Isotopes and Predator-Prey Interactions on the Canadian Tundra

Gustaf Samelius

Ray Alisauskas, Keith Hobson, and Serge Larivière

Generalized Terrestrial Tundra System

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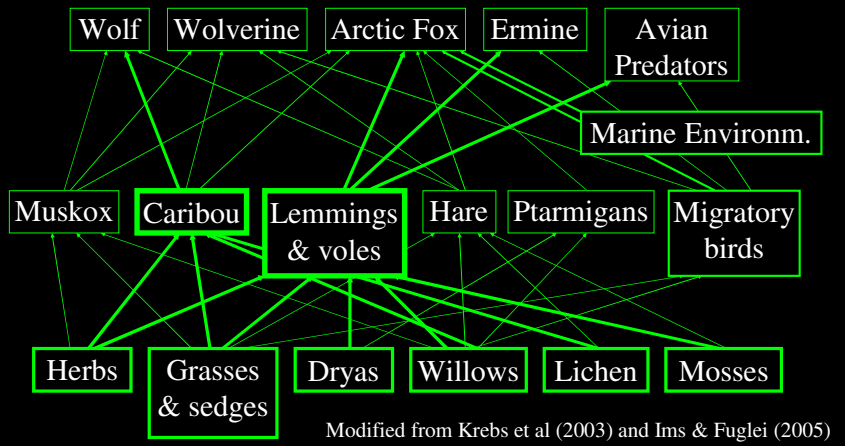

Modified from Krebs et al (2003) and Ims & Fuglei (2005)

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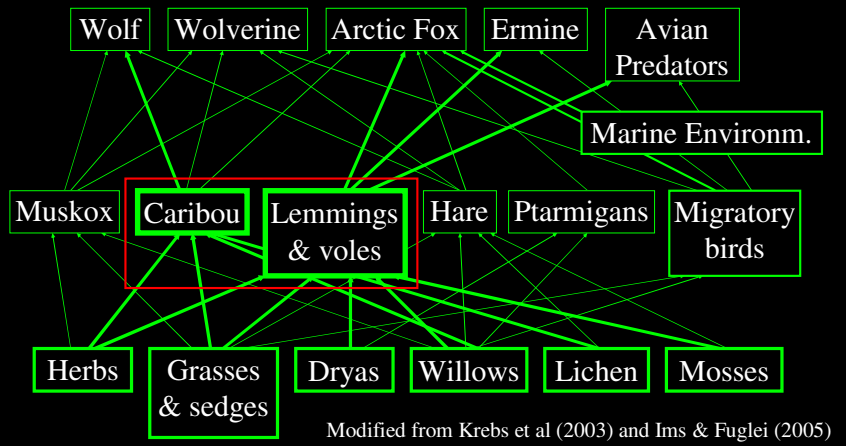

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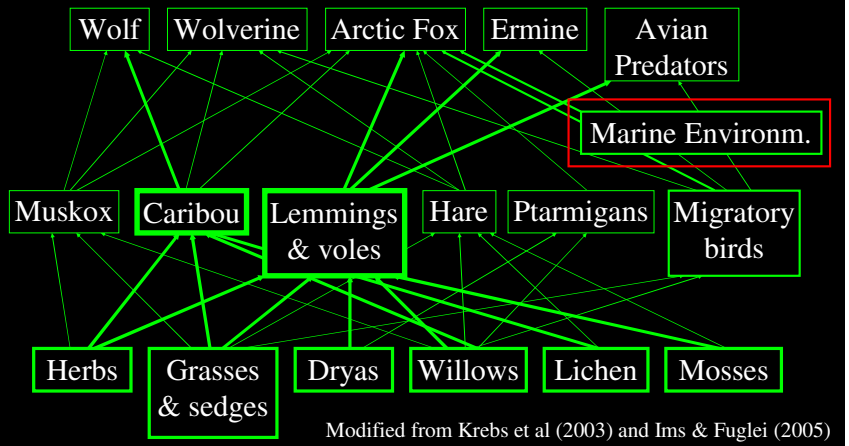

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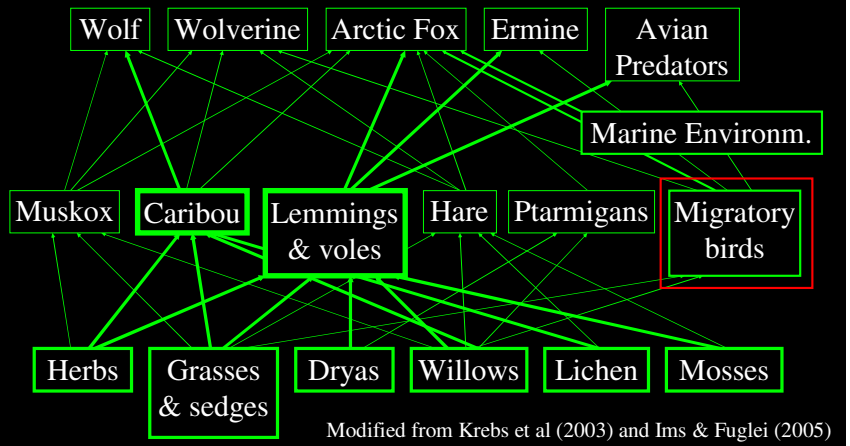

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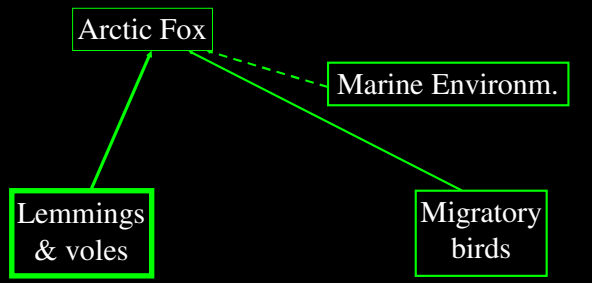
The Focus of Our Study



Arctic foxes - Generalist Predators

Rely heavily on Small Mammals throughout their range but ...

Commonly Cache Foods

Commonly Cache Foods

cache >1,000 eggs per fox

Objectives

- examine arctic fox diets of an inland population

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- examine when and to what extent arctic foxes use cached eggs

Study Area

Karrak Lake
2000-2004

Karrak Lake, June 2005

Methods

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- blood and winter fur collected in spring
- classed foxes as *local* and *unknown origin*
- corrected for fractionation using values for red foxes

Methods

- For local foxes, we used Program IsoSource to estimate the contribution of different foods (with emphasis on the contribution of cached eggs)

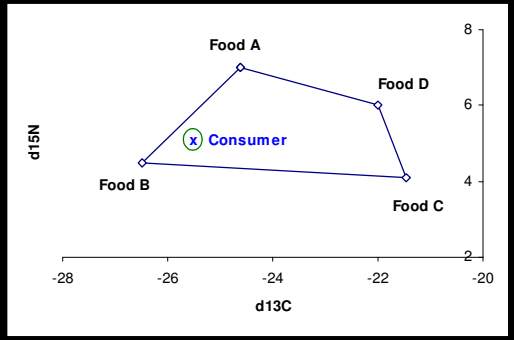
(Phillips & Gregg 2003)

Methods

- For local foxes, we used Program IsoSource to estimate the contribution of different foods (with emphasis on the contribution of cached eggs)
- Program IsoSource is an extension of regular mixing models that provides *ranges* of possible source contributions in situations that regular mixing models can not handle (i.e. when # of sources > # of isotopes + 1).

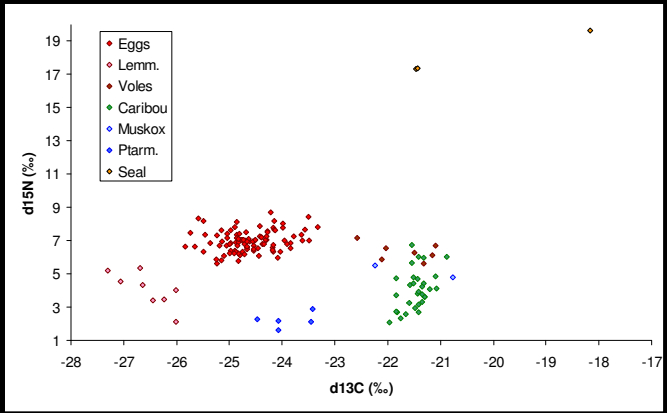
(Phillips & Gregg 2003)

Program IsoSource - A hypothetical Example



(Phillips & Gregg 2003)

Signatures of Foods at Karrak Lake



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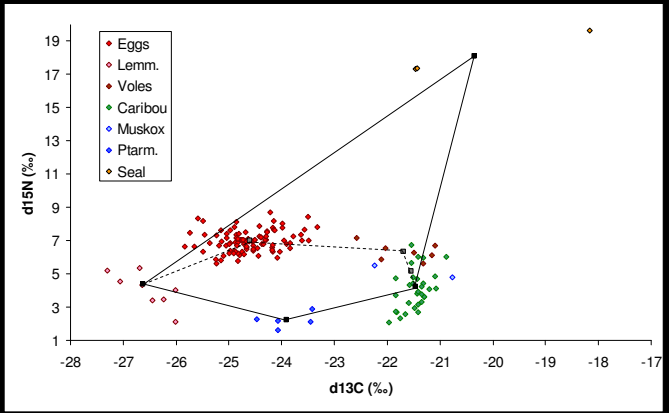
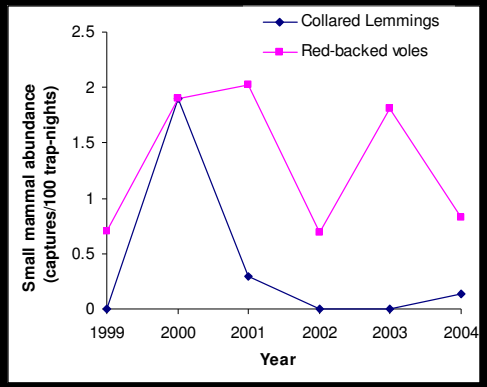
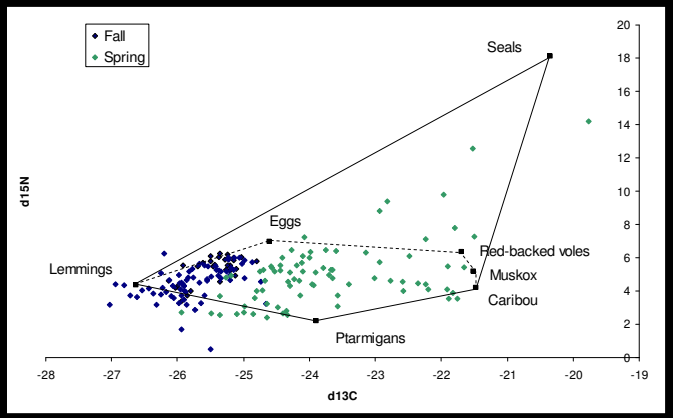


Small Mammal Abundance at Karrak Lake 1999 to 2004

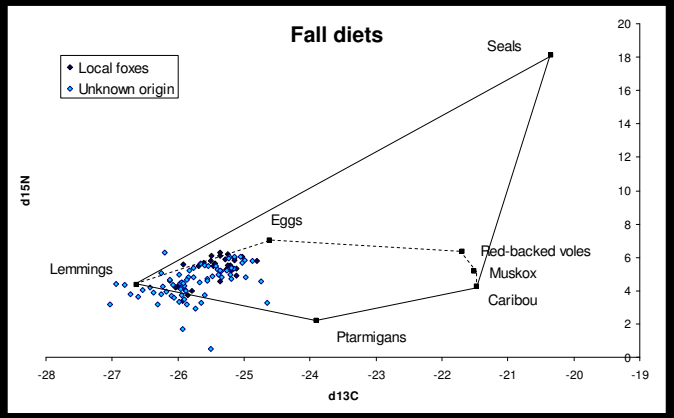


Part 1 - Diets of All Foxes Captured

Spring and Fall Diets



Local Foxes vs Unknown Origin



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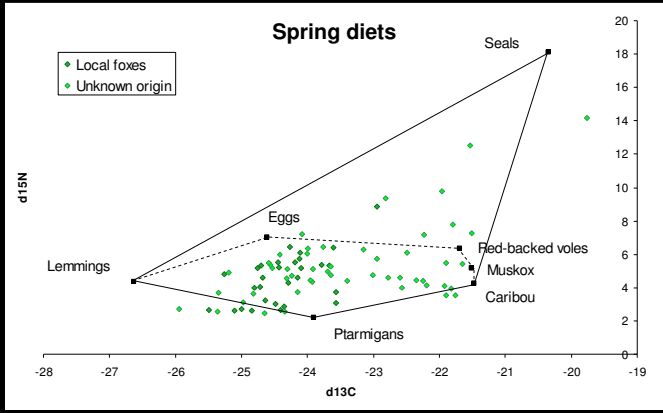
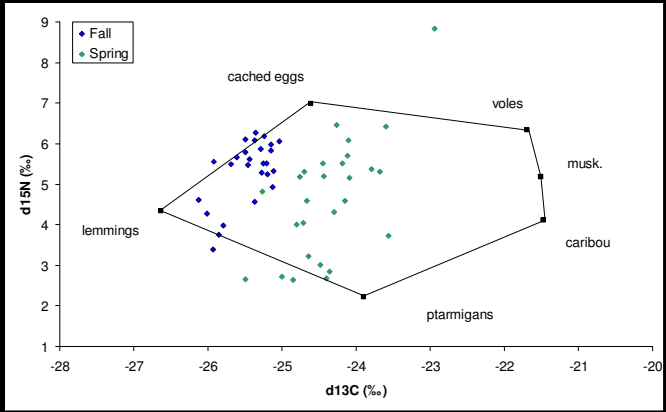


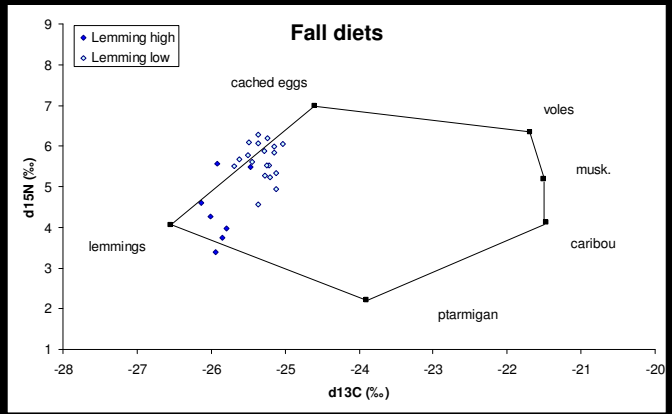
Part 2 - Diets of Local Foxes

Samelius et al (2007)

Fall and Spring Diets



Fox Diets and Lemming Abundance



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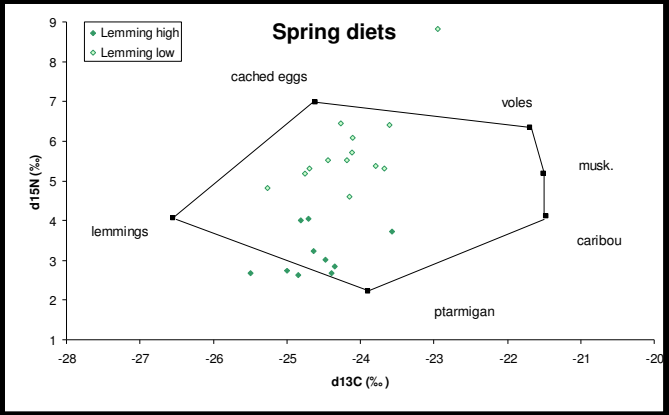

Proportion of Cached Eggs in Spring and Fall Diets (1st – 99th Percentiles)

Year	Spring	Fall
2000	0-3%	0-6%
2001	0-19%	41-55%
2002	22-59%	55-65%
2003	43-72%	48-60%
2004	0-32%	.

Estimates from Program IsoSource

Summary

Stable isotope techniques allowed us to show that:

- arctic fox diets varied among seasons and years – with annual variation being driven by fluctuations in lemming abundance

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Stable isotope techniques allowed us to show that:

- arctic fox diets varied among seasons and years – with annual variation being driven by fluctuations in lemming abundance

- arctic foxes relied heavily on cached eggs in years when lemmings were scarce

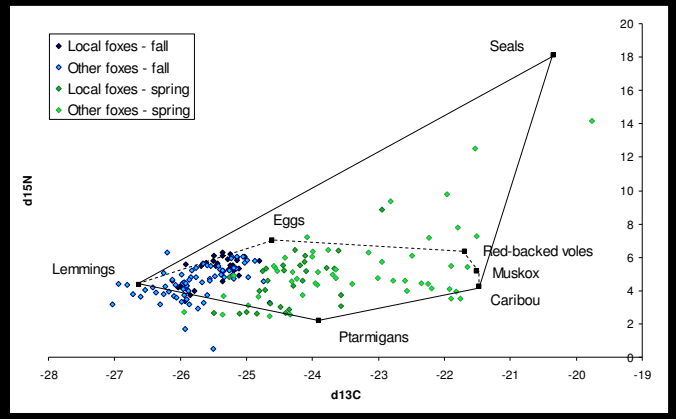
Thanks to

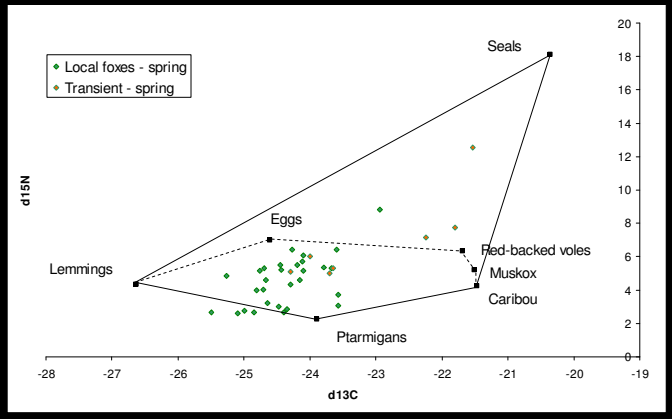
- California Department of Fish & Game, Canadian Wildlife Service, Delta Waterfowl Foundation, Ducks Unlimited, Polar Continental Shelf Project, Sweden-America Foundation, Jennifer Robinson Memorial Scholarship, & University of Saskatchewan
- Alain, Chris, Christoffer, Doug, Jason, Jorgan, Justin, Kim, Nathan, Rob, and Wolf

Thank you!

Alternative Slides

Local vs "Other" Foxes





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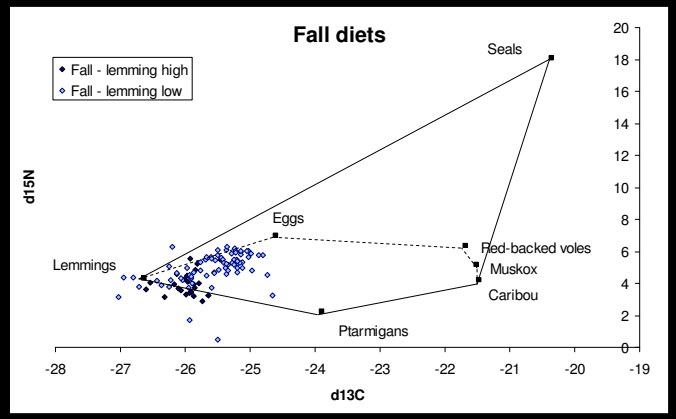

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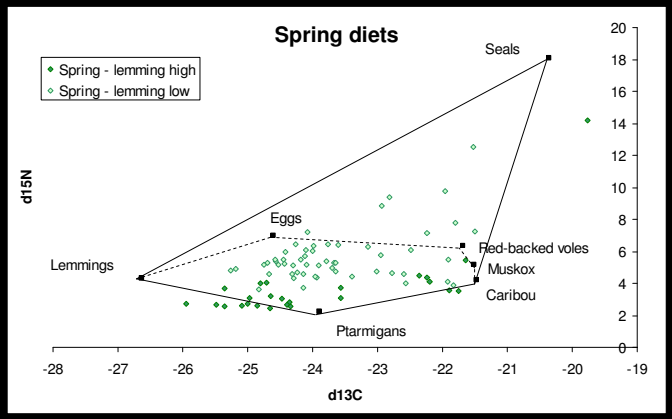

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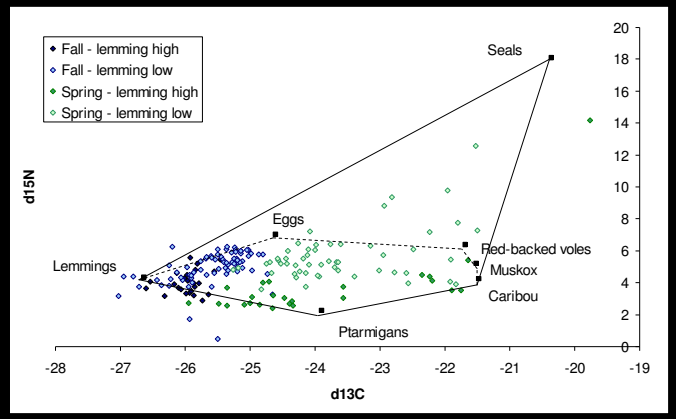
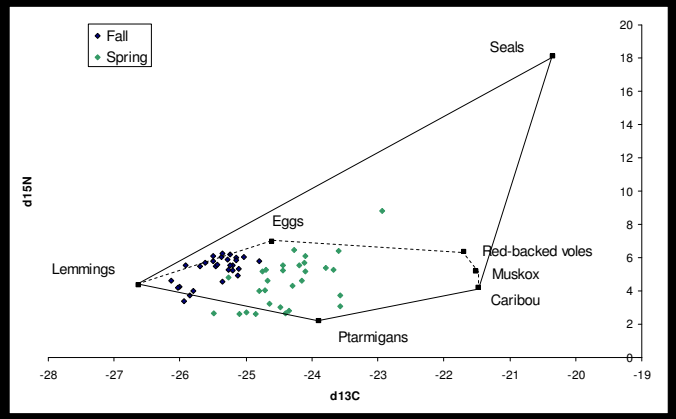


Fall and Spring Diets



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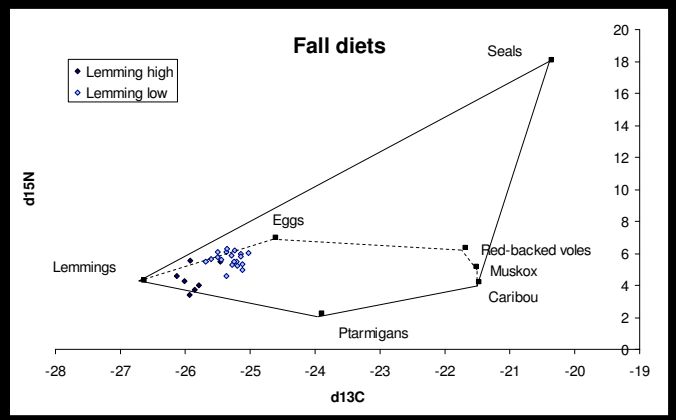

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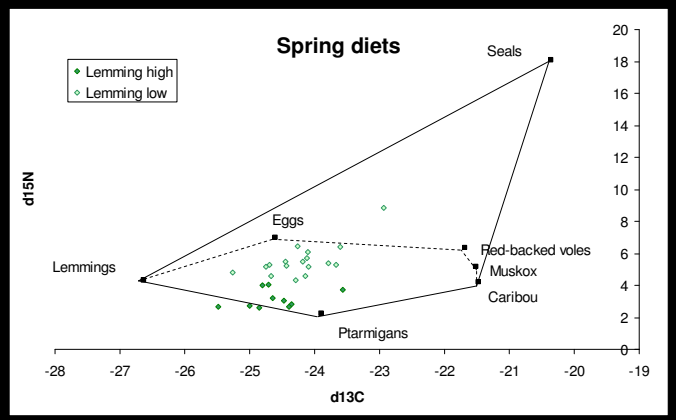

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(Phillips & Gregg 2003)

Methods

- Regular mixing models are limited to situations when the number of sources = the number of isotopes used +1

For example, 2 isotopes → 3 foods
3 isotopes → 4 foods

(Phillips & Gregg 2003)

Methods

Regular mixing models:

2 isotopes → 3 foods
3 isotopes → 4 foods

Program IsoSource:

unlimited number of foods

(Phillips & Gregg 2003)