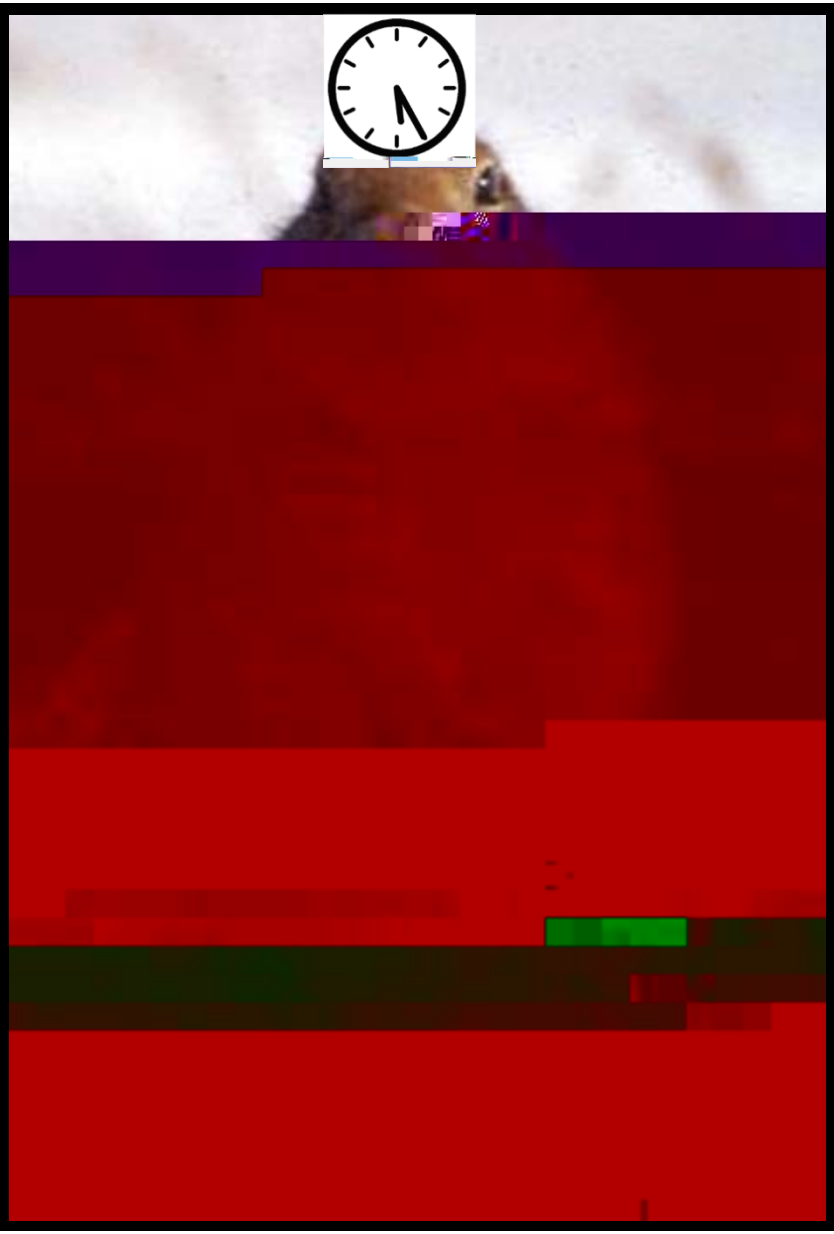

Integrative biology from landscapes, phenology to cell and molecular mechanisms regulating changes in morphology, physiology and behavior.

Phenotypic flexibility of coping mechanisms. Will