

Not So Mice? The Consumptive And Competitive Impacts Of Invasive House Mice (*Mus Musculus*) On Southeast Farallon Island

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Photo: NOAA's Greater Farallones National Marine Sanctuary



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1:30 PM - 1:45 PM PST / 3:30 PM - 3:45 PM CST



[@MJPolito](https://twitter.com/MJPolito)

Background:

The Farallon Islands



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The Farallon Islands



Background:

Eurasian House Mouse (*Mus musculus*)

- Introduced in late 19th century
- Some of the highest recorded densities on any island
 - 60k mice on a 0.3 km² island



Background:

What are the ecological impacts of introduced mice on the Farallon Islands?



Background:

What is Known?

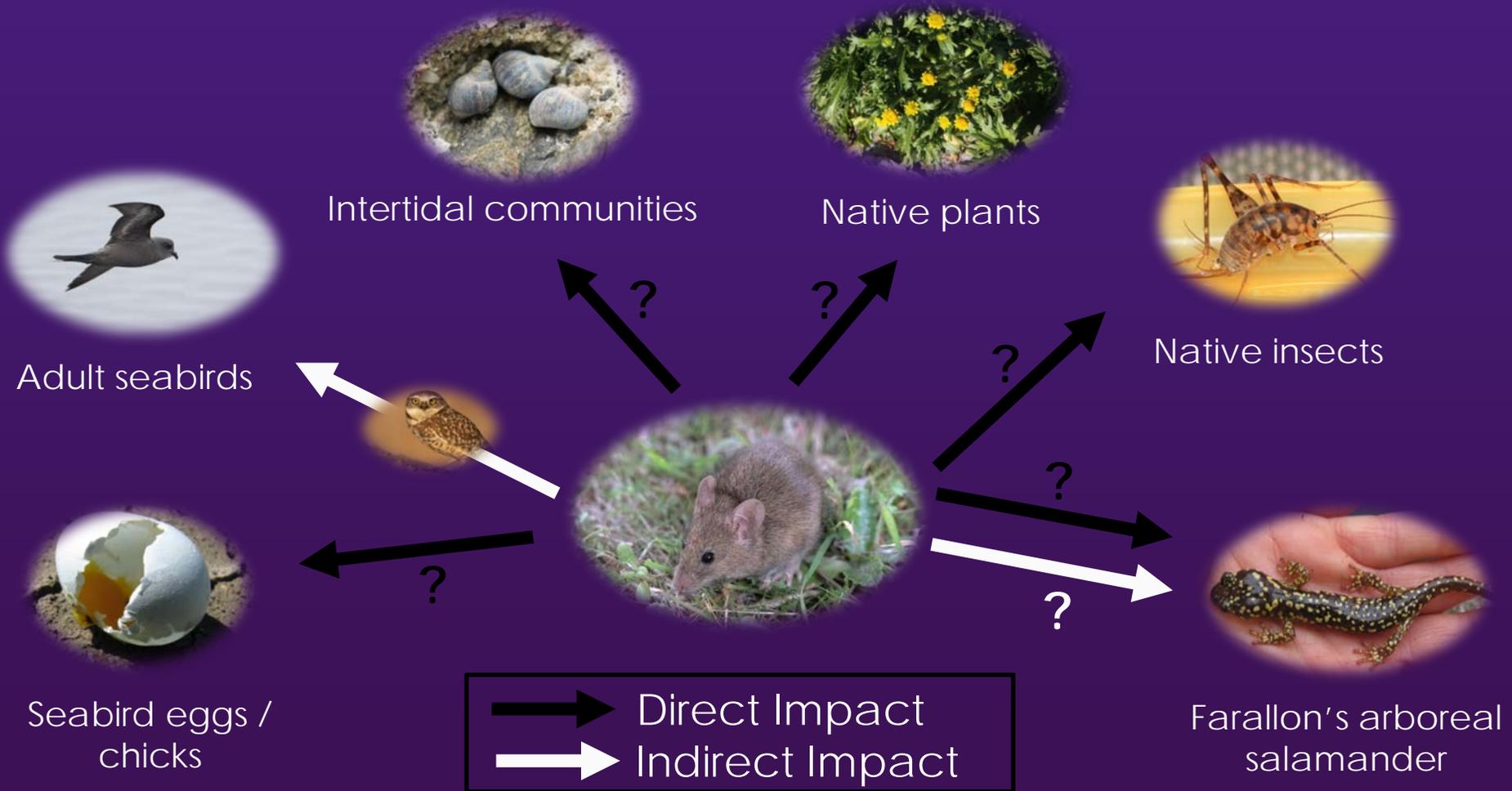
Mice indirectly impact adult seabirds via facilitated predation by Burrowing owls



Nur, N., Bradley, R. W., Salas, L., Warzybok, P., & Jahncke, J. (2019). Evaluating population impacts of predation by owls on storm petrels in relation to proposed island mouse eradication. *Ecosphere*, 10(10), e02878.

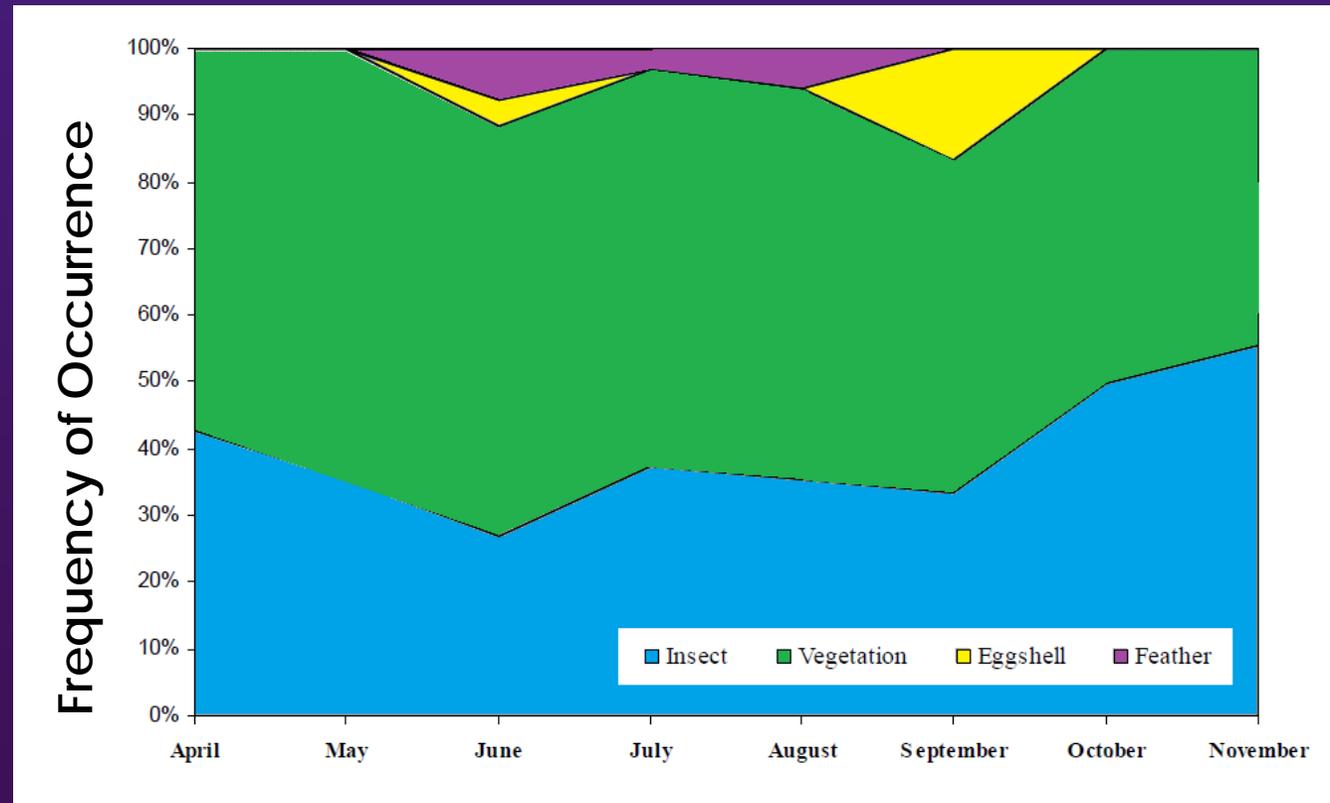
Background:

Other Impacts?



Background:

A prior dietary study focused on stomach contents



Jones, M.A. and R.T. Golightly. 2006. Annual variation in the diet of house mice (*Mus musculus*) on Southeast Farallon Island. Unpublished report. Department of Wildlife, Humboldt State University, Arcata, CA U.S.A



Objective:

Use stable isotope analysis (SIA) to quantify the diet & ecological niche of invasive house mice on the Farallon Islands

Tissue SIA provide an integrated record of diet that avoids many of the biases of stomach contents



Questions:

1. How does mouse abundance and resource availability change seasonally?
2. How does mouse diet respond to seasonal changes?
3. What are the direct (consumption) and indirect (competition) impacts of mice?

Mouse abundance & resource availability

Seasonal trends:

- Mouse abundance (trapping success): 2001-2017
- Vegetation (precipitation): 2001-2017
- Insect density: 2014
- Seabird abundance (carcass counts): 2001-2017
- Salamander abundance: 2008-2017



Methods:

Mouse diets & ecological niche

Spring/Summer/Fall 2013

Tissue collection:

- Mouse liver & muscle
- Prey tissues: plants, seabird, salamander (tail clips), insects, intertidal sp. (snails)

Data analysis:

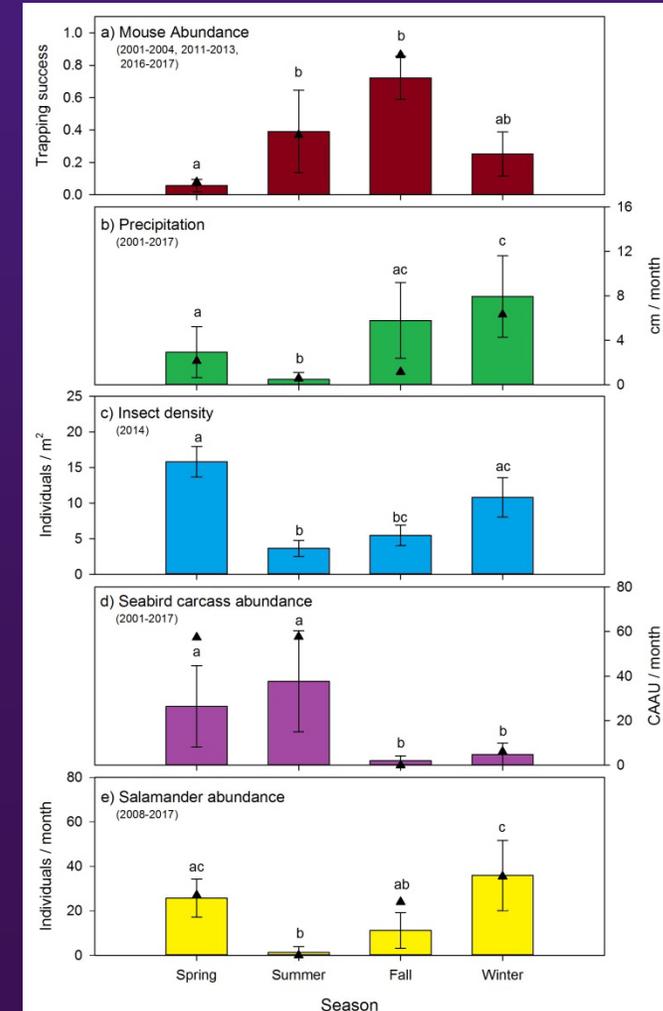
- $\delta^{13}\text{C}$ & $\delta^{15}\text{N}$
- Isotopic mixing model (Parnell et al. 2010)
- Isotopic niche overlap (Jackson et al. 2011)



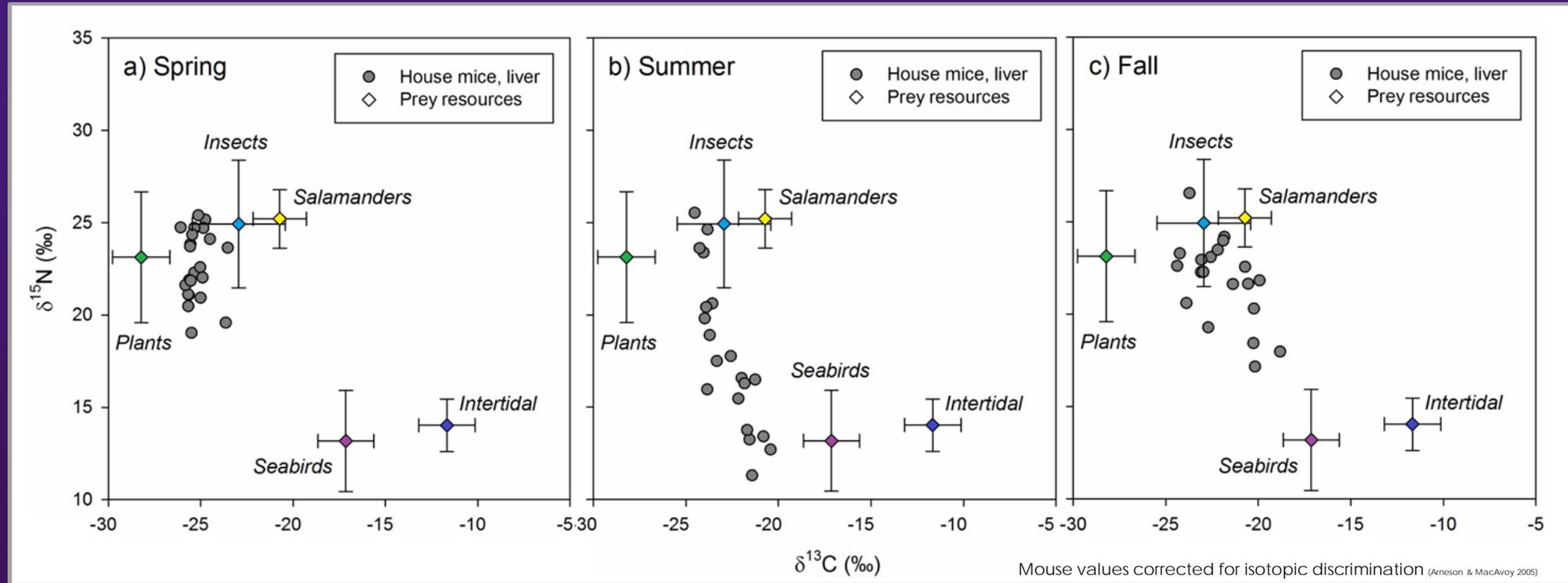
Results:

Mouse abundance & resource availability varies seasonally

- **Spring:** Mouse abundance is lowest. Insects and veg. cover are high following heavy rain in the fall/winter.
- **Summer:** Seabird abundance peaks. Salamander & insect abundances are lowest.
- **Fall:** Mouse abundance peaks. Veg. cover and seabird abundances are lowest.
- **Winter:** Mouse abundance crashes with heavy rain. Salamander abundance peaks.



Mouse stable isotope values vary seasonally

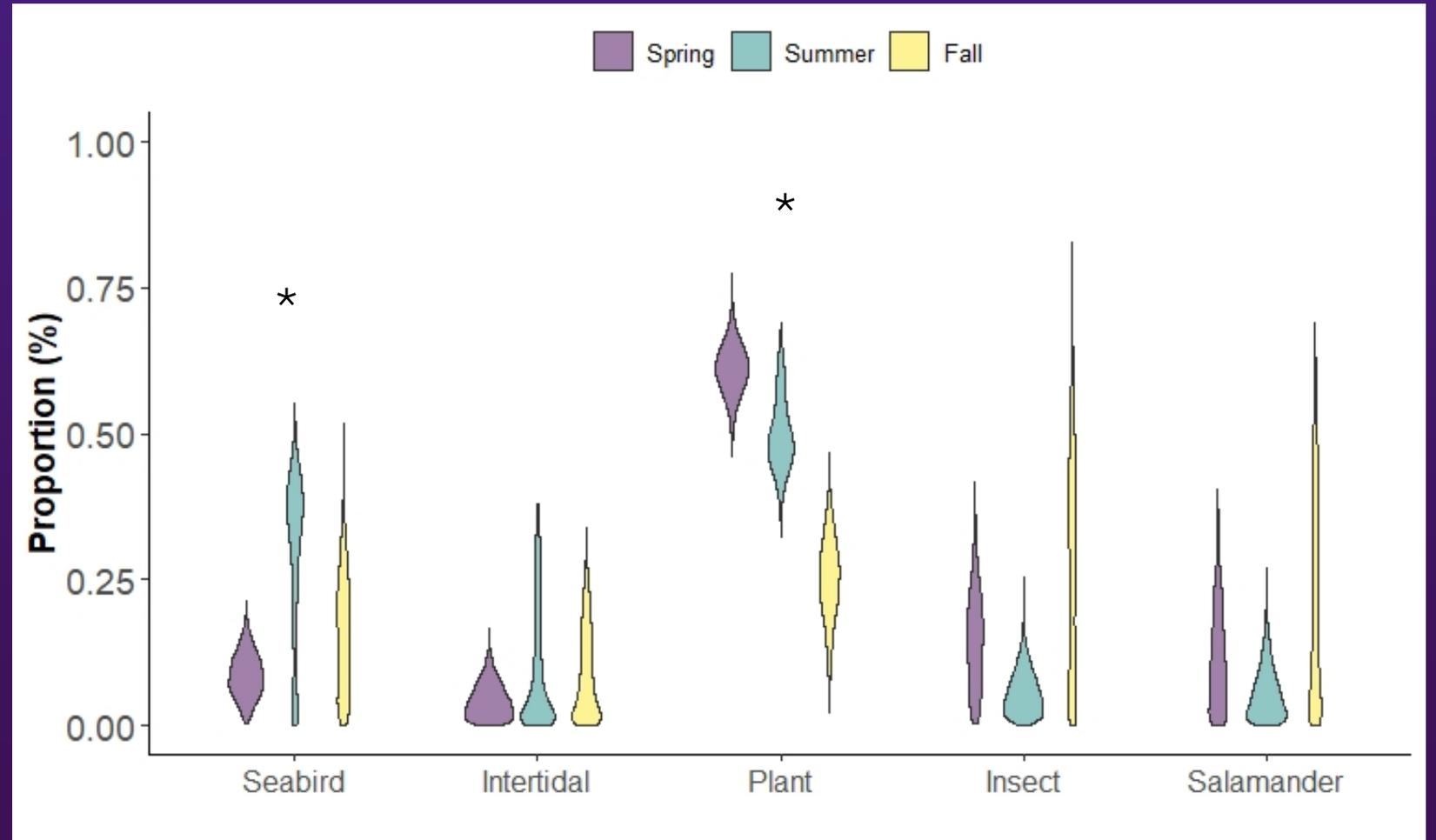


- Mouse SIA values differ between seasons ($\delta^{13}\text{C}$: $F_{2,126} = 66.61$, $p < 0.001$; $\delta^{15}\text{N}$: $F_{2,126} = 26.60$, $p < 0.001$)
- Liver and muscle tissue SIA values strongly correlated ($\delta^{13}\text{C}$: $r = 0.908$, $p < 0.001$; $\delta^{15}\text{N}$: $r = 0.946$, $p < 0.001$)

Results:

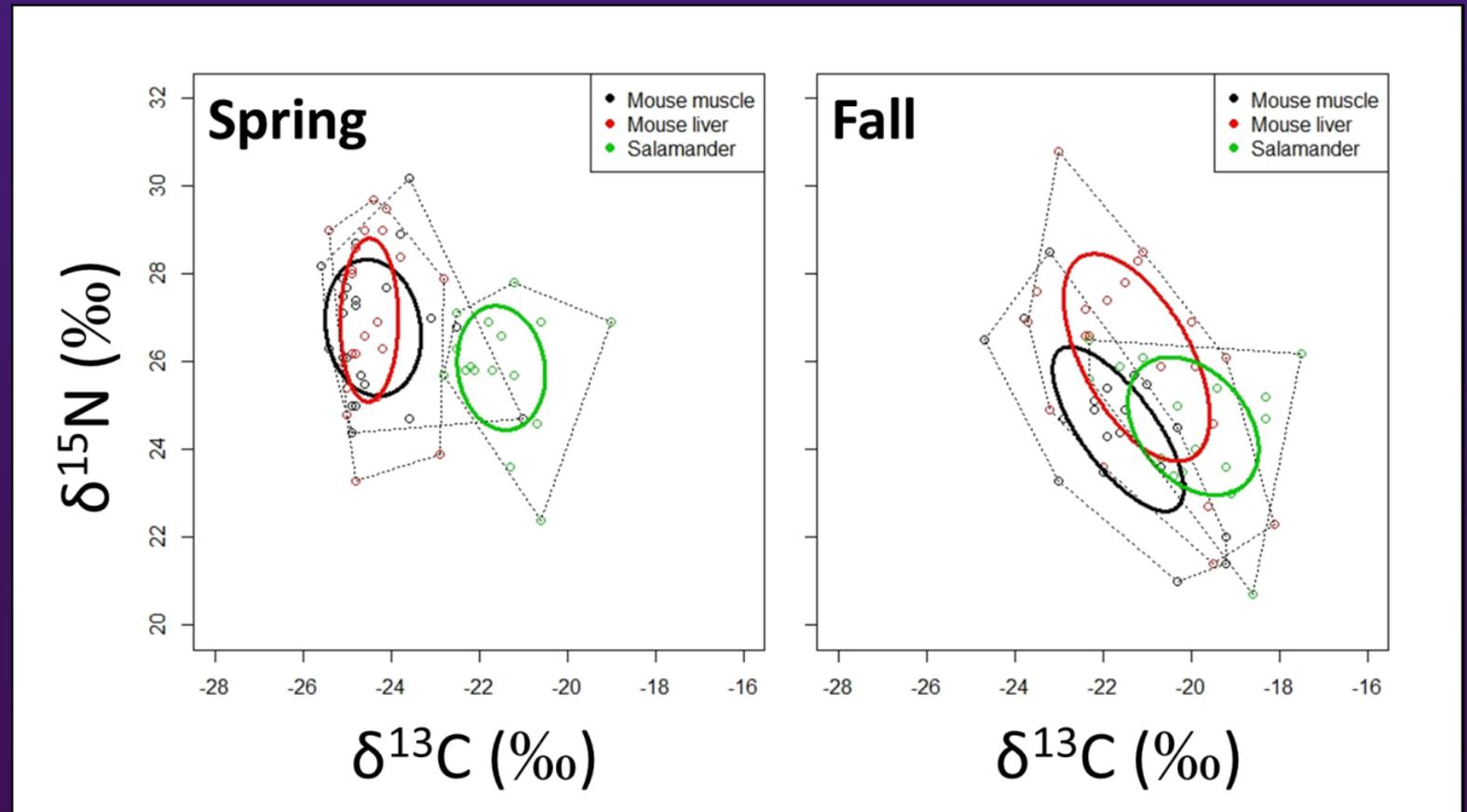
Mouse diets shift seasonally

- Plants are always important and peak in diets during **Spring**
- Seabirds peak in diets during **Summer**
- Insects possibly peak in diets during **Fall**



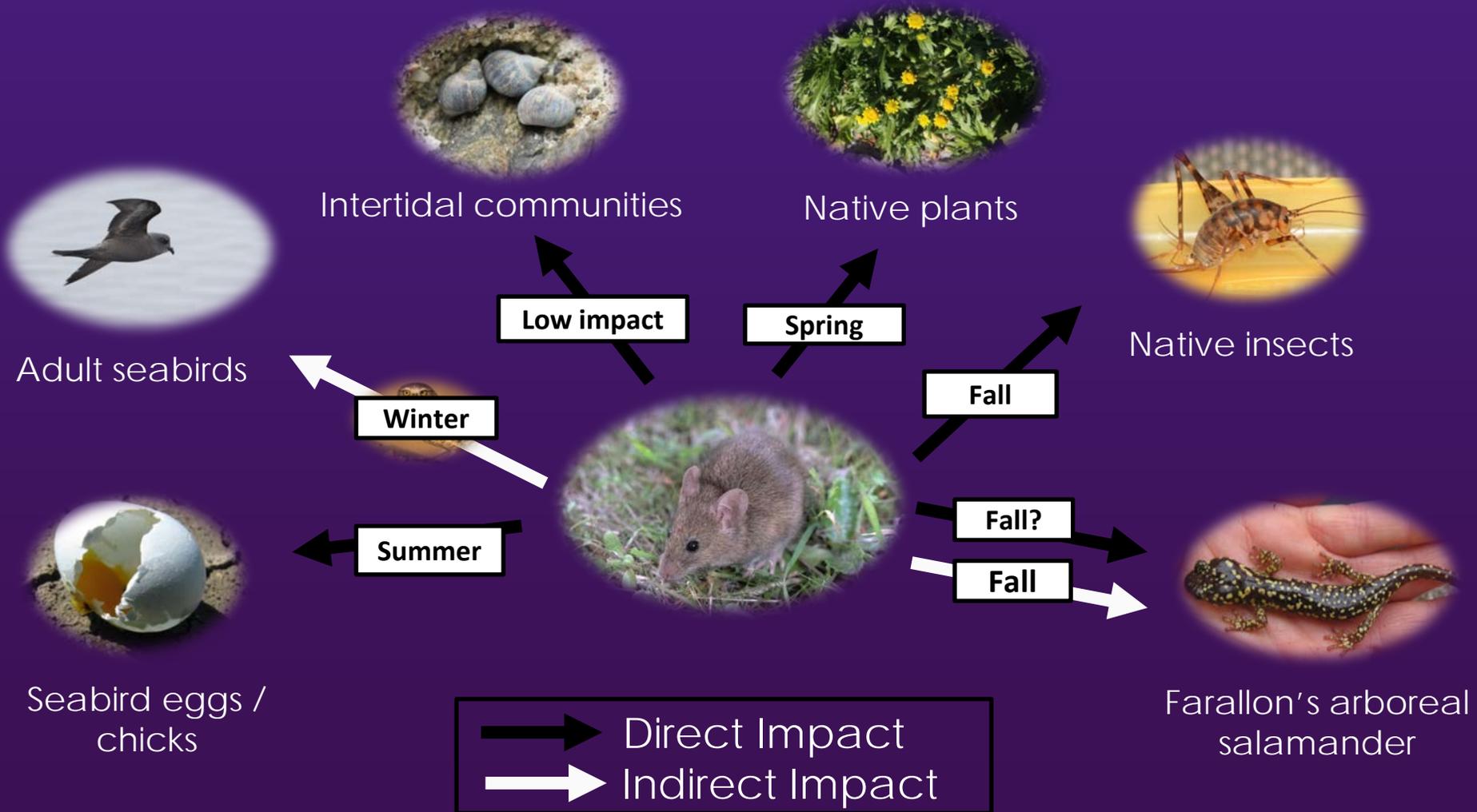
Isotopic niches of mice & salamanders overlap in the Fall but not Spring

- Mice & salamanders both consume insects
- Highest niche overlap in the Fall when mouse populations peak and other food sources are low



Summary:

Mouse diets (& impacts) shift with seasonal changes in resource availability



Mice have consumptive & likely competitive impacts on the Farallon Islands Ecosystem

- Seabirds increase in mouse diet during seabird breeding SEASON (predation or scavenging?)
- Mice may compete with salamanders for insect prey, direct predation is possible as well
- Uncertainty remains
 - Relative vs. absolute abundance
 - Winter diets?
 - Native vs. non-native plants in diets?

Questions?

Thank you!

- PSG Organizing Committee
- Point Blue
- US Fish & Wildlife Service
- Farallon Islands National Wildlife Refuge

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