Retrospective stable isotope analysis reveals ontogenetic population subdivision among white sharks (Carcharodon carcharias) from Australia.

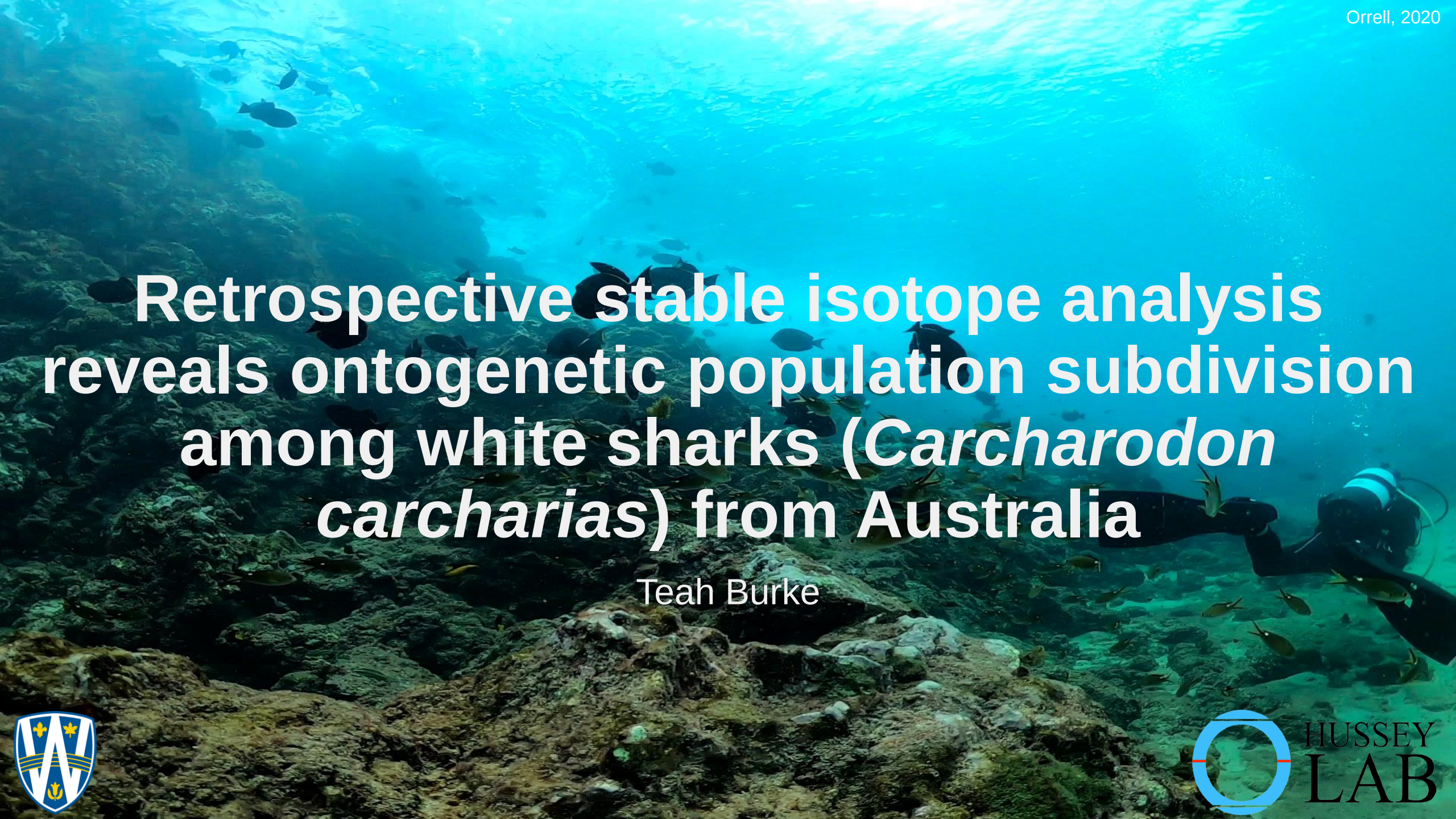
Teah G. Burke
University of Windsor, burke11j@uwindsor.ca

Charlie Huveneers Dr
Flinders University, charlie.huveneers@flinders.edu.au

Lauren Meyer Dr
Flinders University, lauren.meyer@flinders.edu.au

Lisa Loseto Dr
Freshwater Institute - Fisheries and Oceans Canada, Lisa.Loseto@dfo-mpo.gc.ca

Nigel E. Hussey Dr
University of Windsor, nehussey@uwindsor.ca



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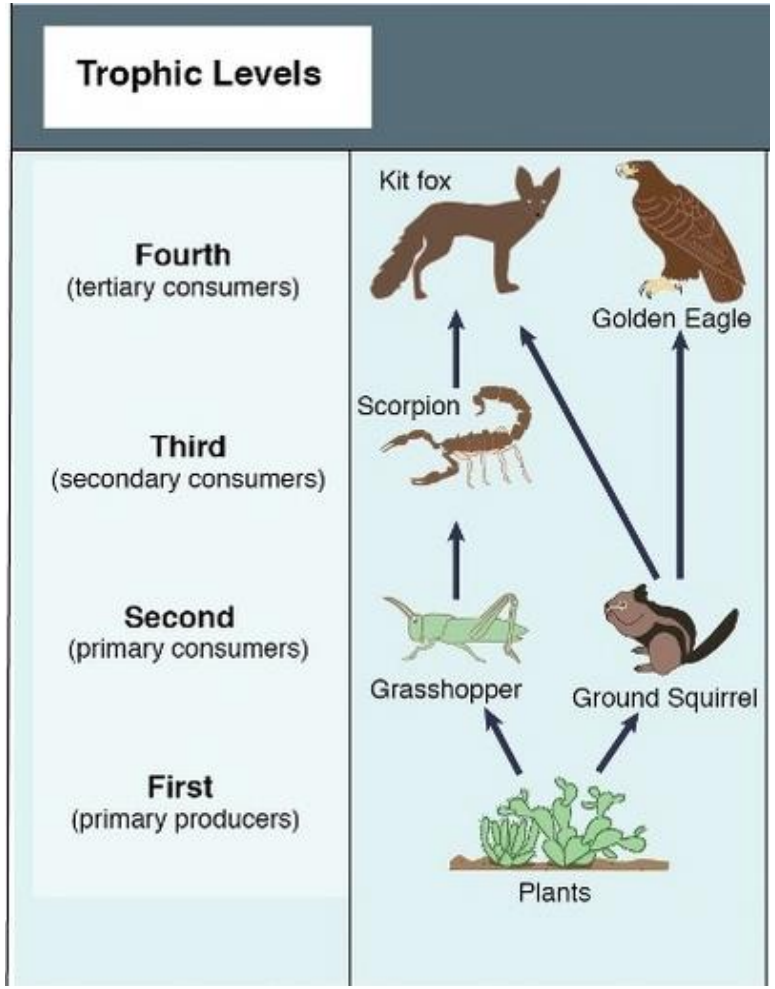
Teah Burke

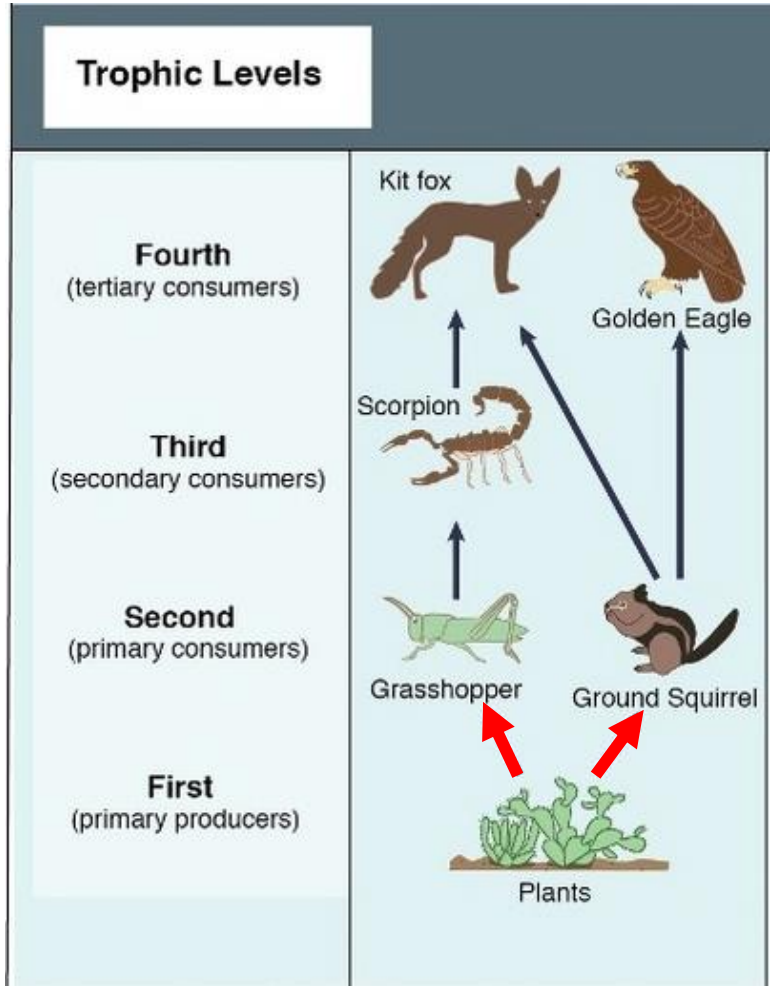
HUSSEY LAB

FOOD WEBS



SIMPLE

FOOD WEBS



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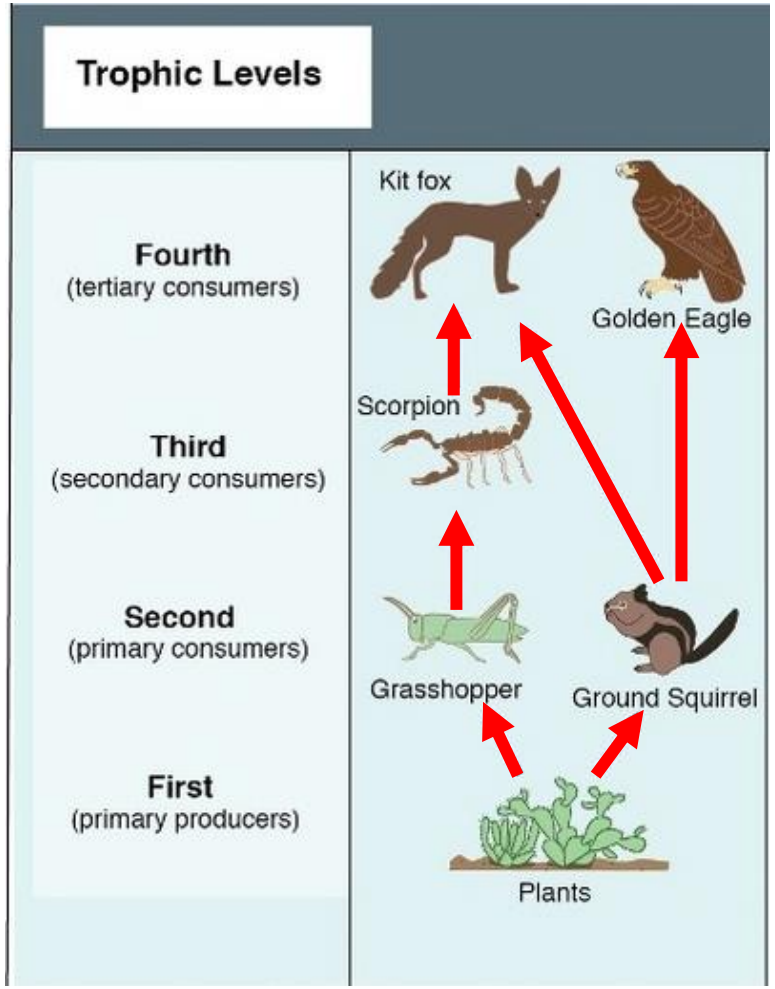

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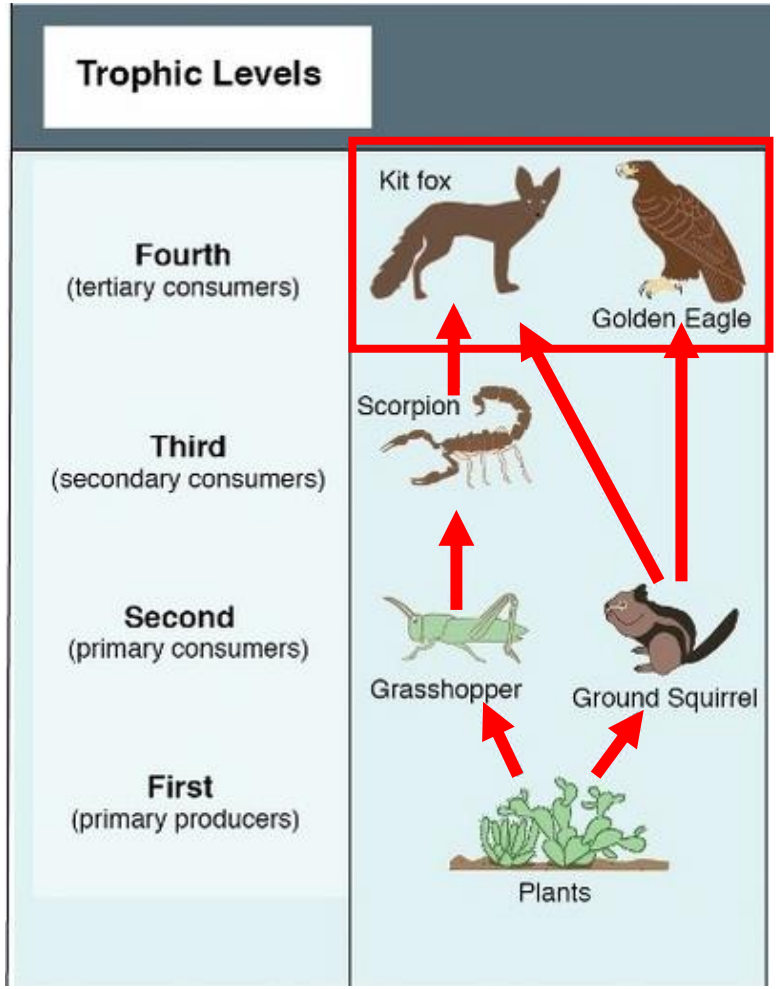

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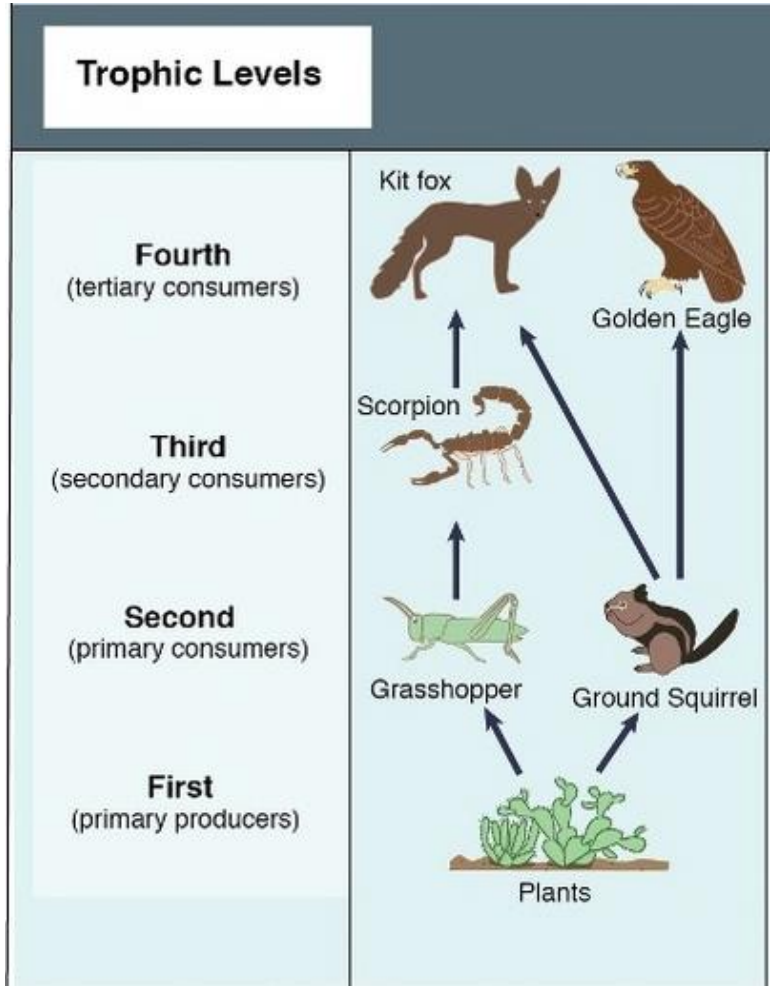
FOOD WEBS



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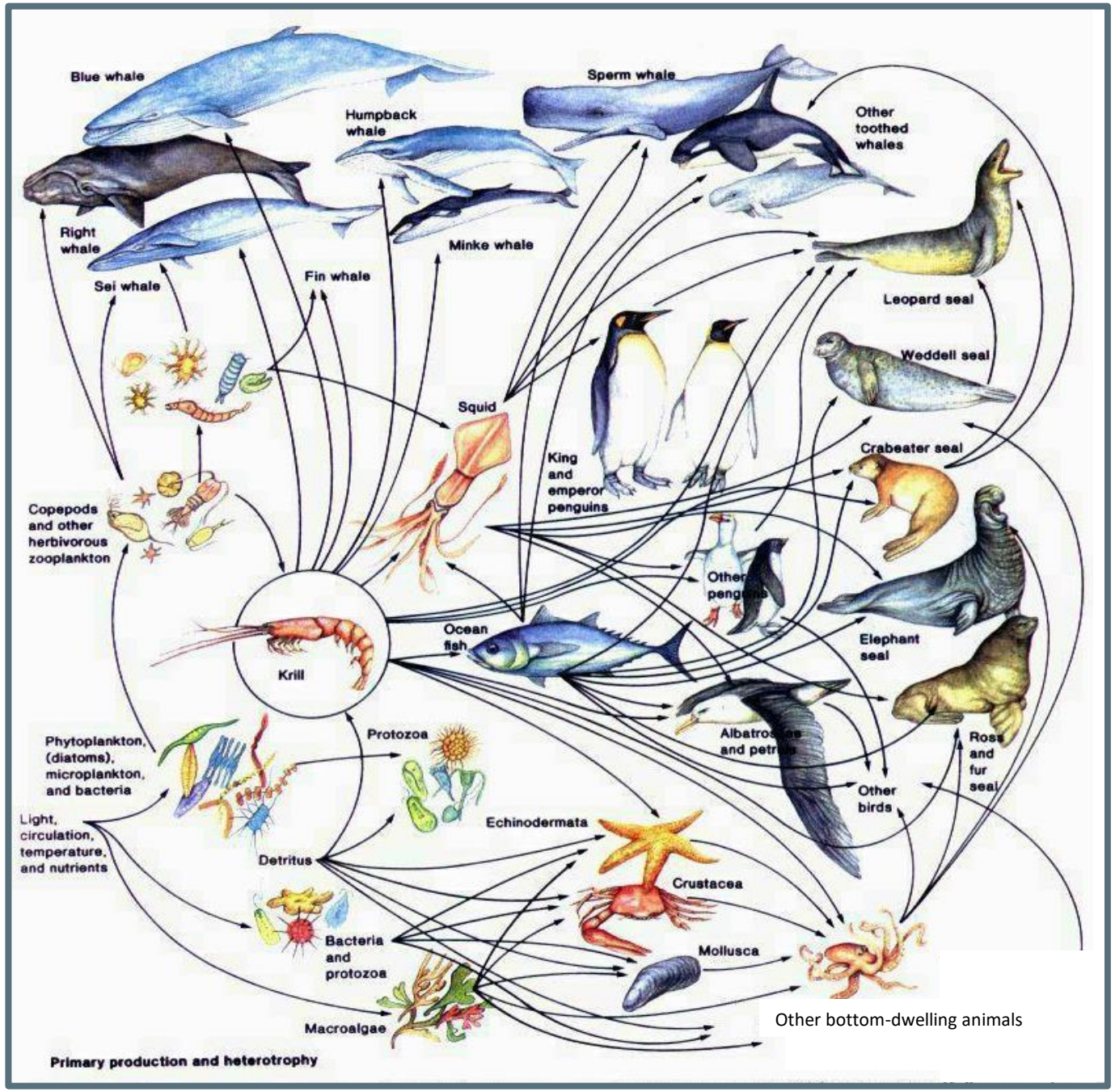
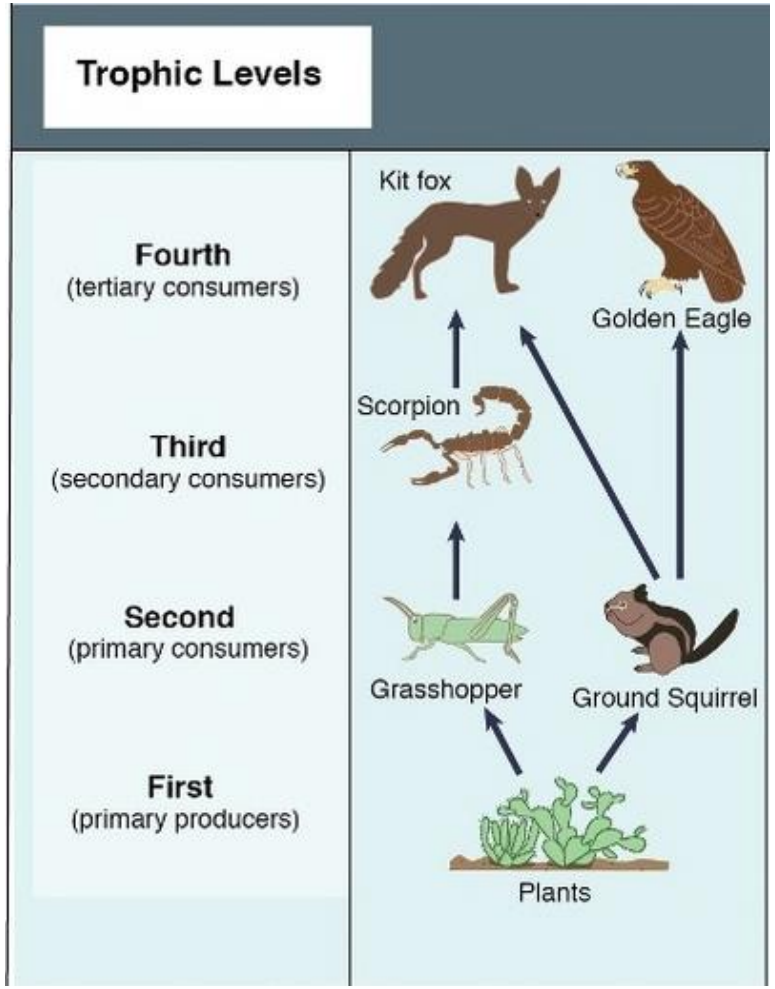


COMPLEX

FOOD WEBS



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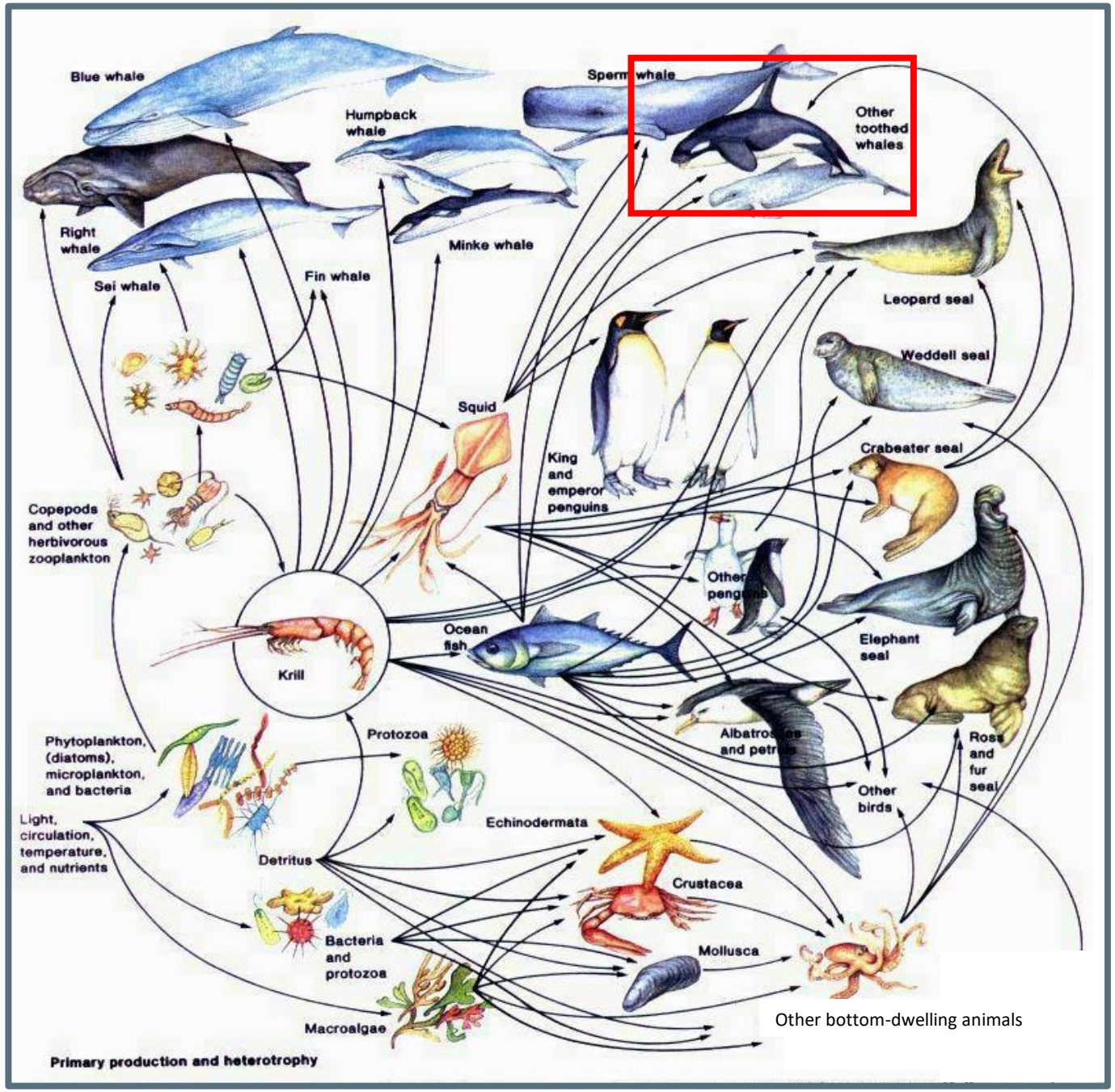

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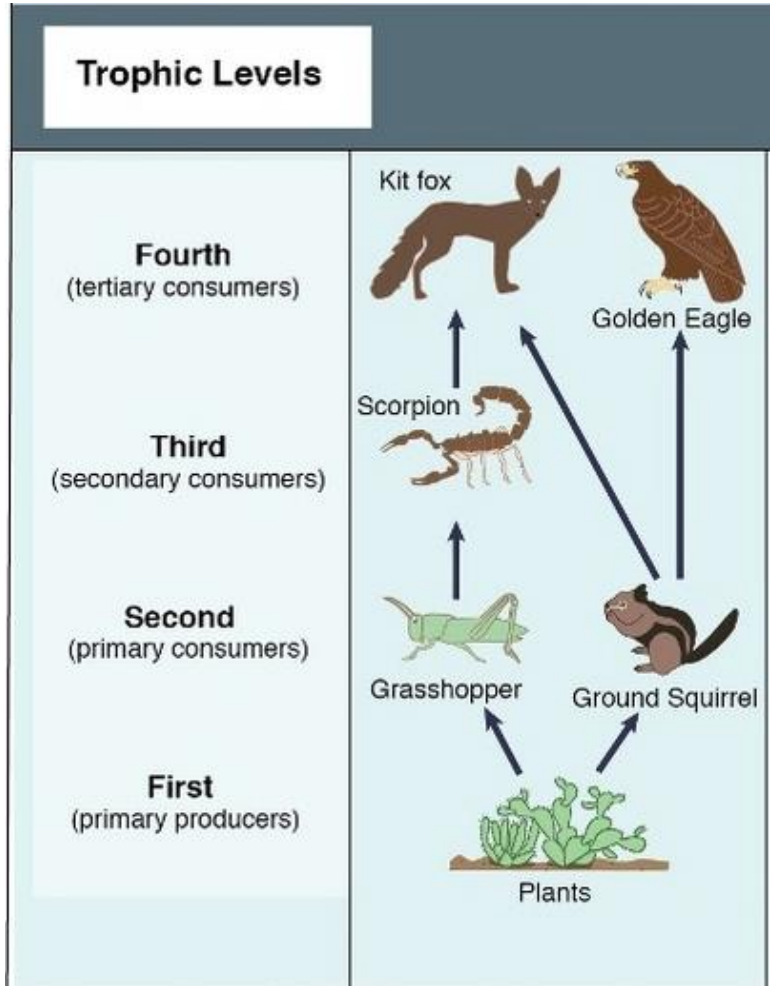

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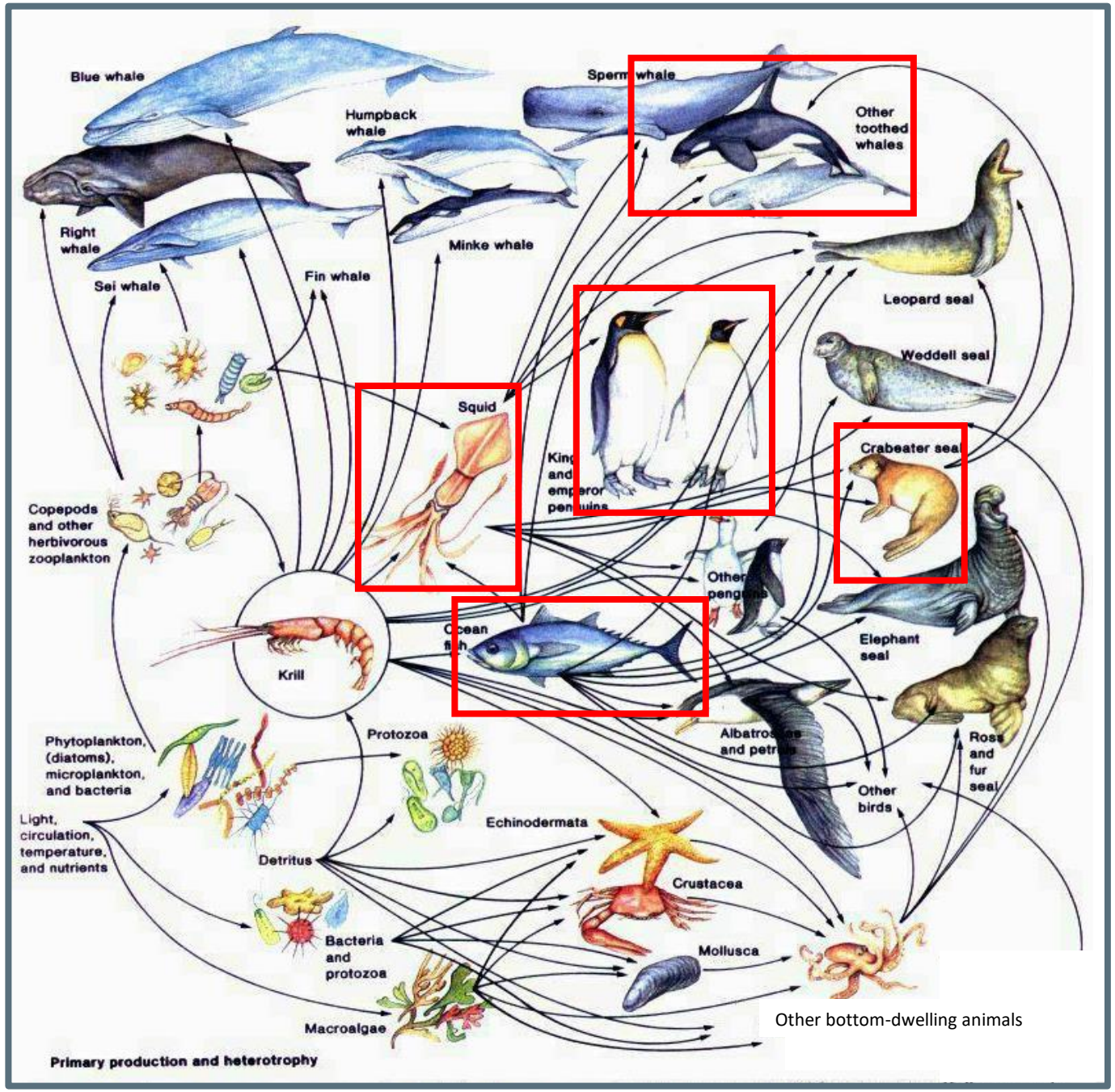
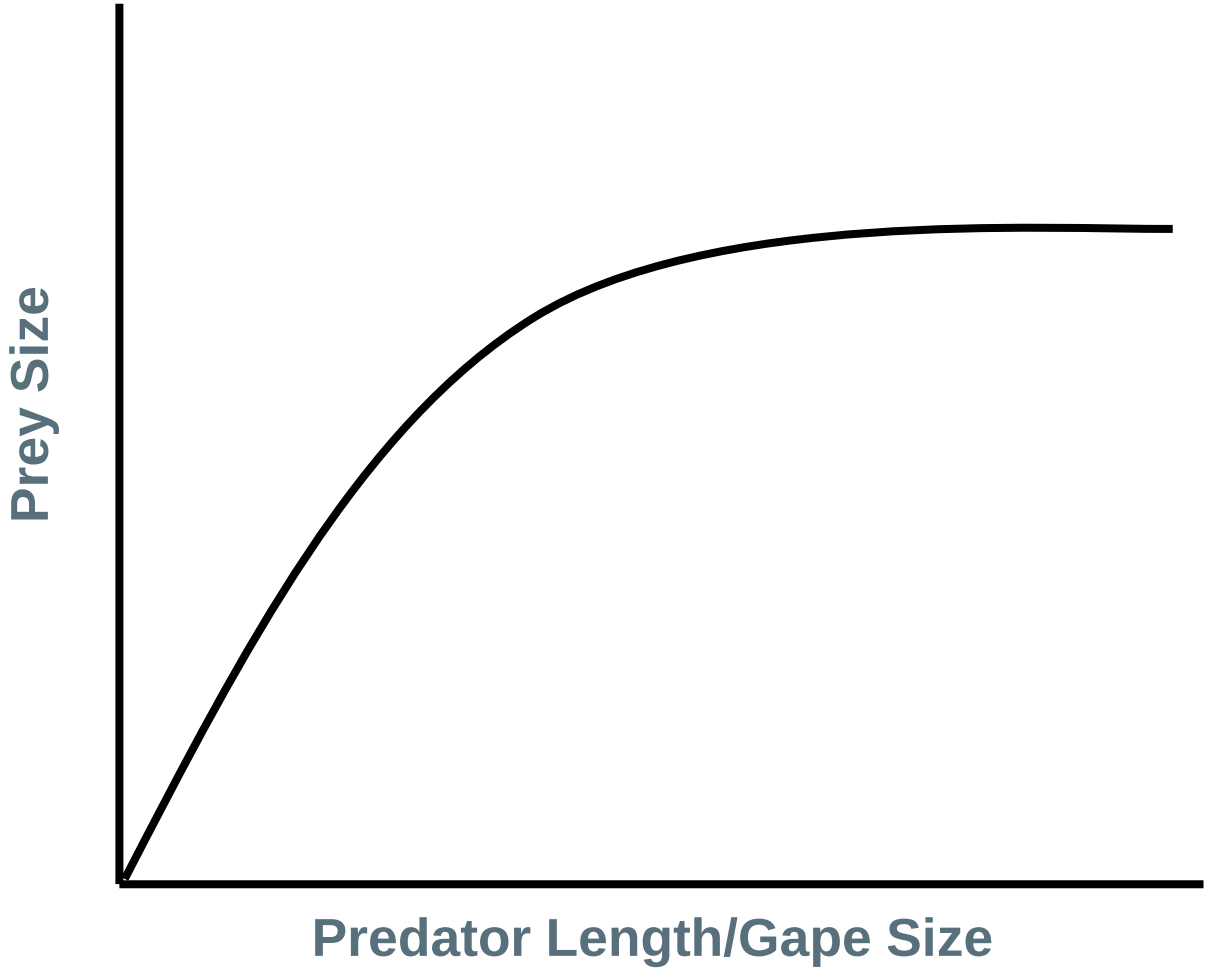


COMPLEX

PREY SIZE/SELECTION INCREASES WITH GAPE SIZE



Adapted from Scharf et al. 2000

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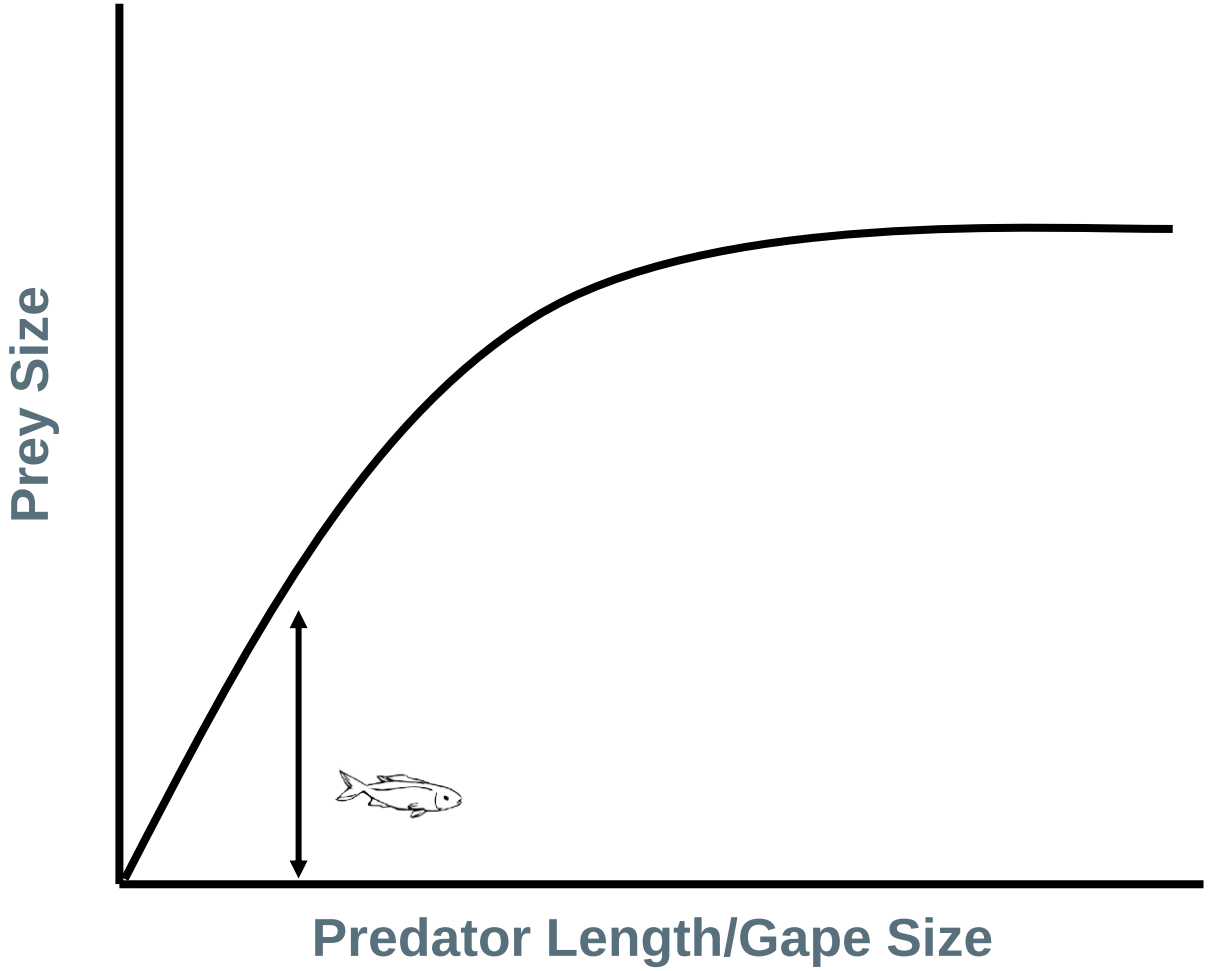

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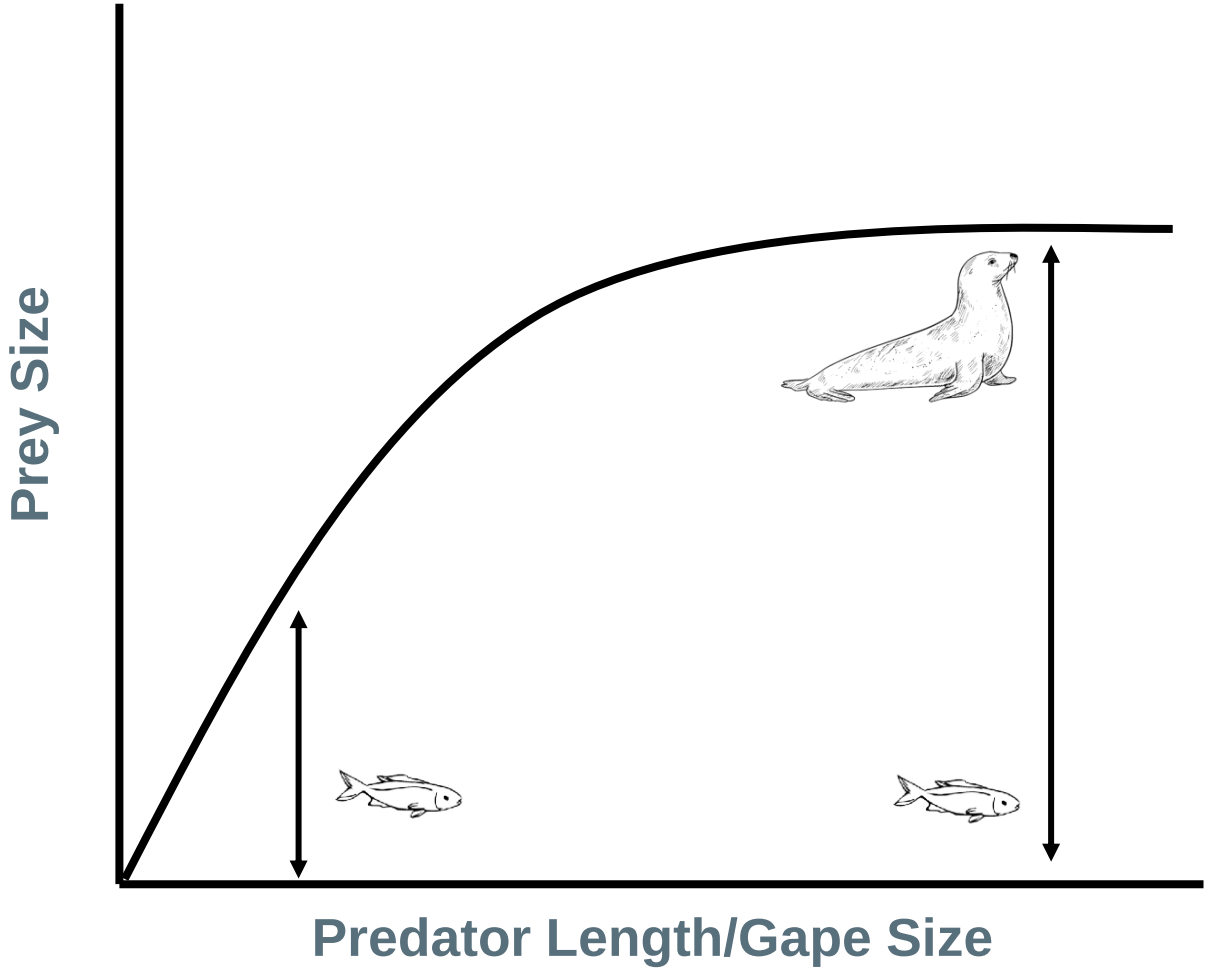


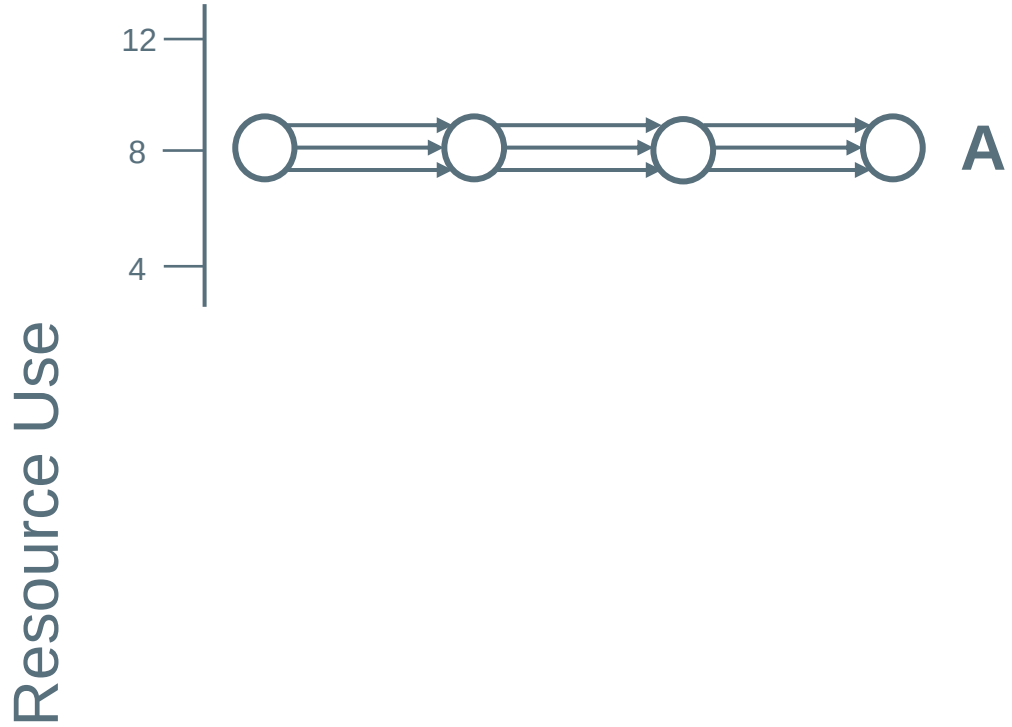
Adapted from Scharf et al. 2000

How do you quantify the role of predators in food webs?

SPECIALISTS AND GENERALISTS

Adapted from Vander Zanden et al. 2010

SPECIALISTS AND GENERALISTS



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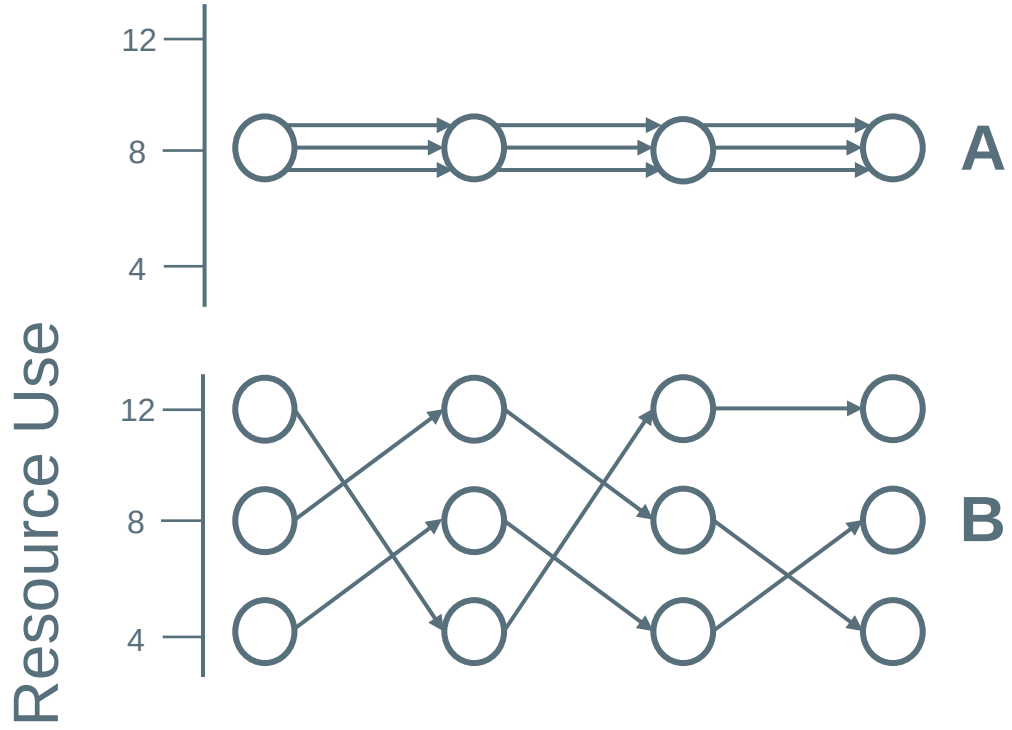

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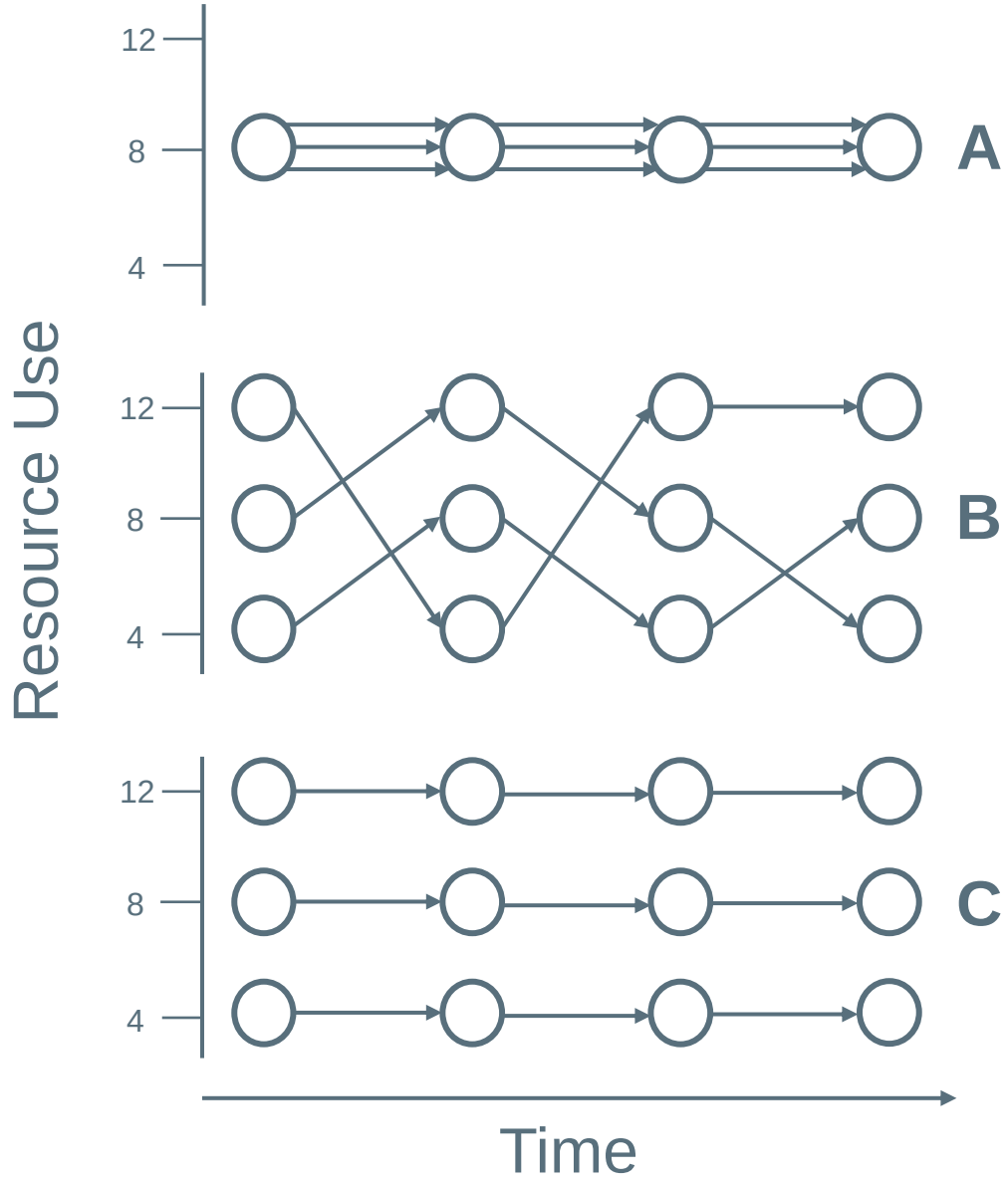
SPECIALISTS AND GENERALISTS



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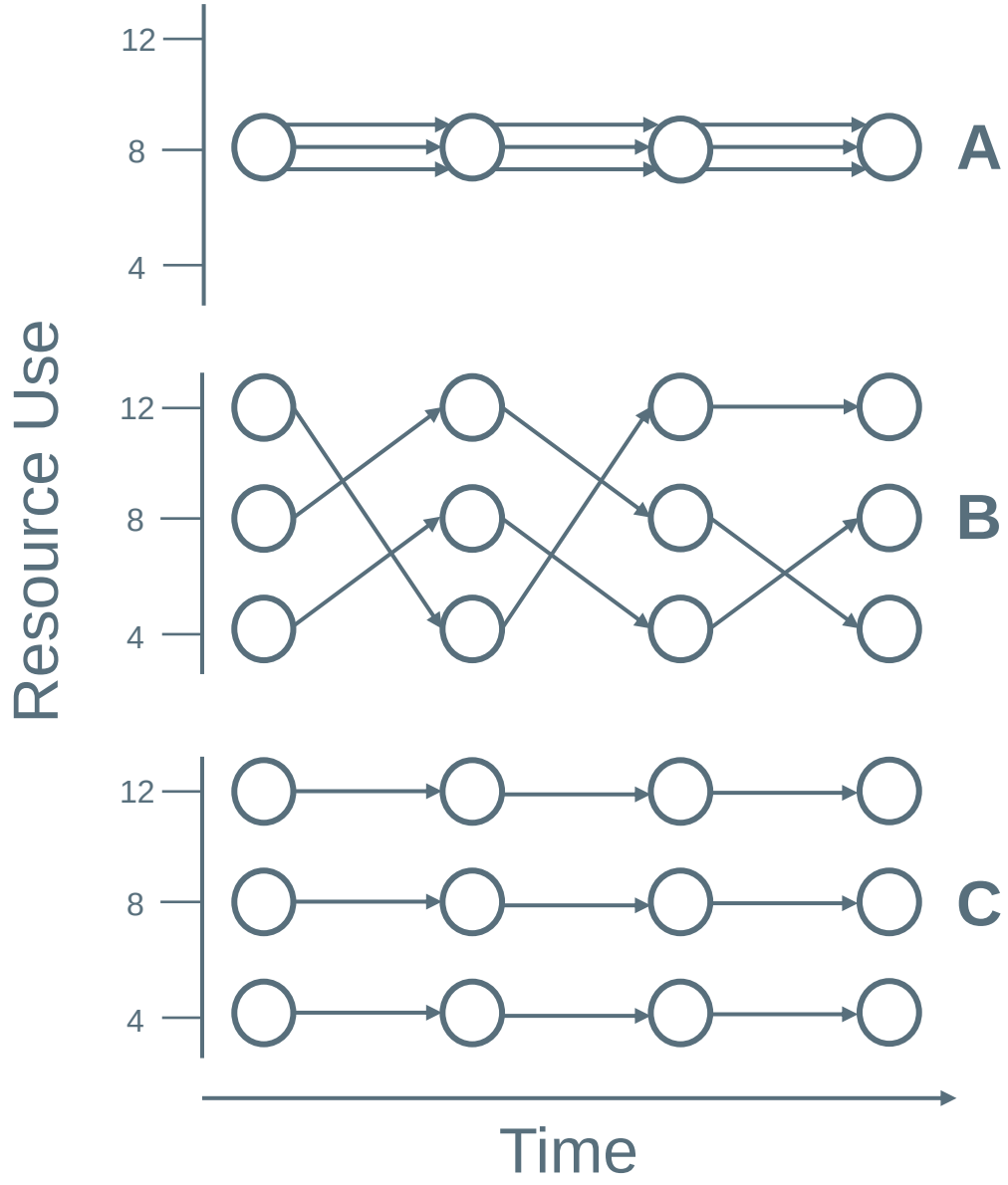
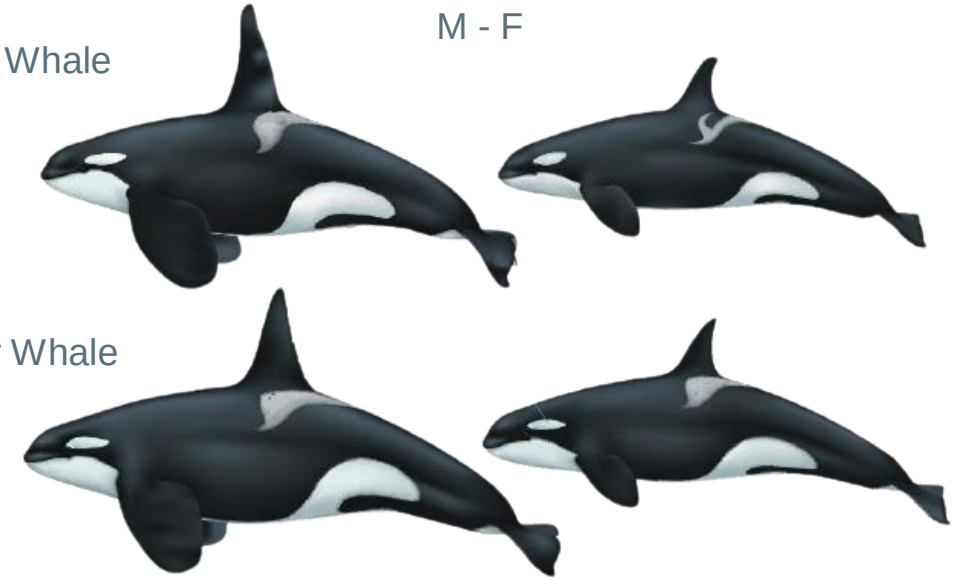
SPECIALISTS AND GENERALISTS



Resident Killer Whale

M - F

Transient Killer Whale



Adapted from Vander Zanden et al. 2010; The Whale Sanctuary Project, 2011

RESEARCH QUESTION

Are marine top predators generalists?

WHITE SHARKS

Apex predator found throughout the world's oceans from temperate to tropical regions (Compagno, 1984).

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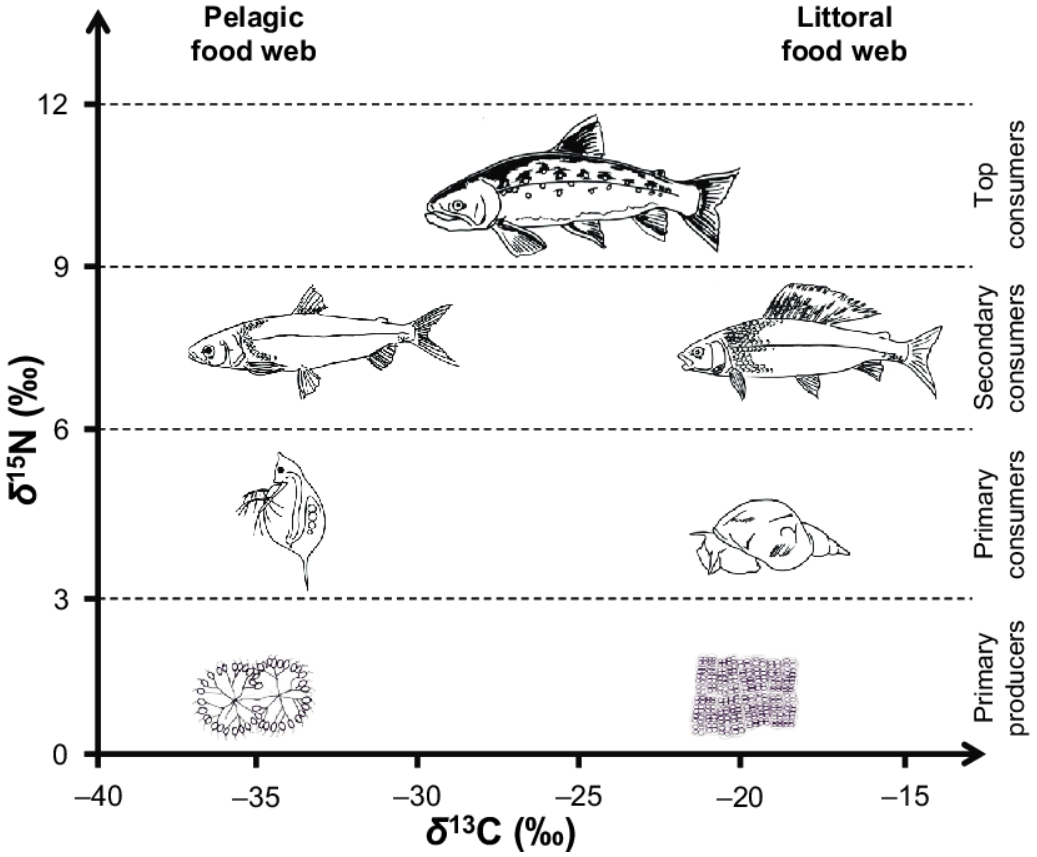
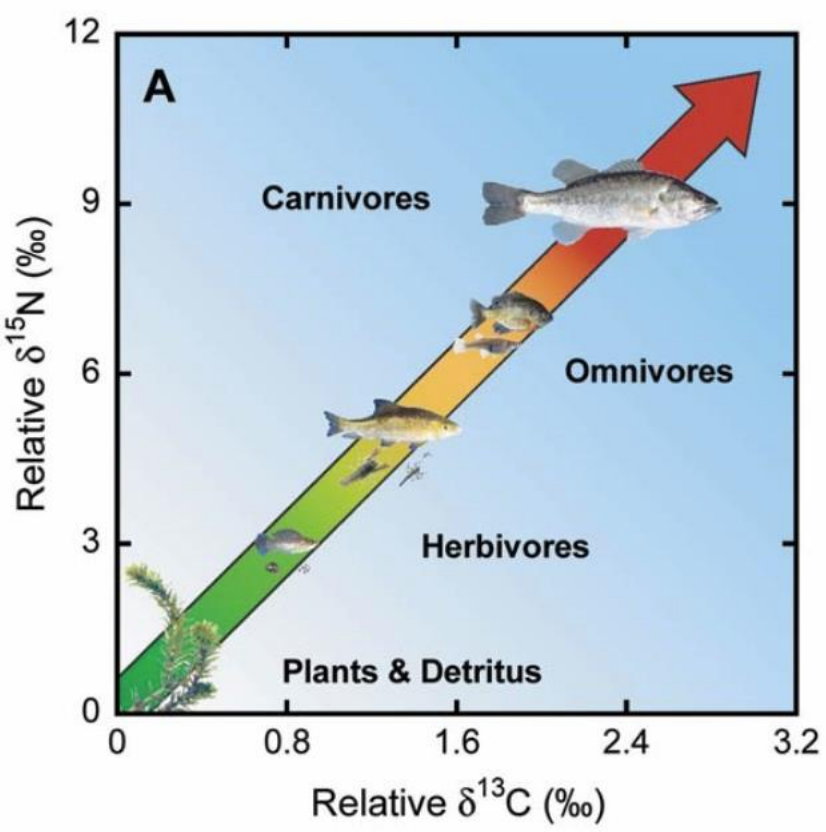
STABLE ISOTOPE ANALYSIS (SIA)

An organism's tissues will reflect a unique stable isotope composition based on its diet and environment (Peterson and Fry, 1987).



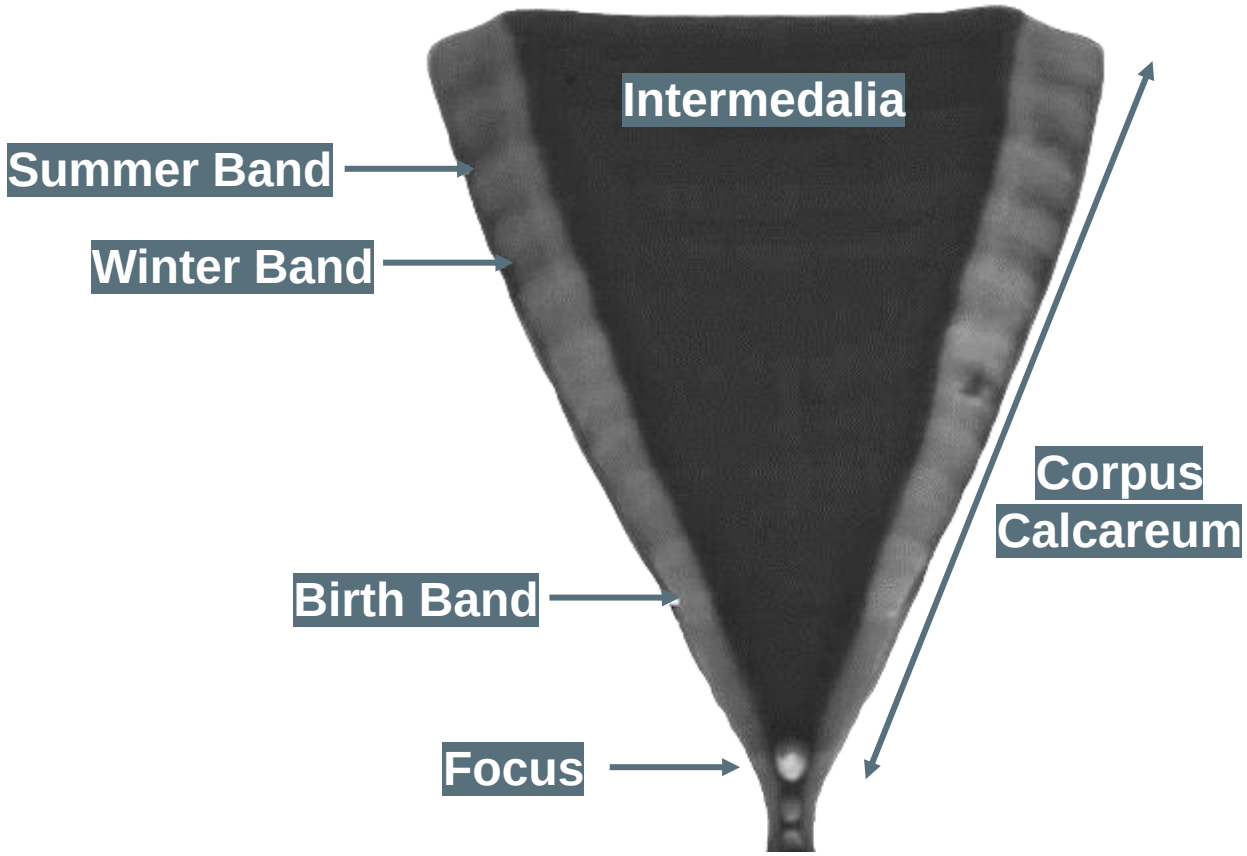


Eloranta, 2013; USGS

VERTEBRAE

Tillett et al. 2011

VERTEBRAE



Tillett et al. 2011

METHODS

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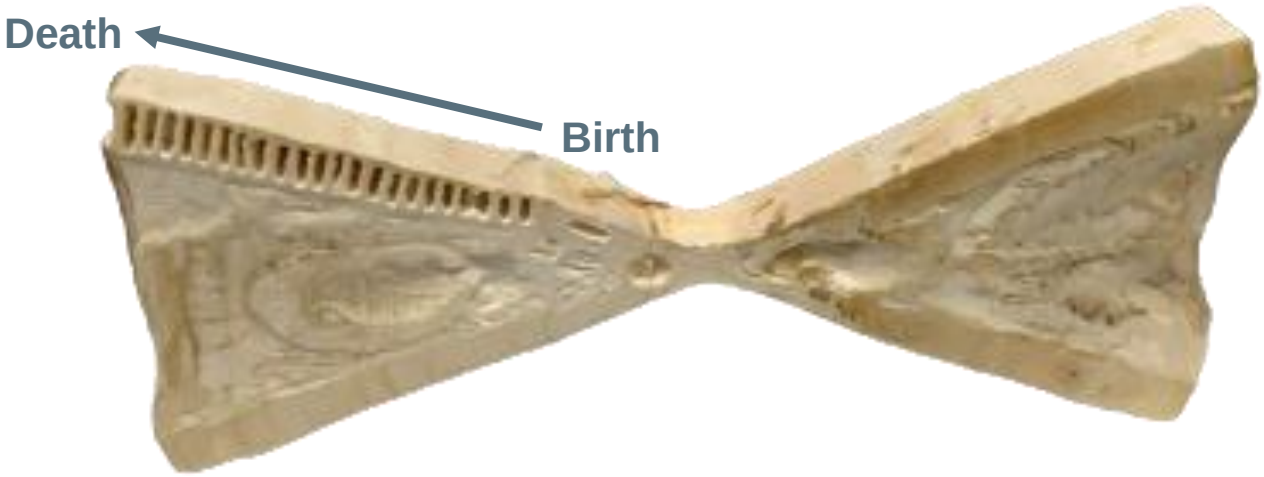

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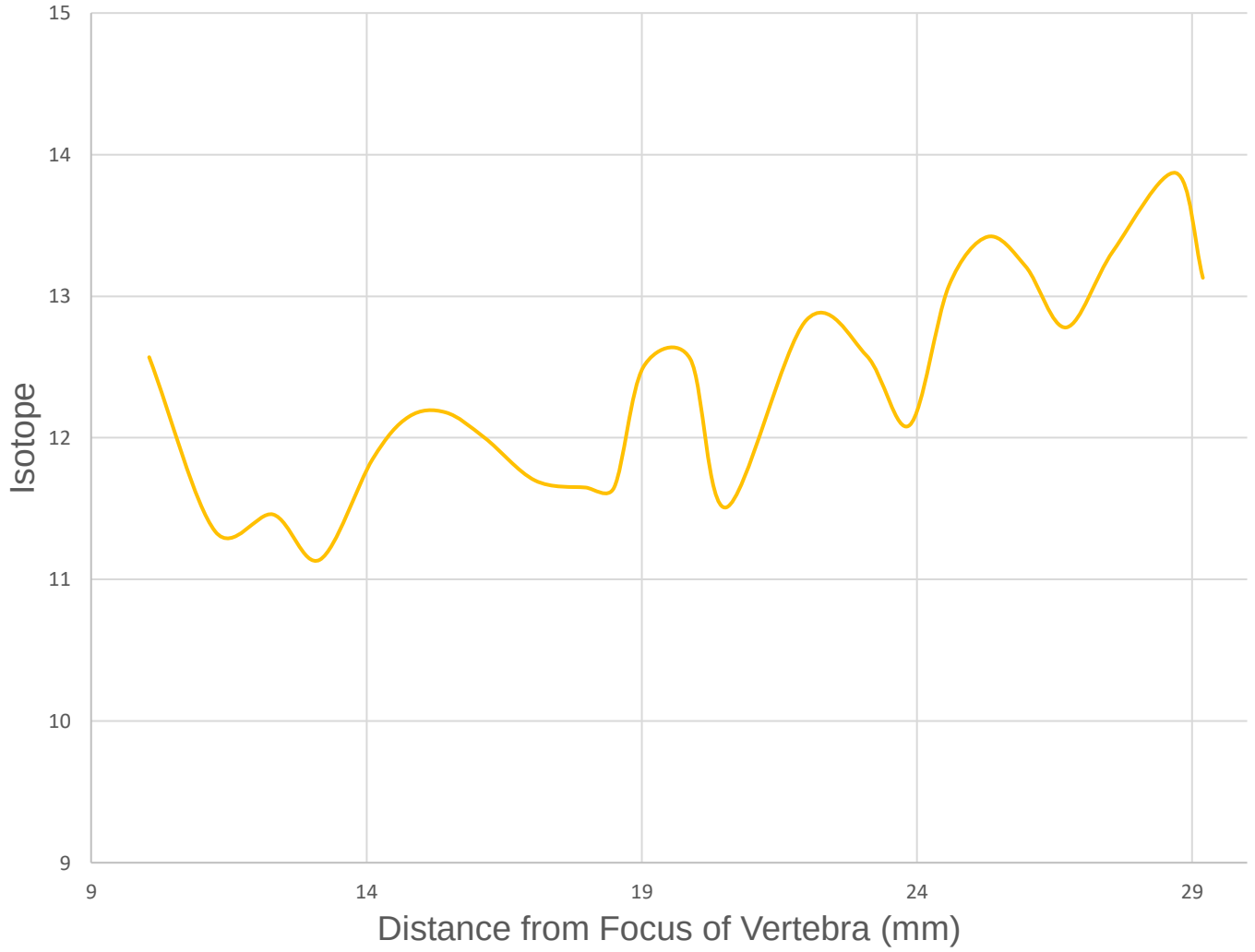
15
14
13
12
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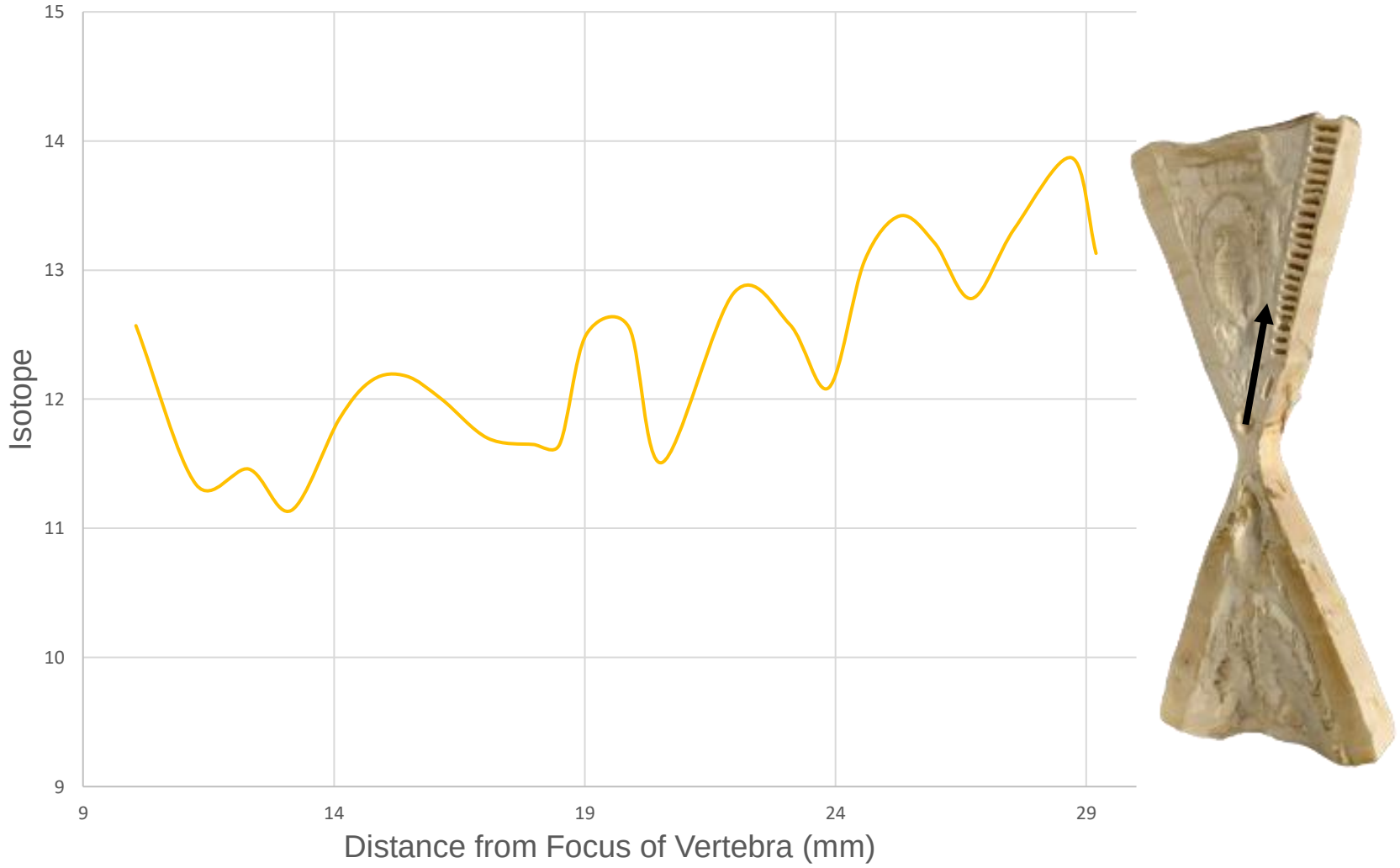
10
9
Isotope
9
14
19
24
29
Distance from Focus of Vertebra (mm)

METHODS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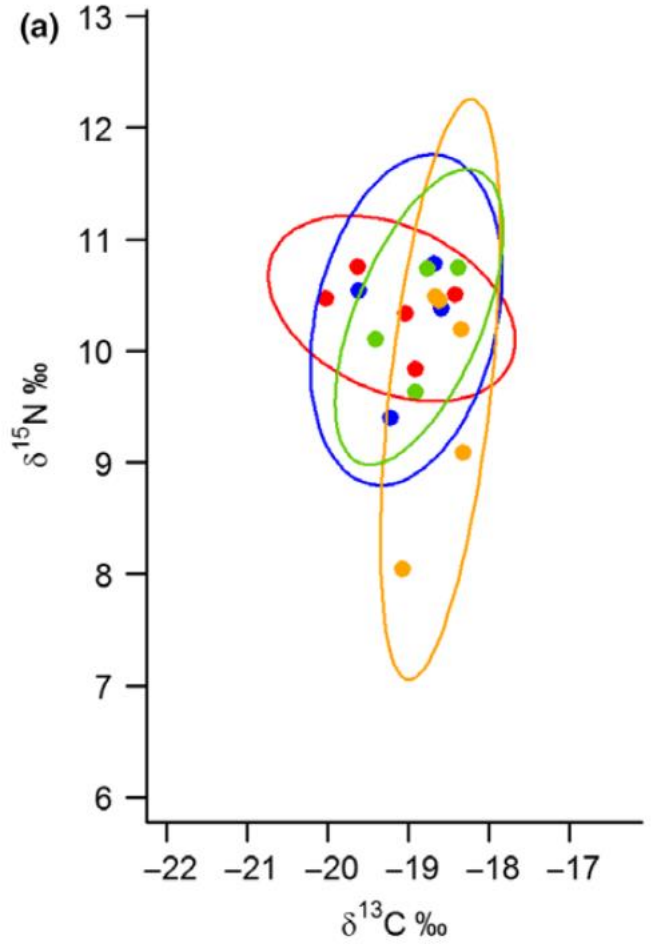
9
14
19
24
29
Distance from Focus of Vertebra (mm)

How do we address specialists and generalists?

RELATIVE INDIVIDUAL NICHE WIDTH (RINI)

$$RINI = SEA_{Ind}/TNW$$



Sheppard et al. 2018

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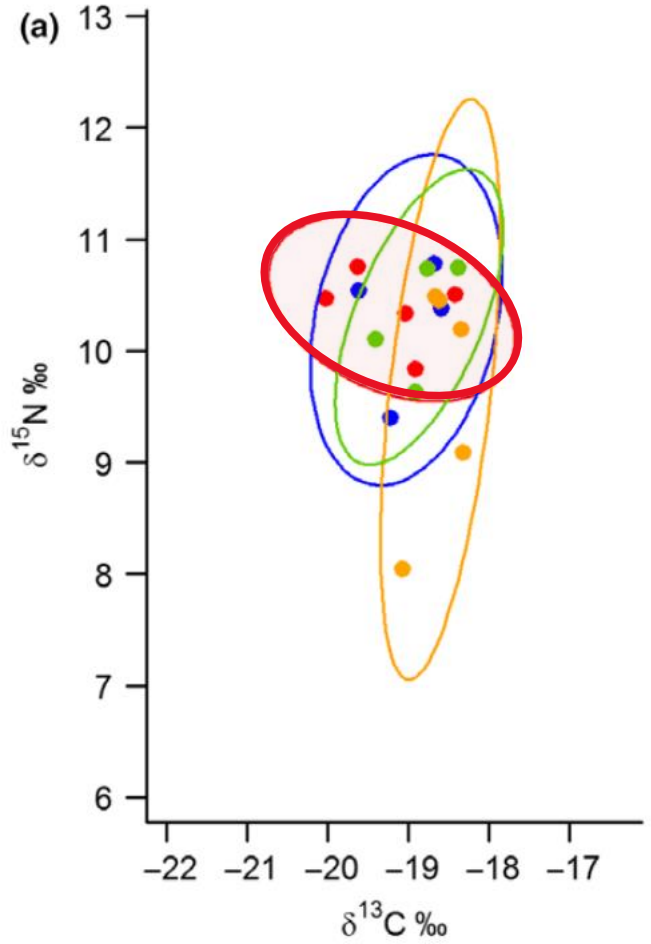

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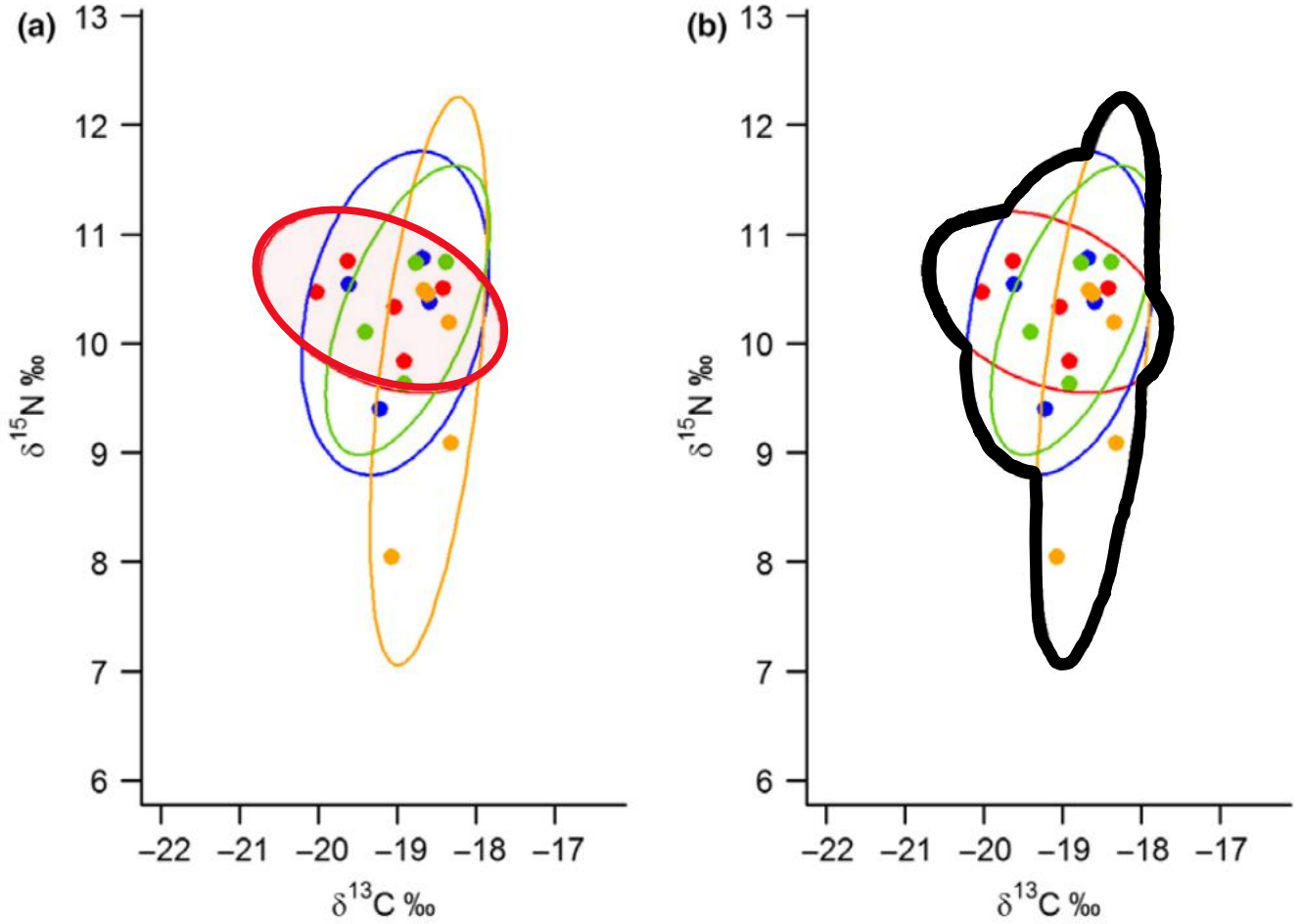

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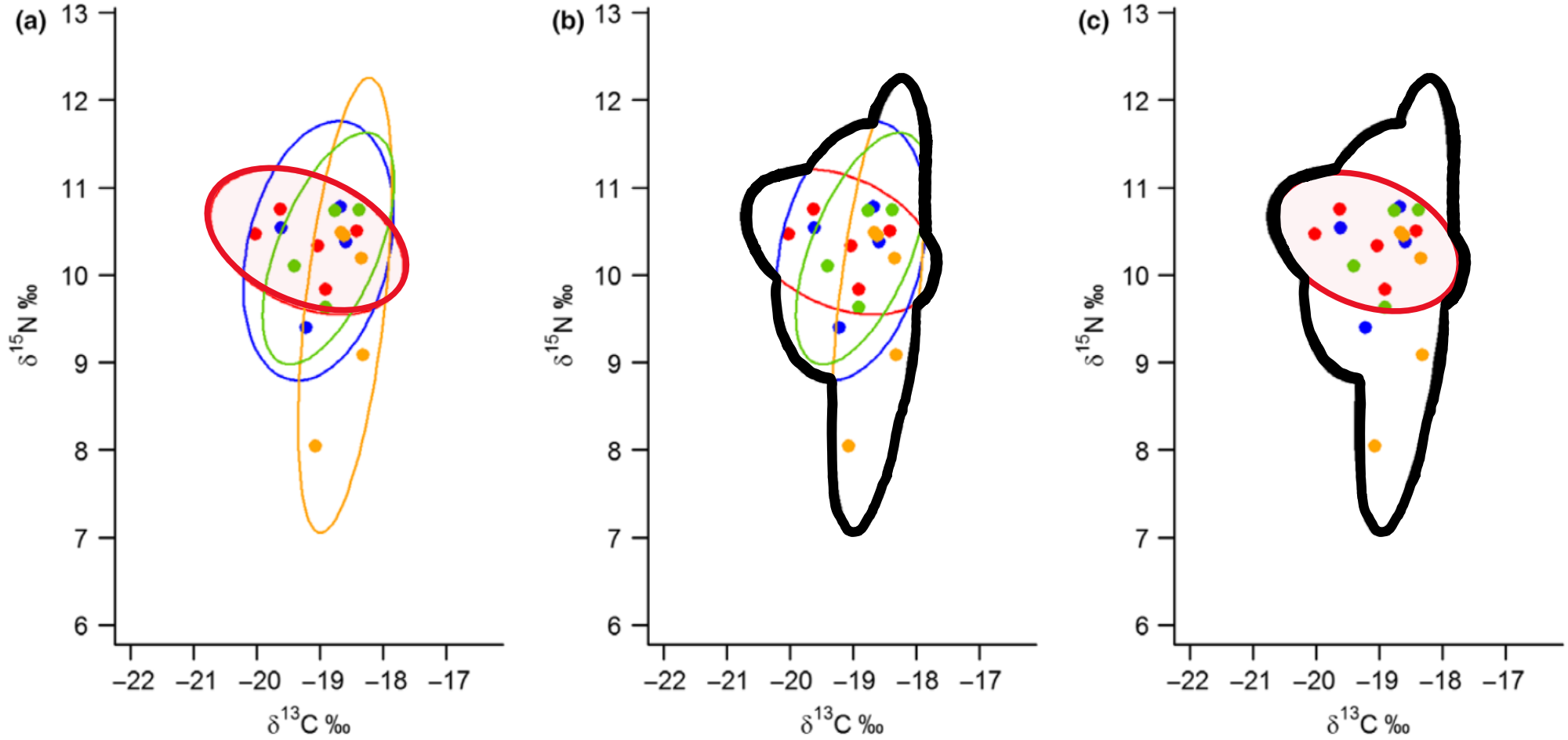

Sheppard et al. 2018

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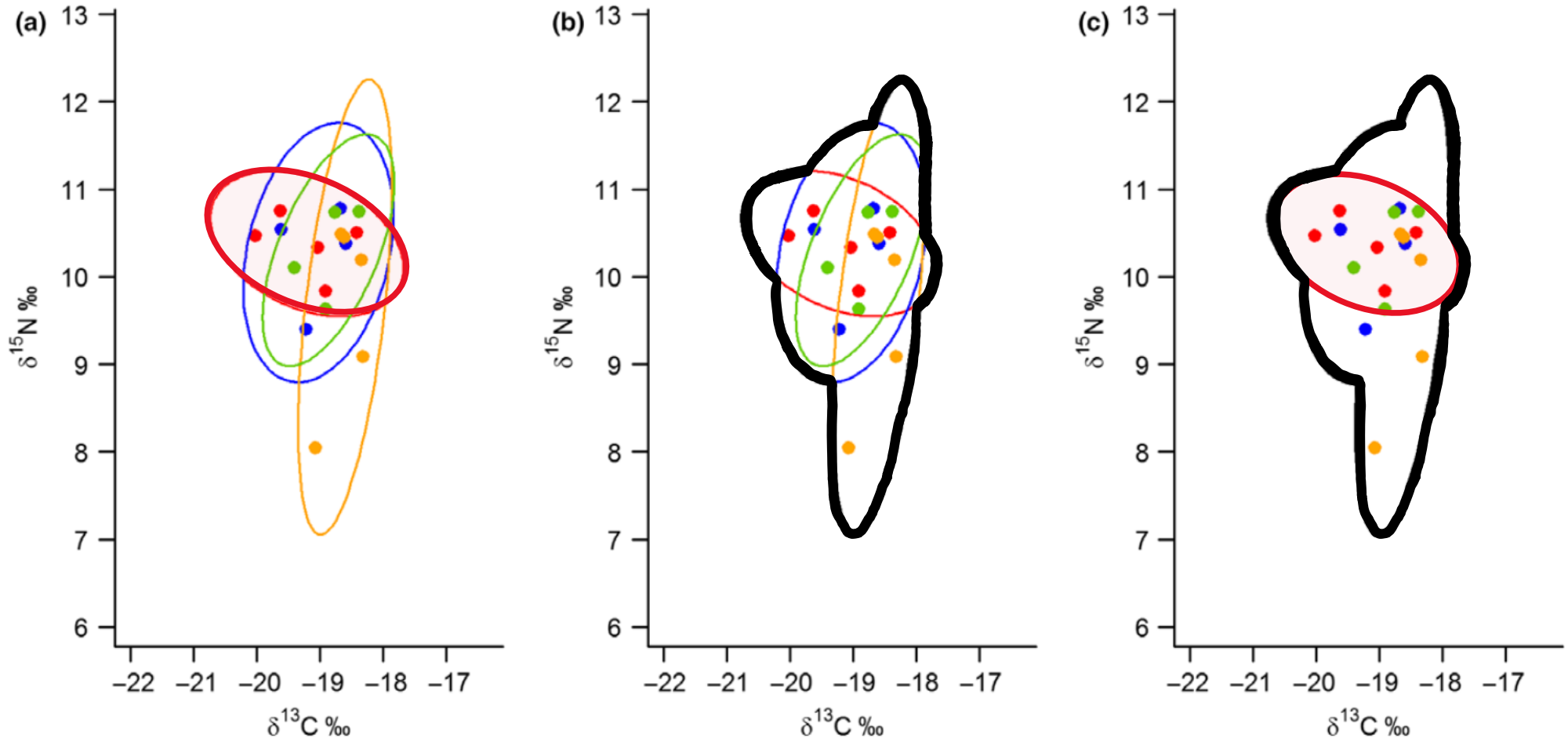
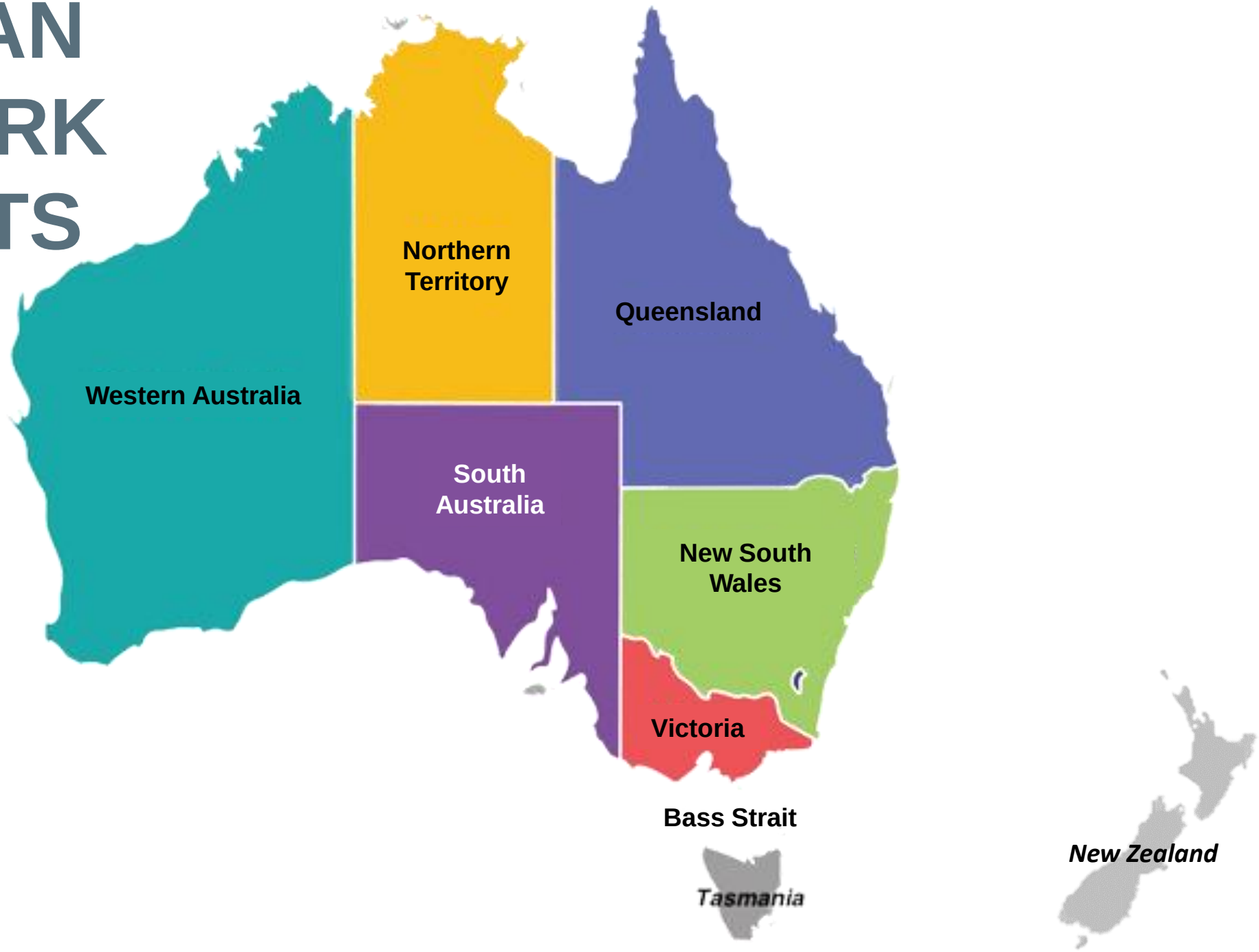


0 (complete specialist) → **1** (complete generalist)

Sheppard et al. 2018

Evidence for subpopulations within Australian white sharks

AUSTRALIAN WHITE SHARK MOVEMENTS



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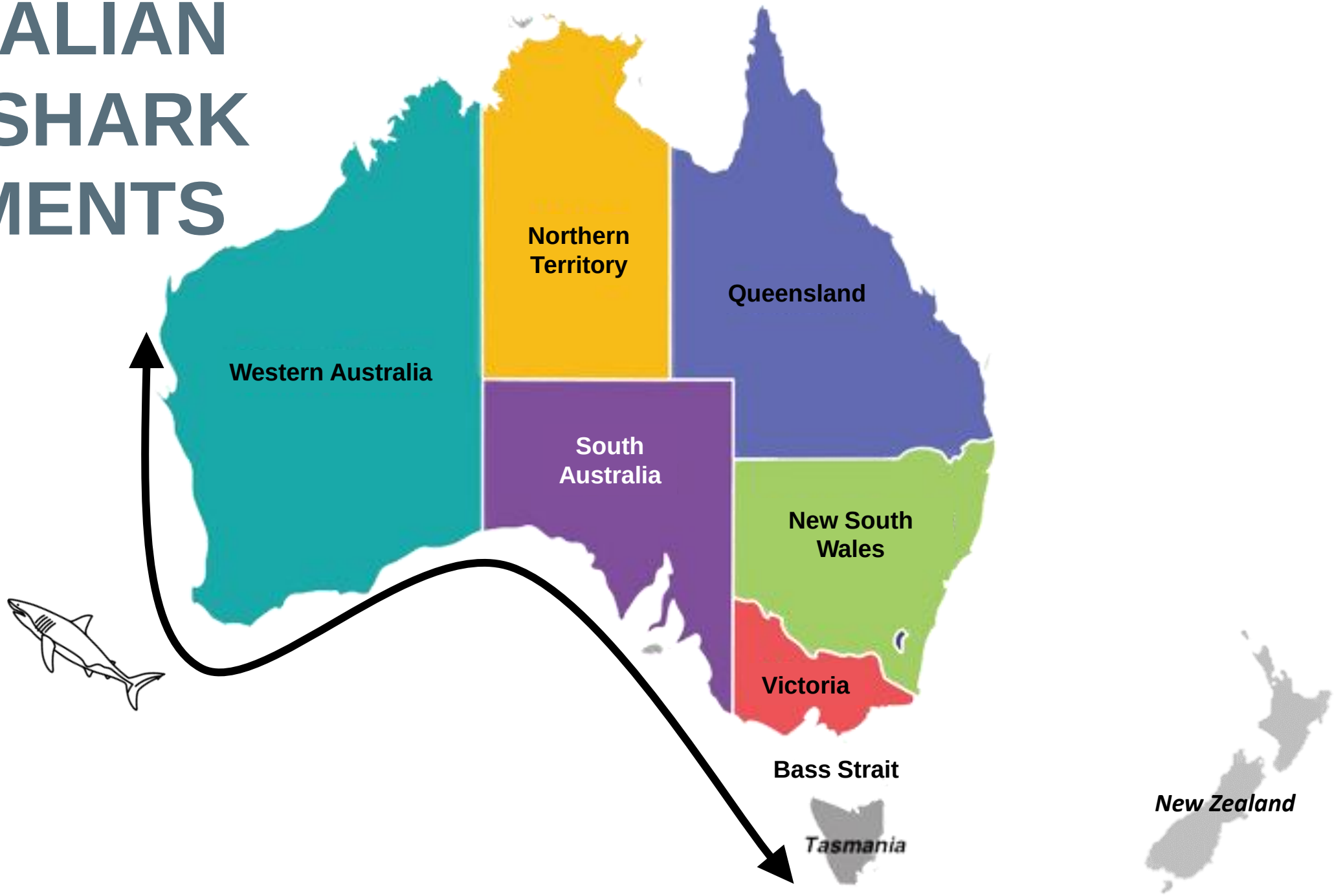

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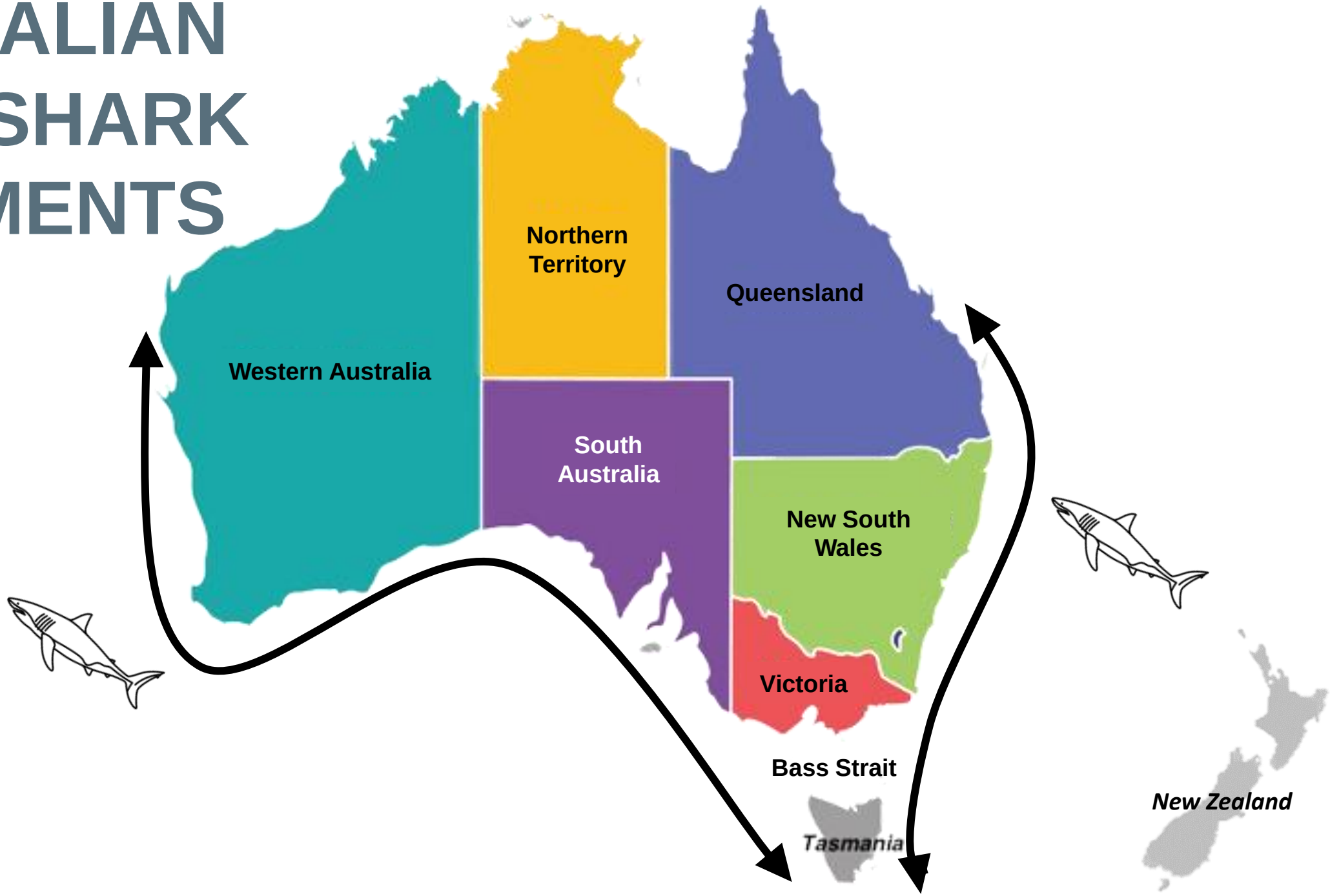

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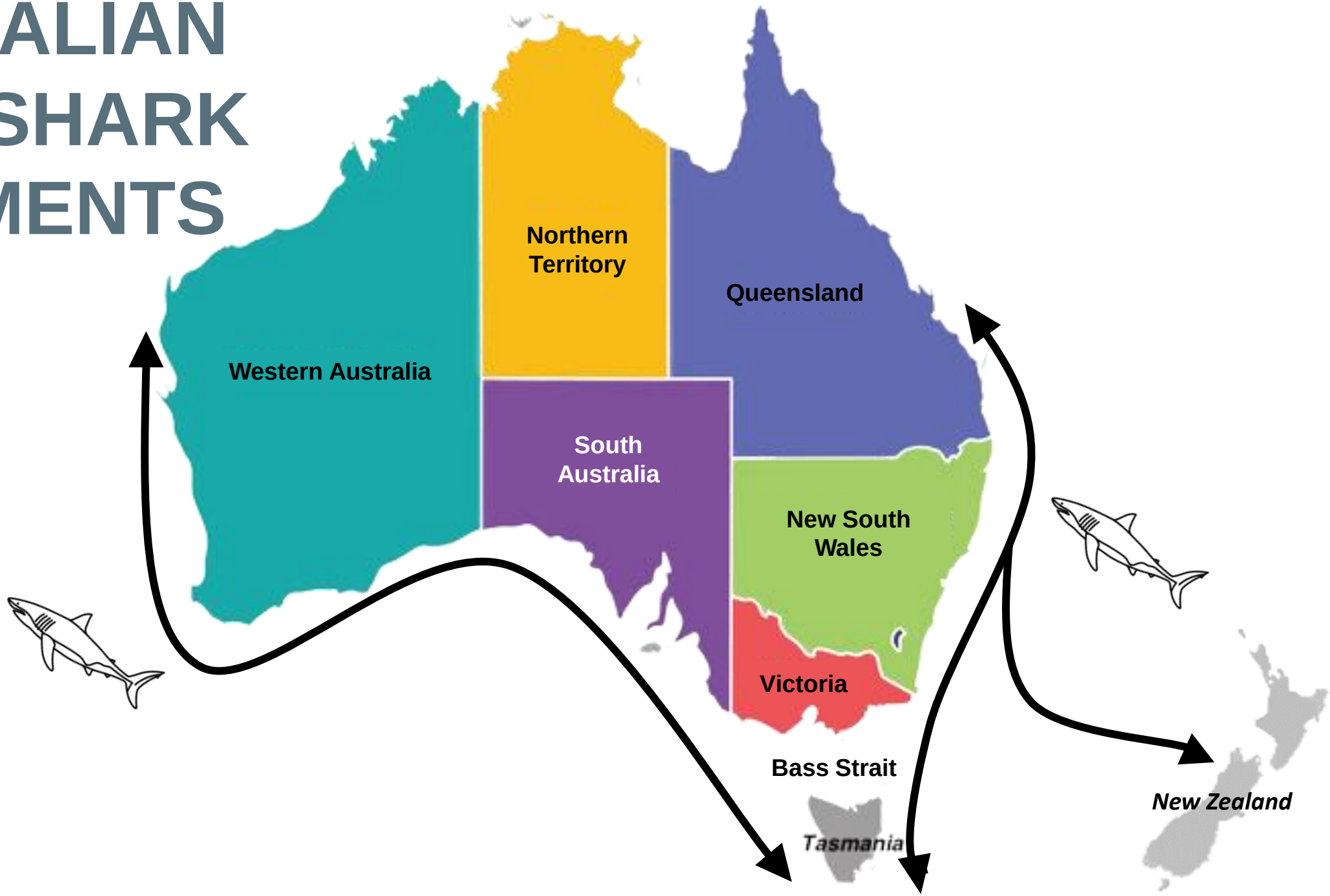
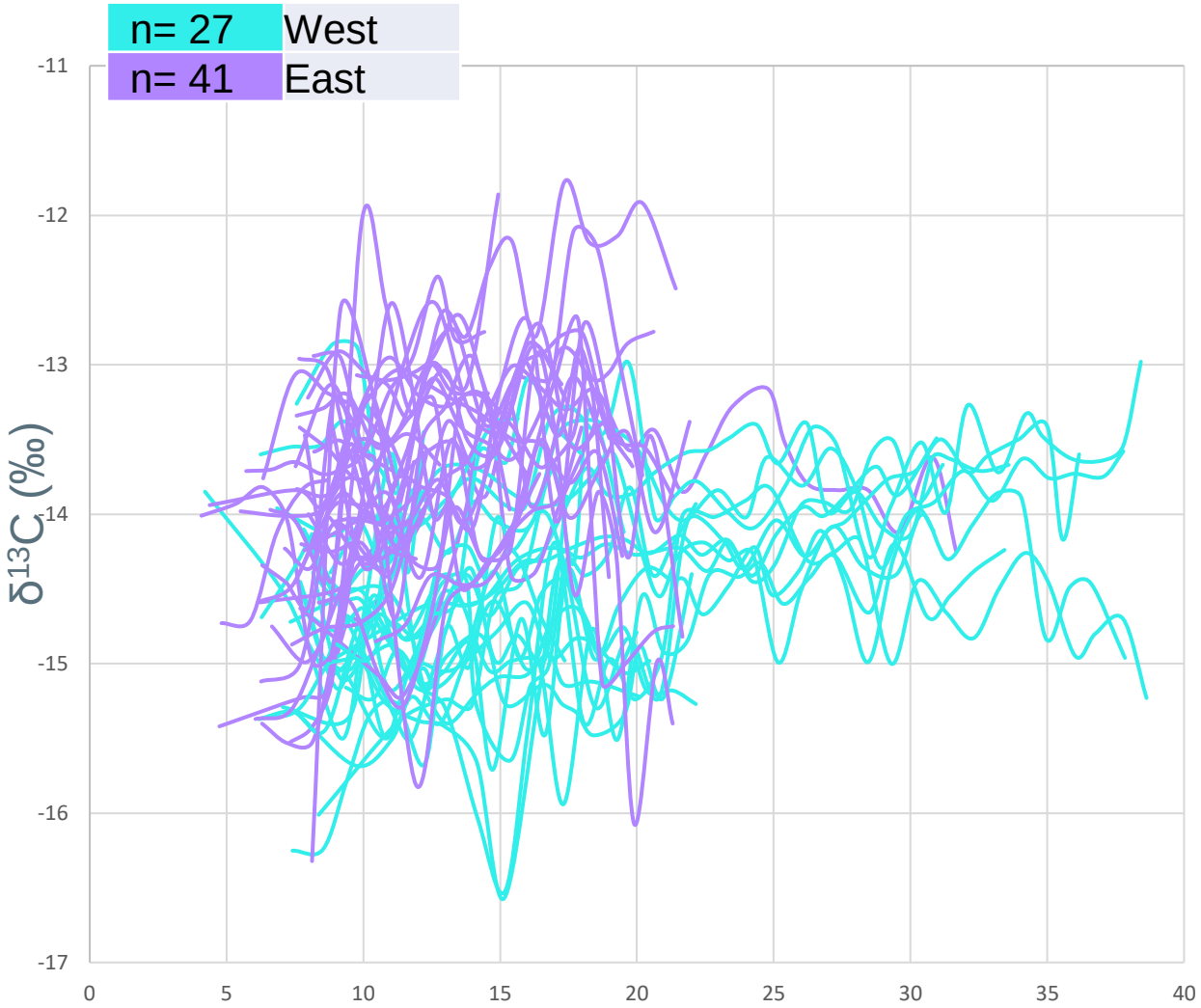


ONTOGENETIC $\delta^{13}C$

Drill Mark (mm)	Shark TL (cm)
5	116.649
10	173.664
15	230.679
20	287.694
25	344.709
30	401.724
35	458.739
40	515.754



West Avg/Std = -14.44 ± 0.64; East Avg/Std = -13.76 ± 0.73; p <0.001

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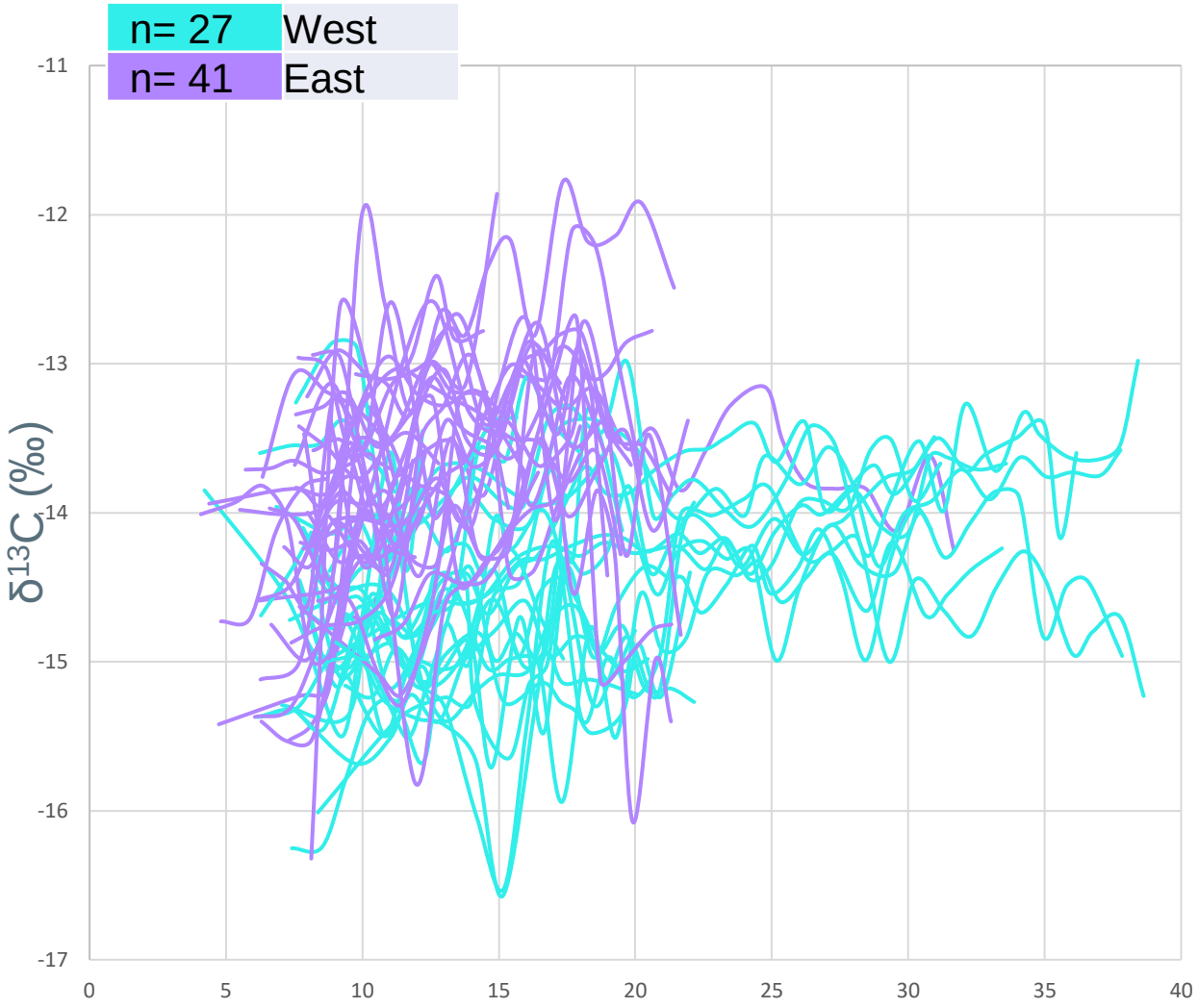

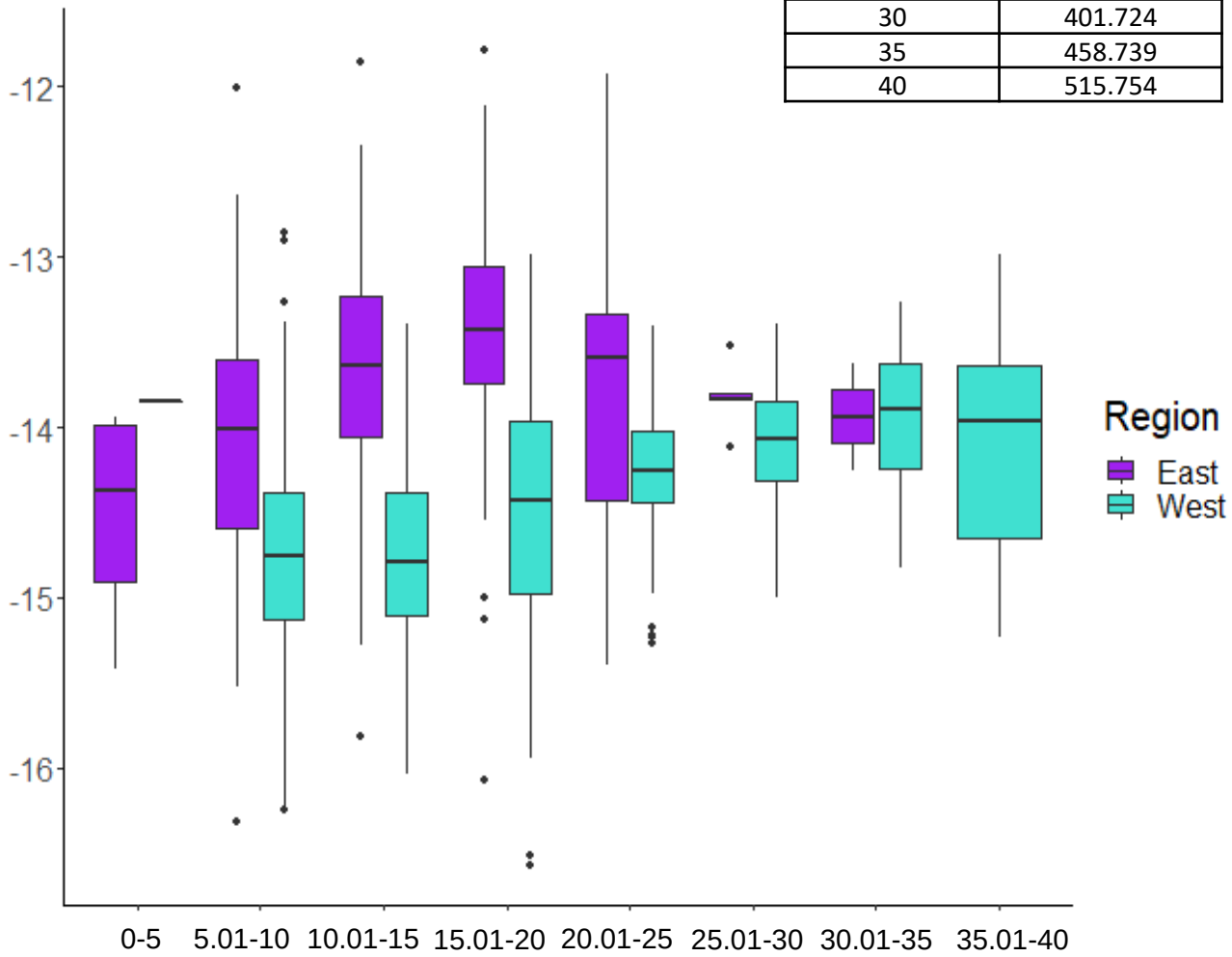

Distance from focus of vertebrae (mm)

West Avg/Std = -14.44 ± 0.64; East Avg/Std = -13.76 ± 0.73; p <0.001

ONTOGENETIC $\delta^{15}N$

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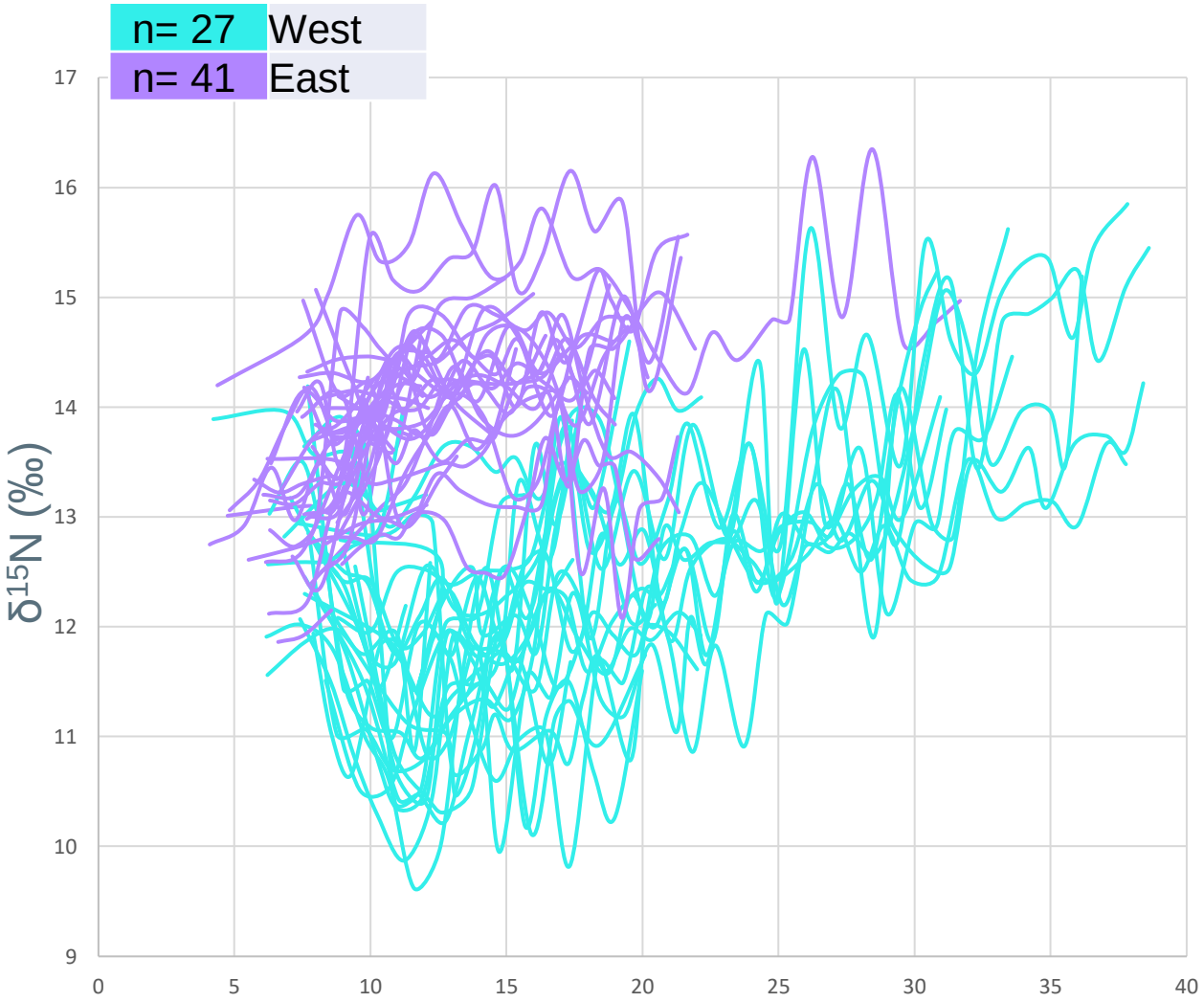

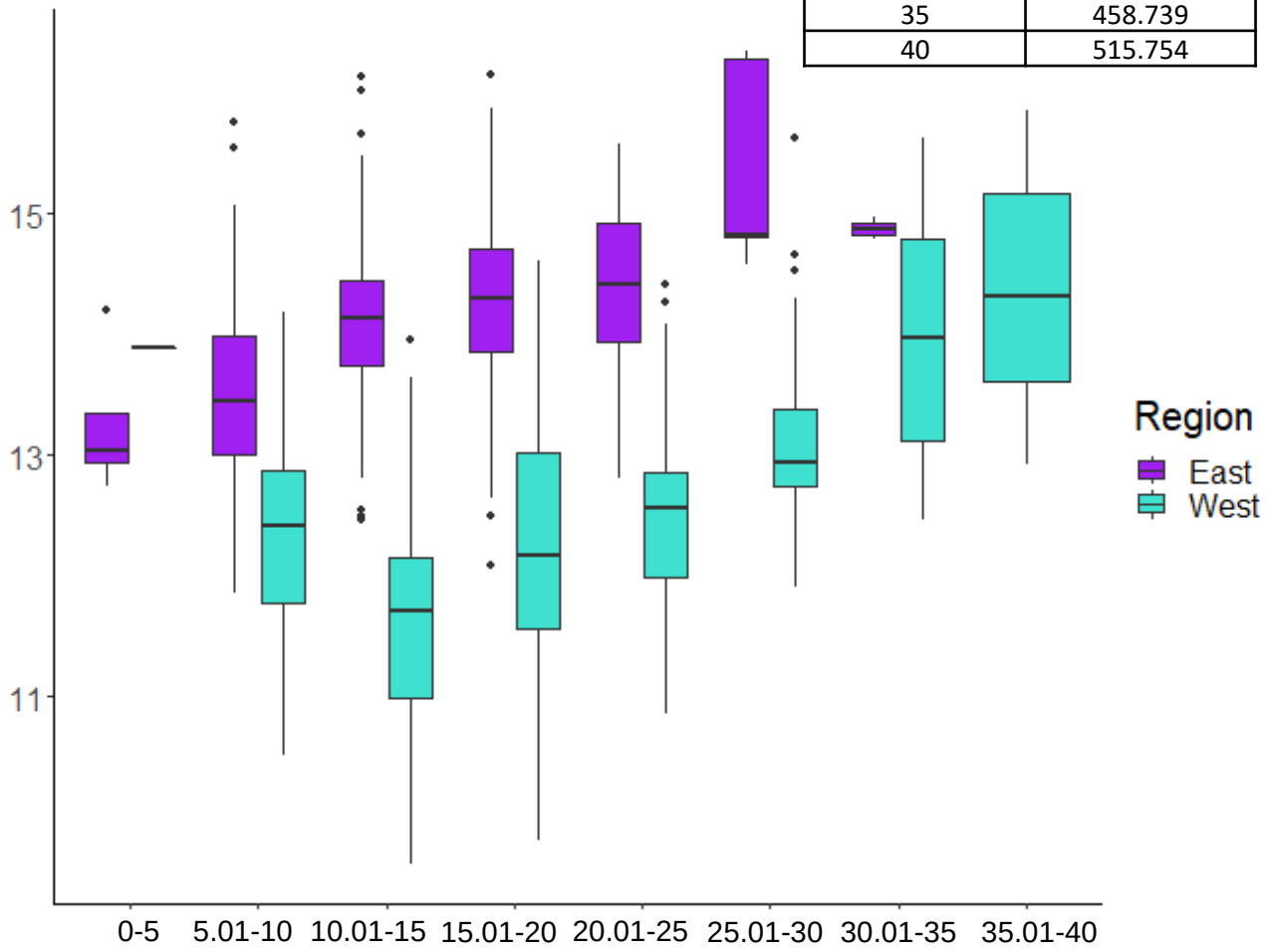

Distance from focus of vertebrae (mm)

West Avg/Std = 12.47 ± 1.17; East Avg/Std = 13.99 ± 0.79; p <0.001

ONTOGENETIC $\delta^{15}N$

Drill Mark (mm)	Shark TL (cm)
5	116.649
10	173.664
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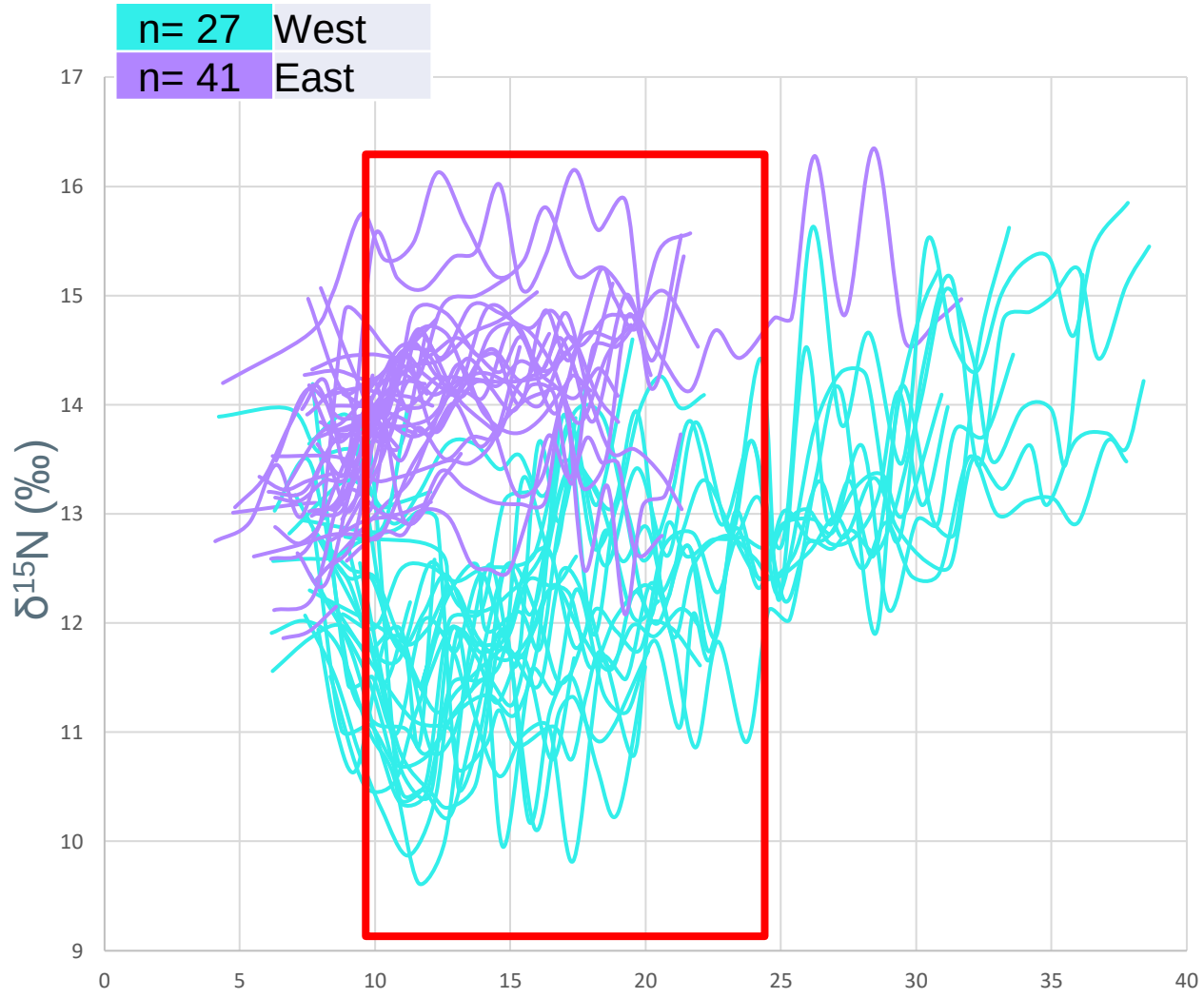

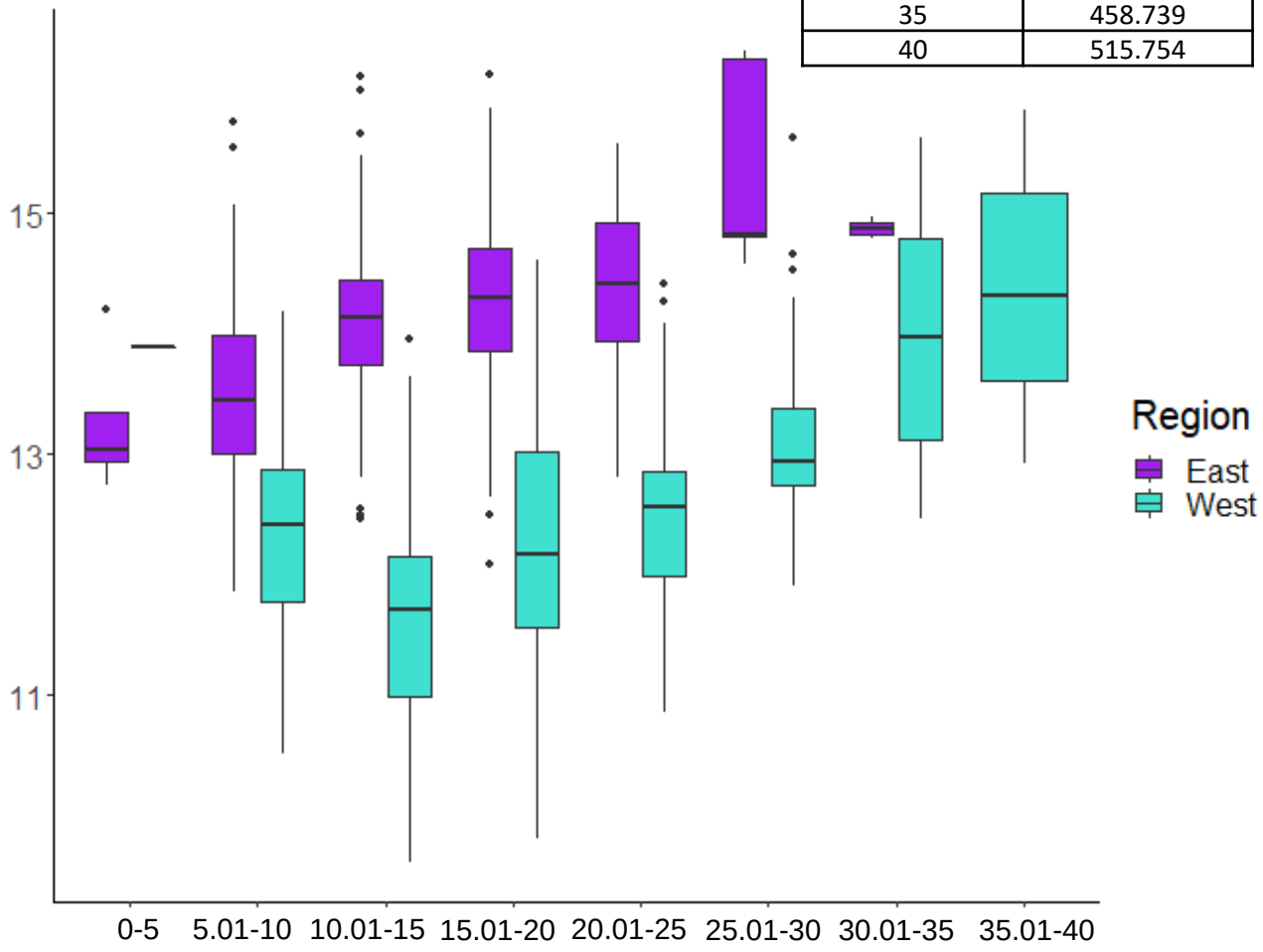

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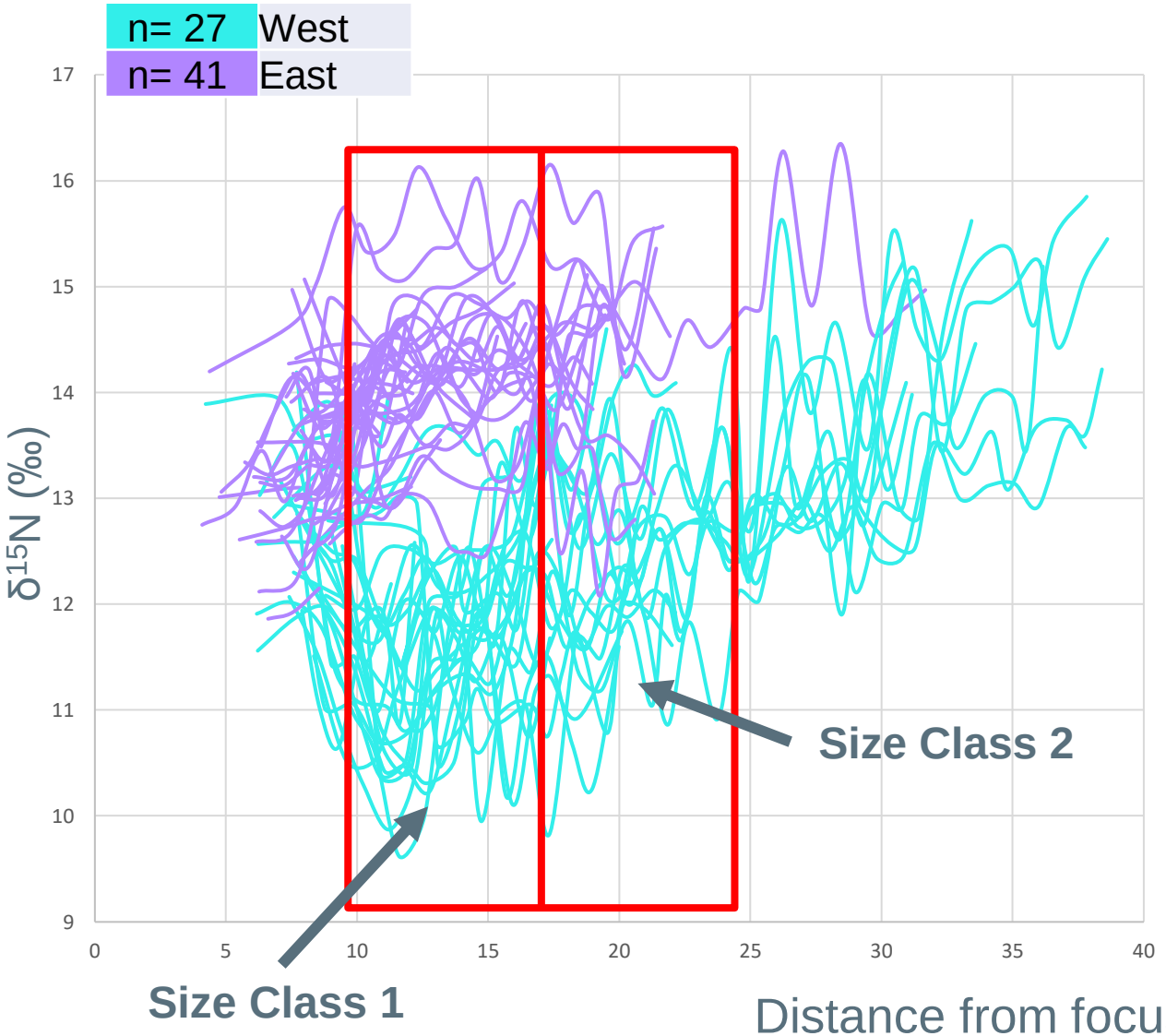
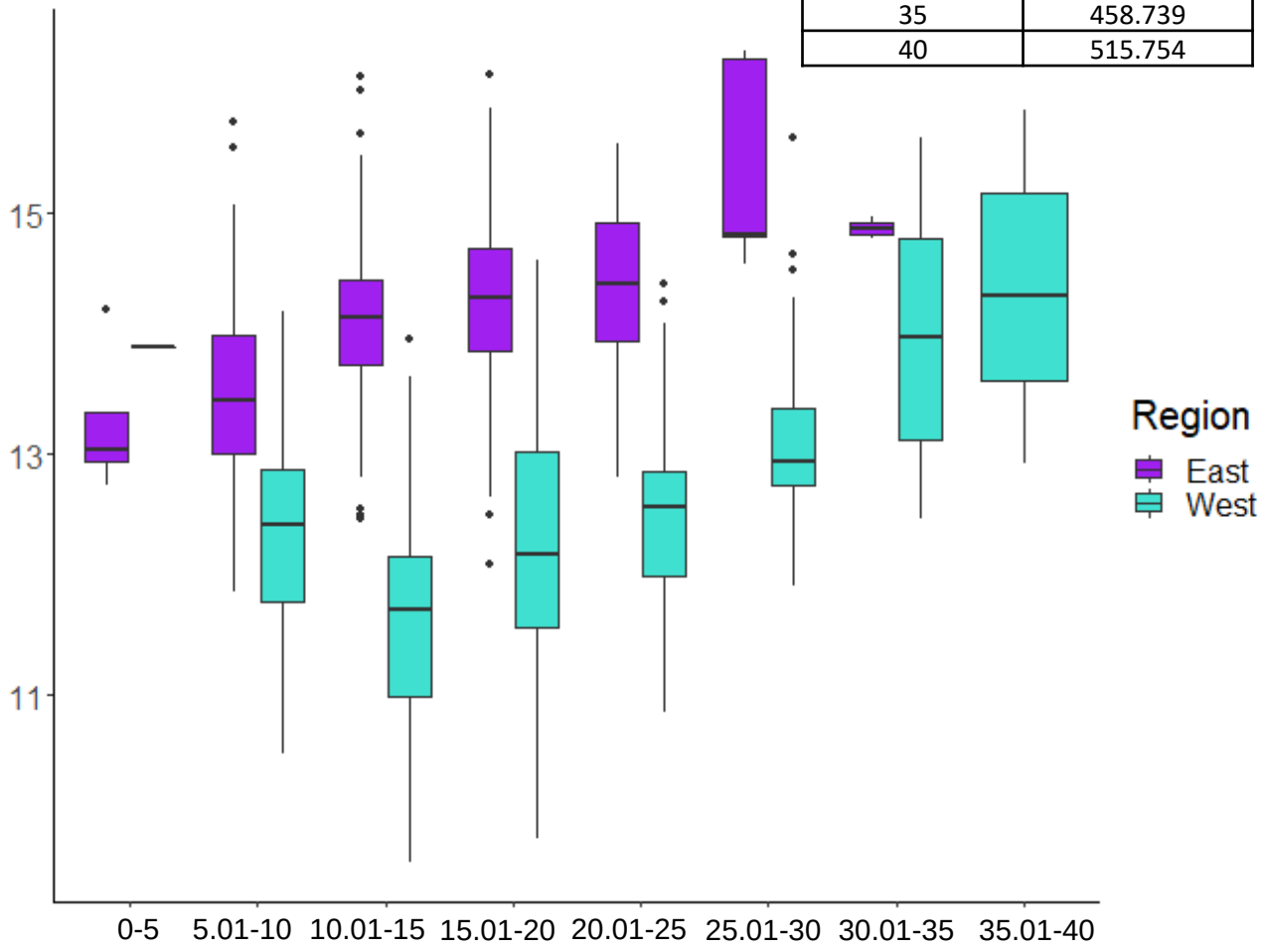




Size Class 1

OLYMPIA

Length – 2.17m

Weight ~ 187lbs

Size Class 1

OLYMPIA
Length – 2.17m
Weight ~ 187lbs

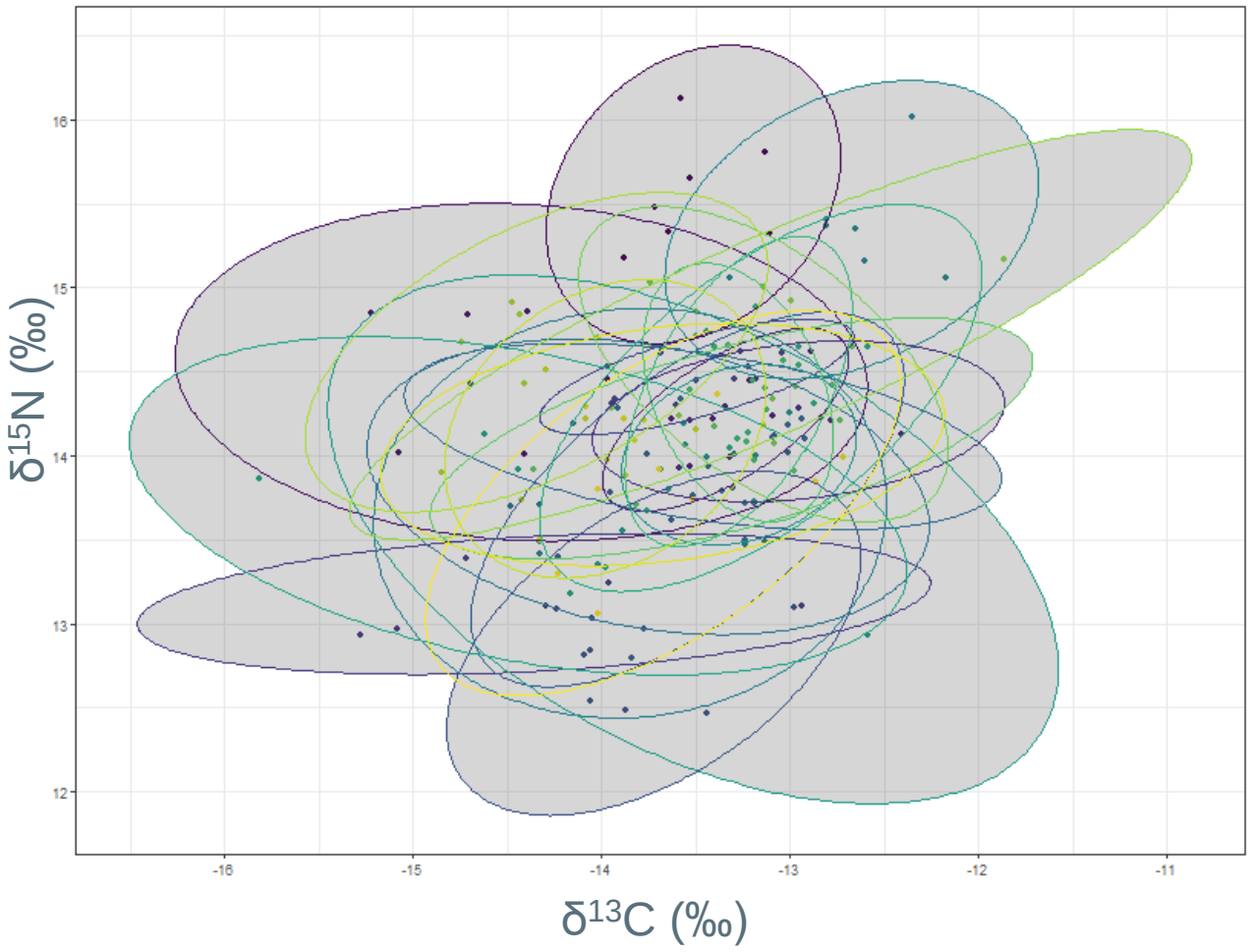
Size Class 2

TANCOOK
Length – 2.97m
Weight ~ 715lbs

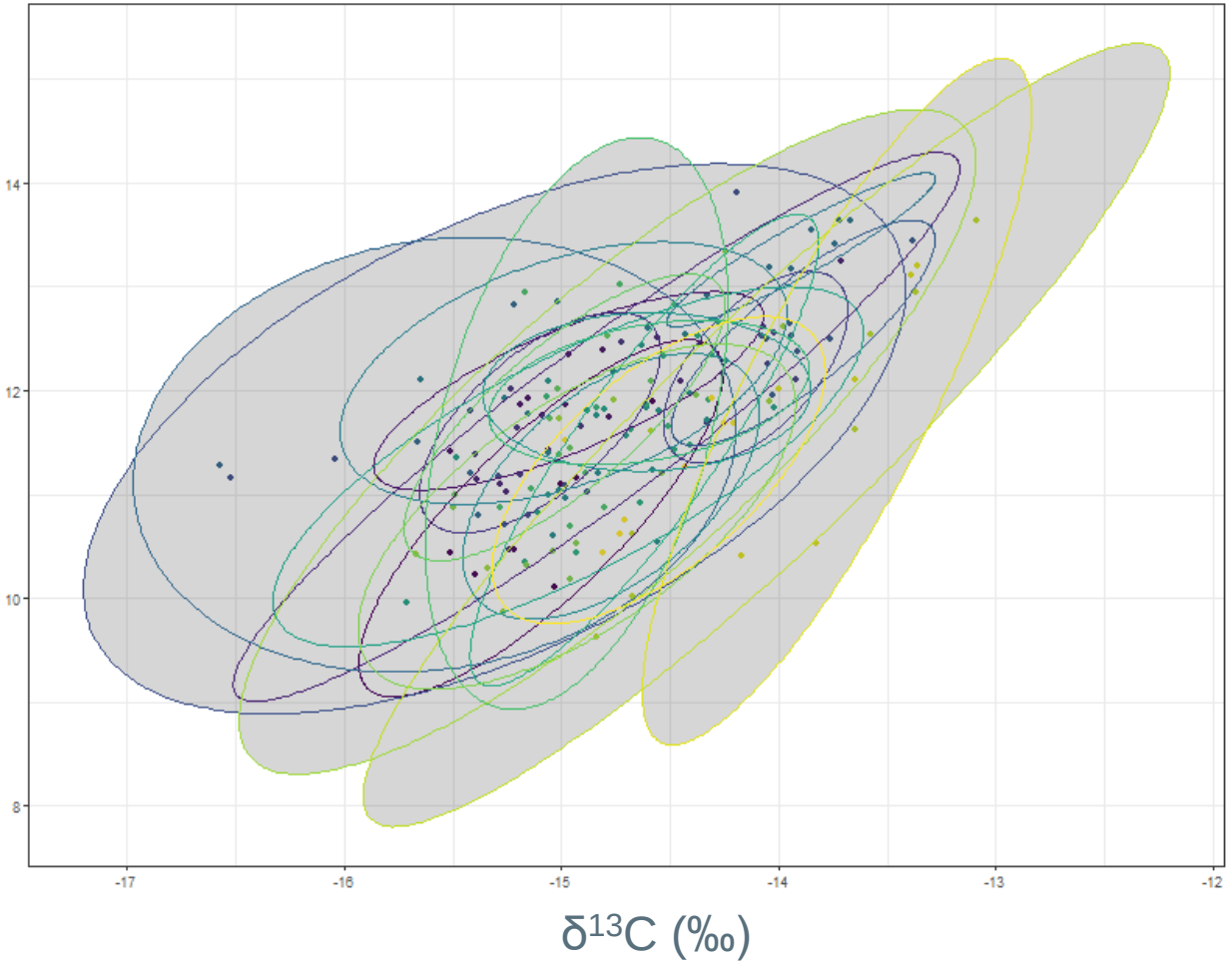
RELATIVE INDIVIDUAL NICHE WIDTH (RINI)

Size Class 1

EAST



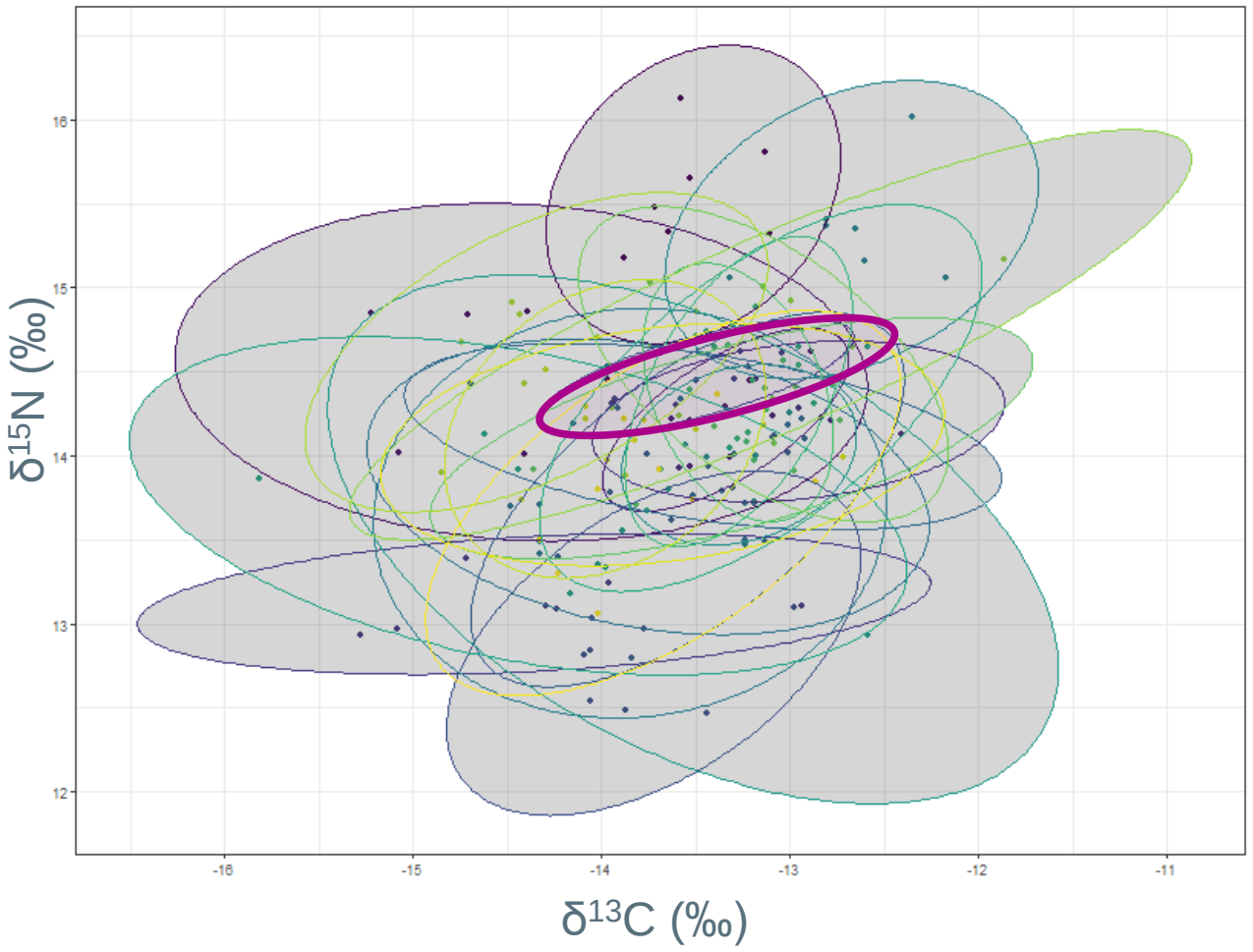
WEST



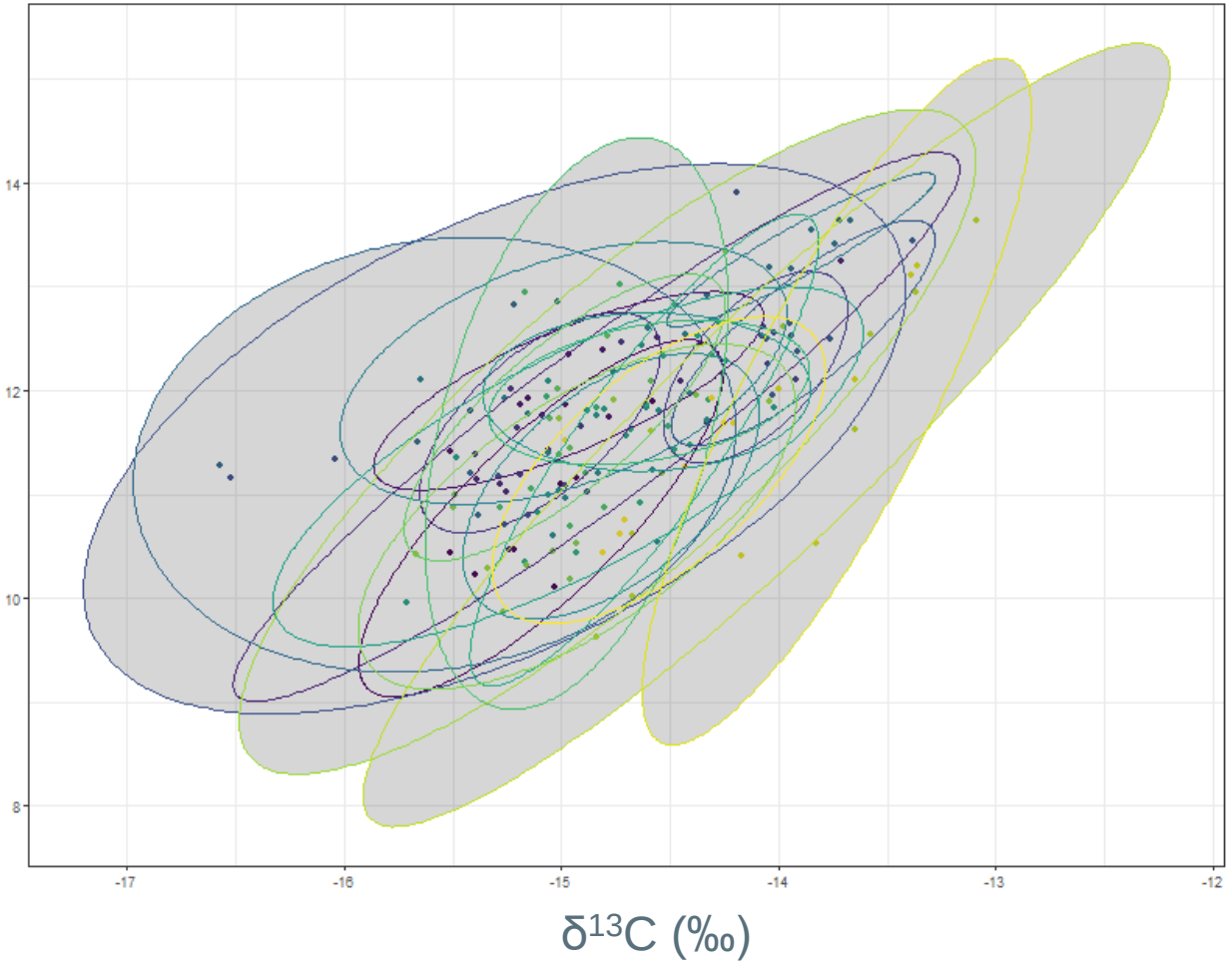
RELATIVE INDIVIDUAL NICHE WIDTH (RINI)

Size Class 1

EAST



WEST



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Size Class 1

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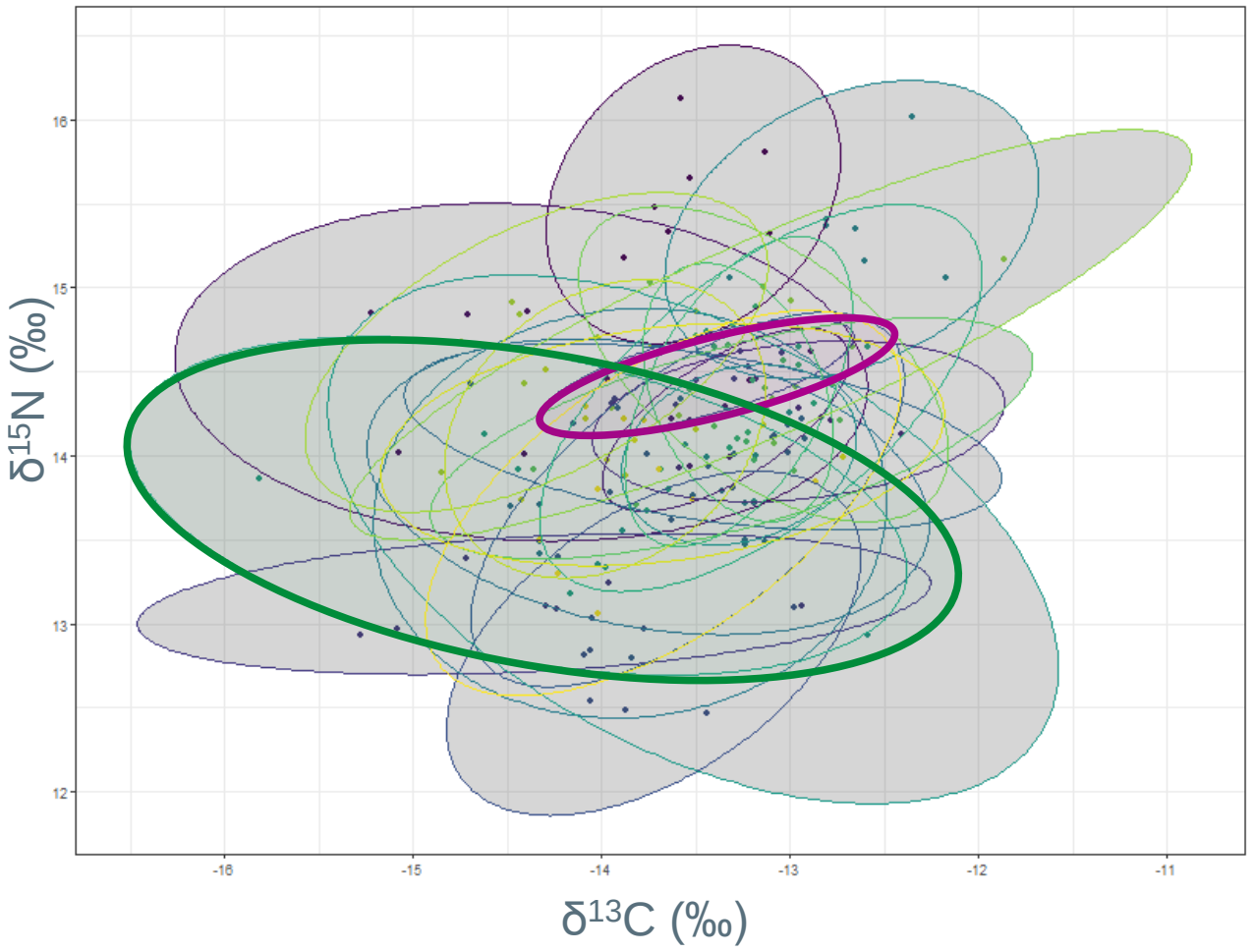
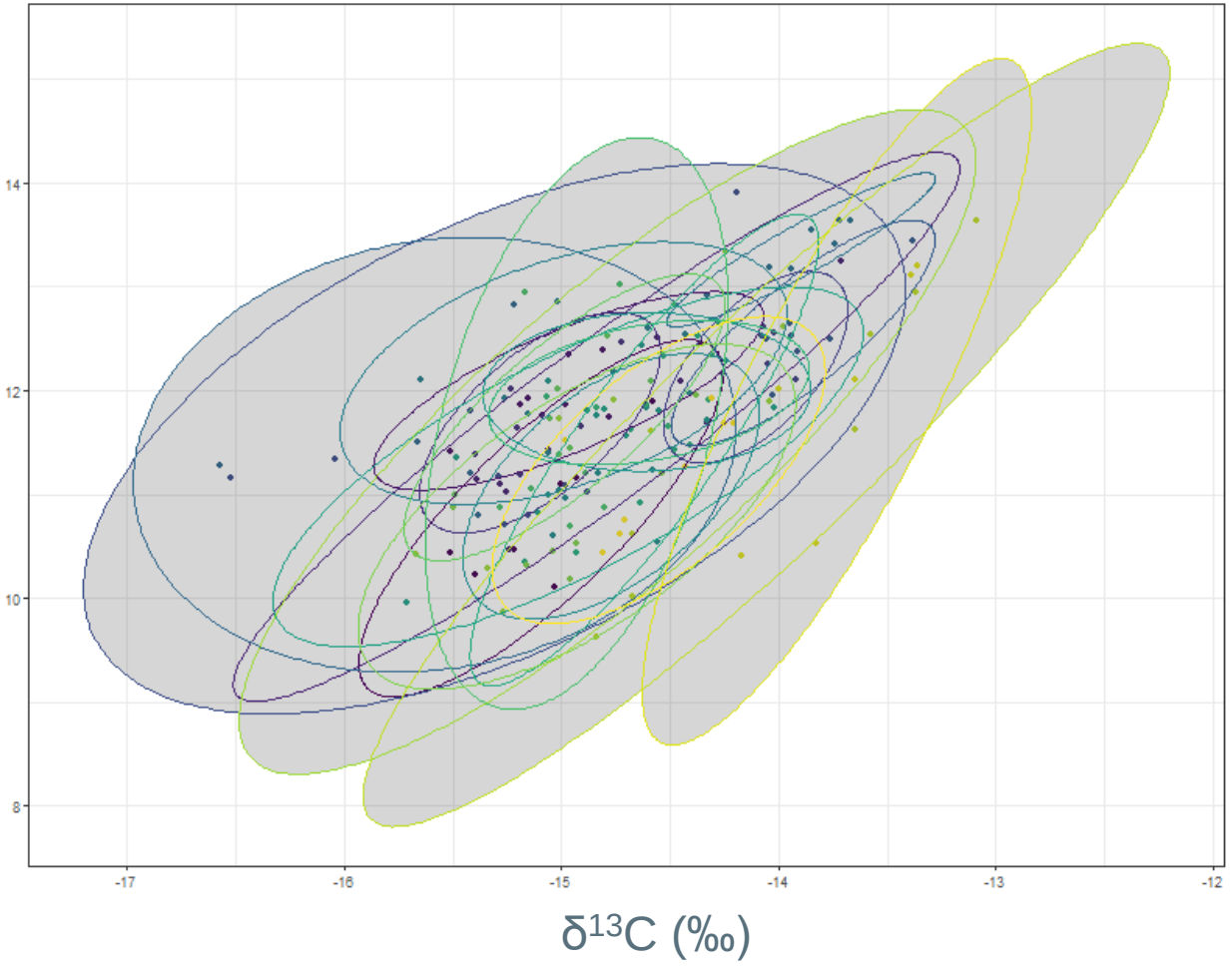


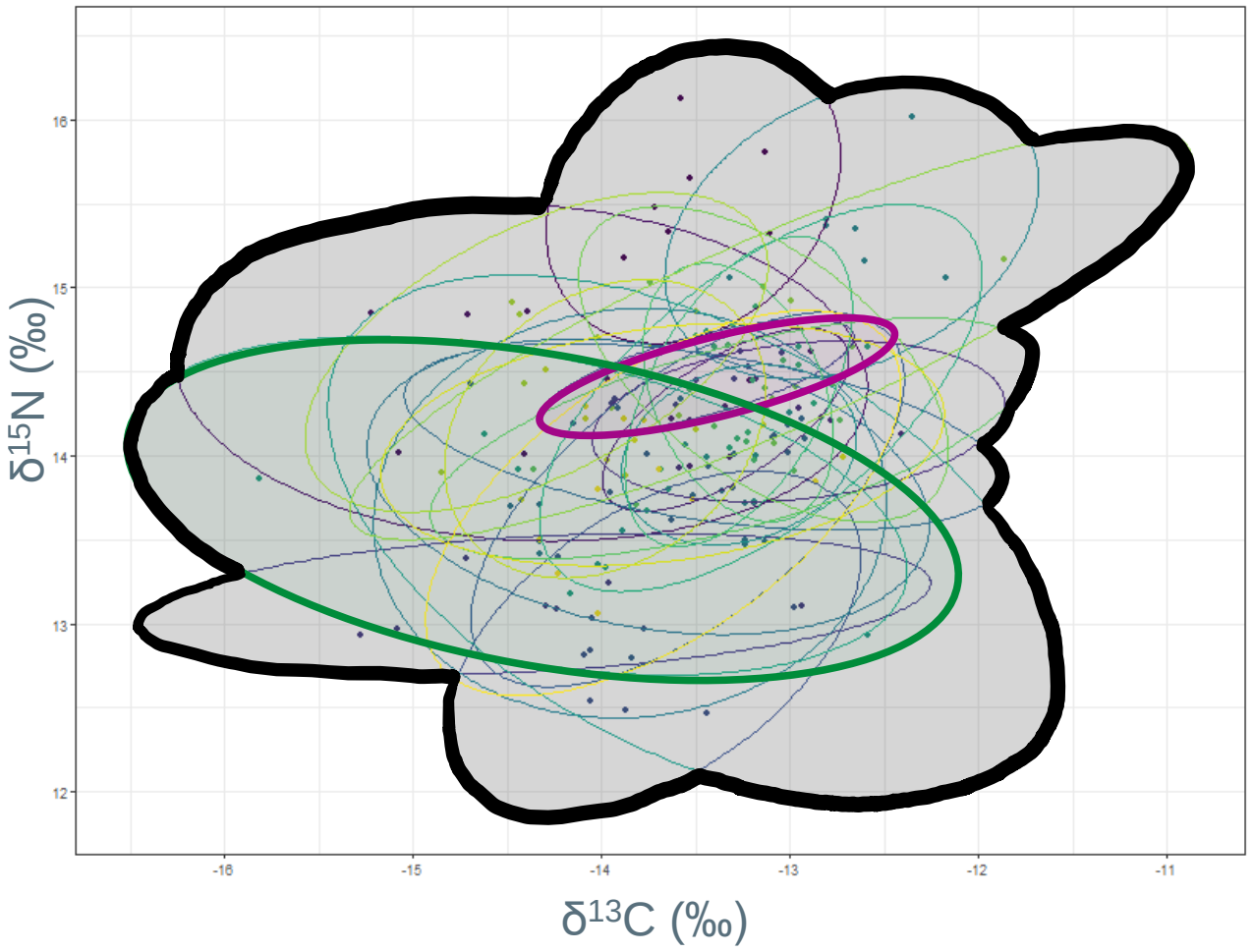
WEST



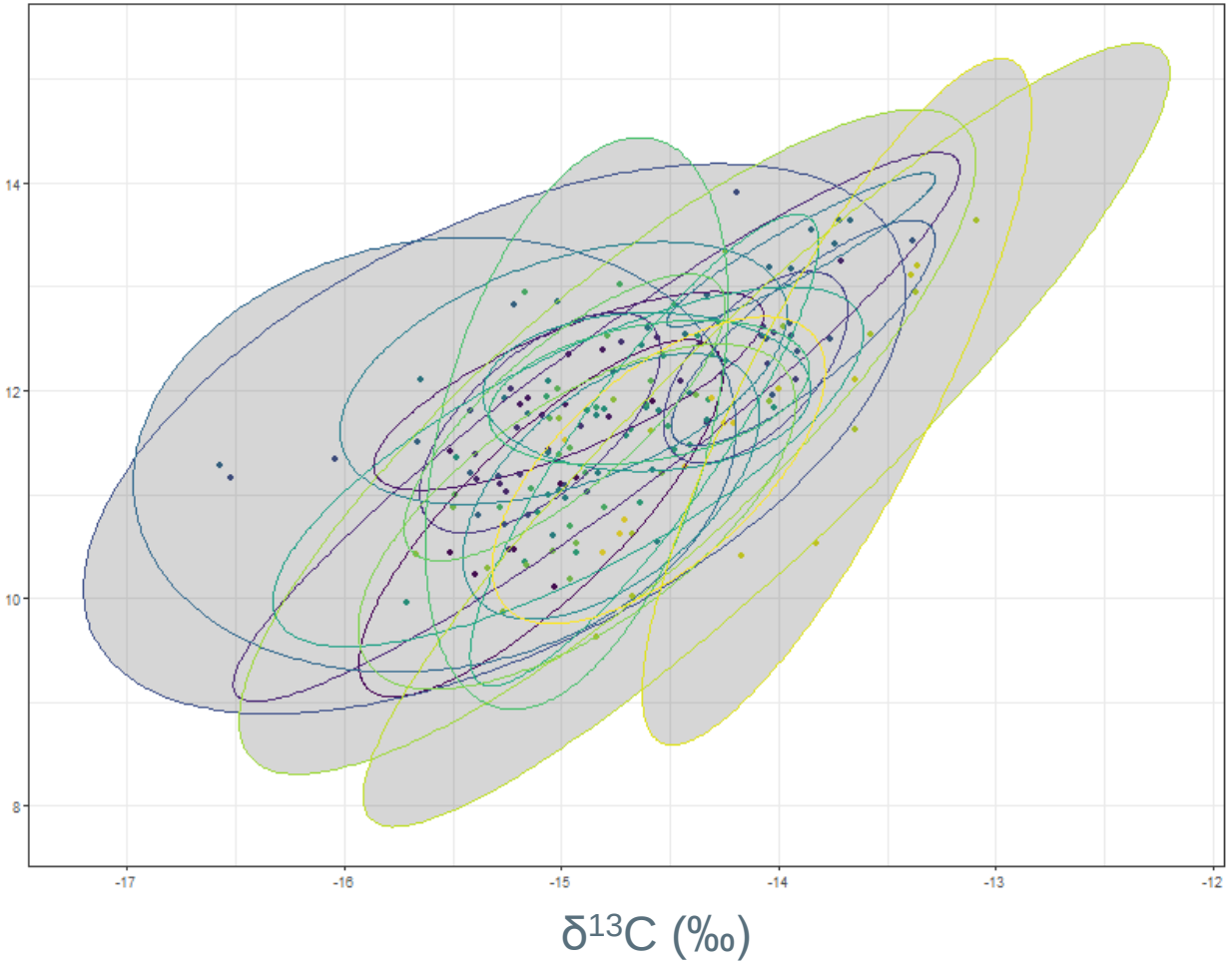
RELATIVE INDIVIDUAL NICHE WIDTH (RINI)

Size Class 1

EAST

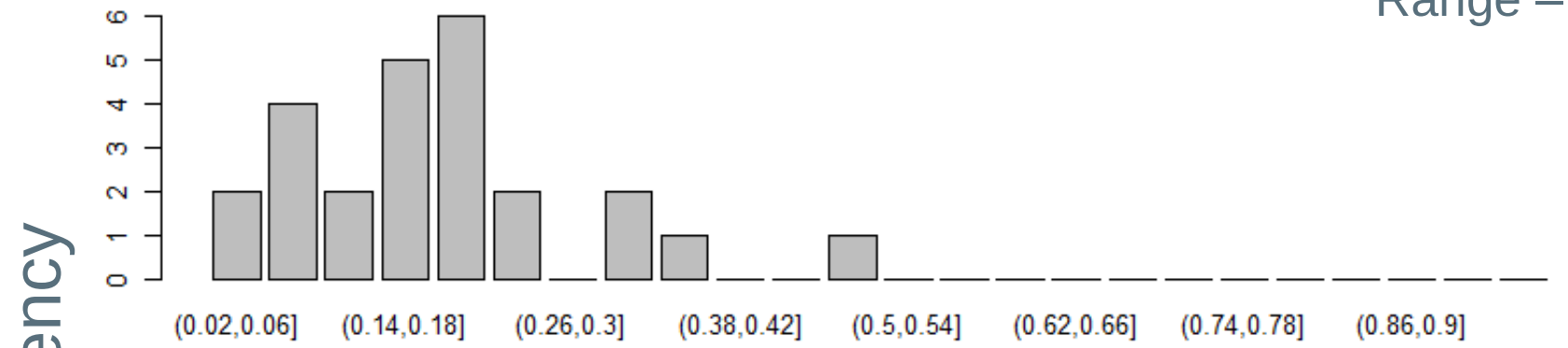


WEST



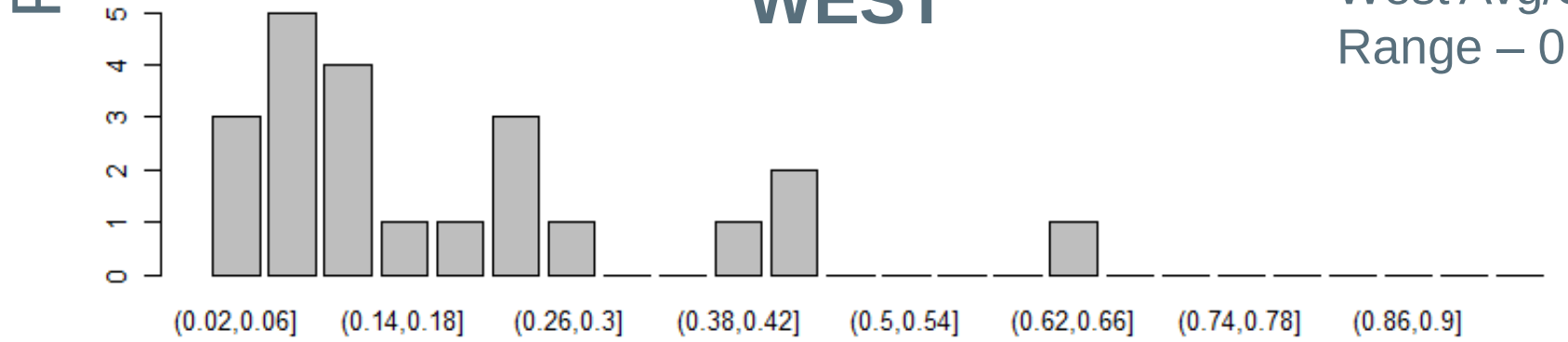
EAST

East Avg/Std - 0.18 ± 0.1
Range – 0.03-0.49 (n=25)



WEST

West Avg/Std - 0.2 ± 0.16
Range – 0.03 – 0.65 (n=22)



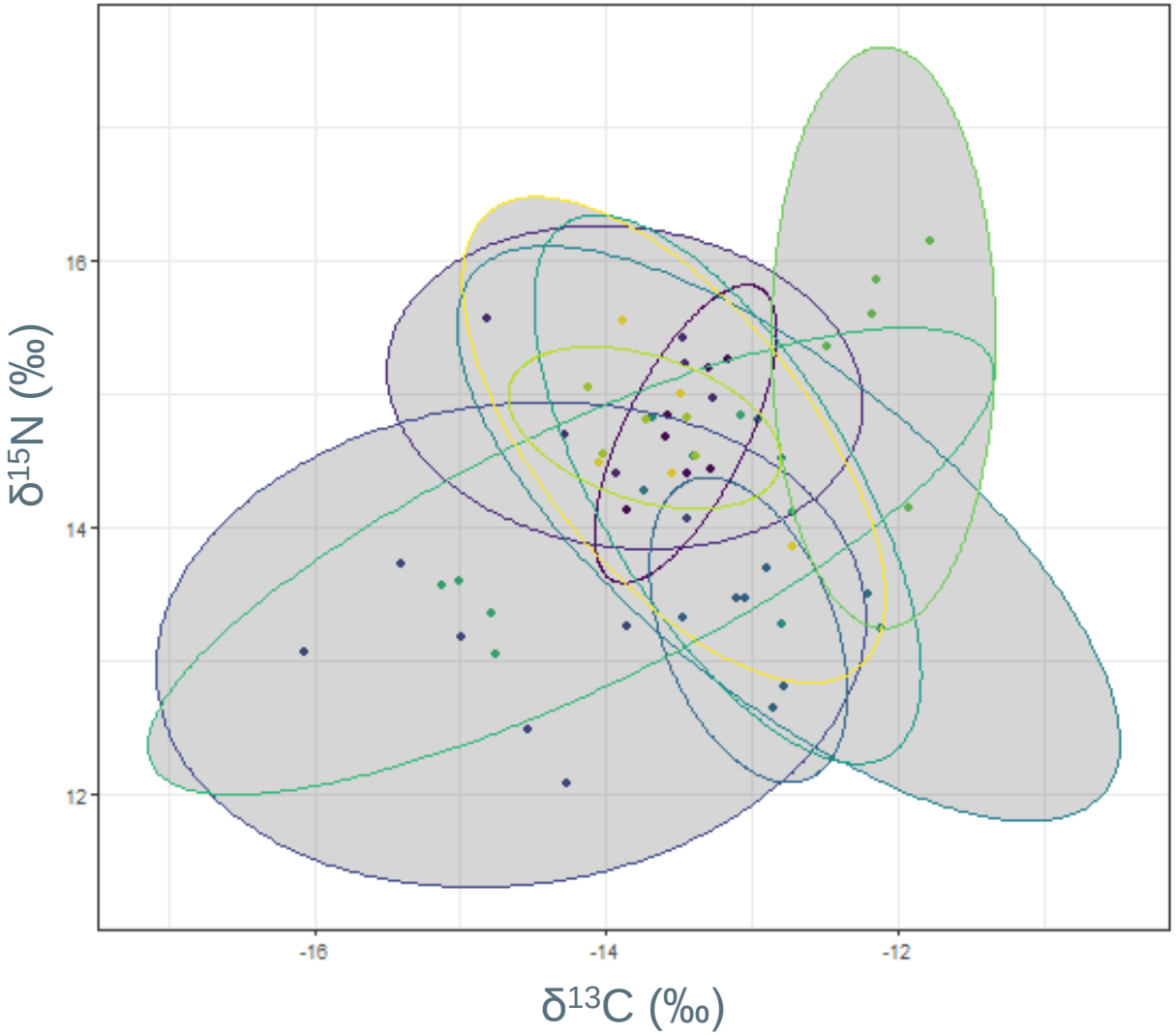
Specialist

Generalist

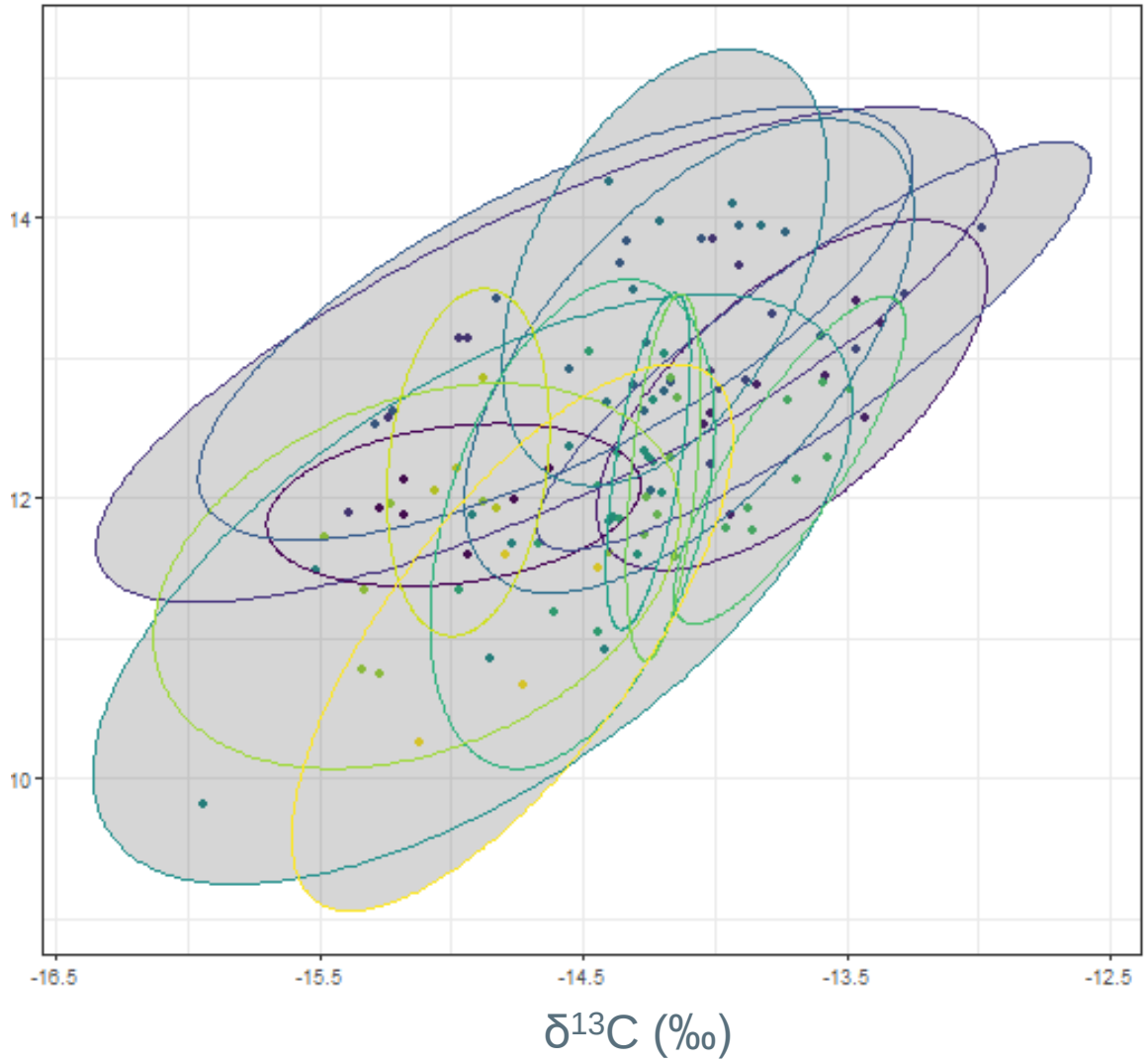
RELATIVE INDIVIDUAL NICHE WIDTH (RINI)

Size Class 2

EAST

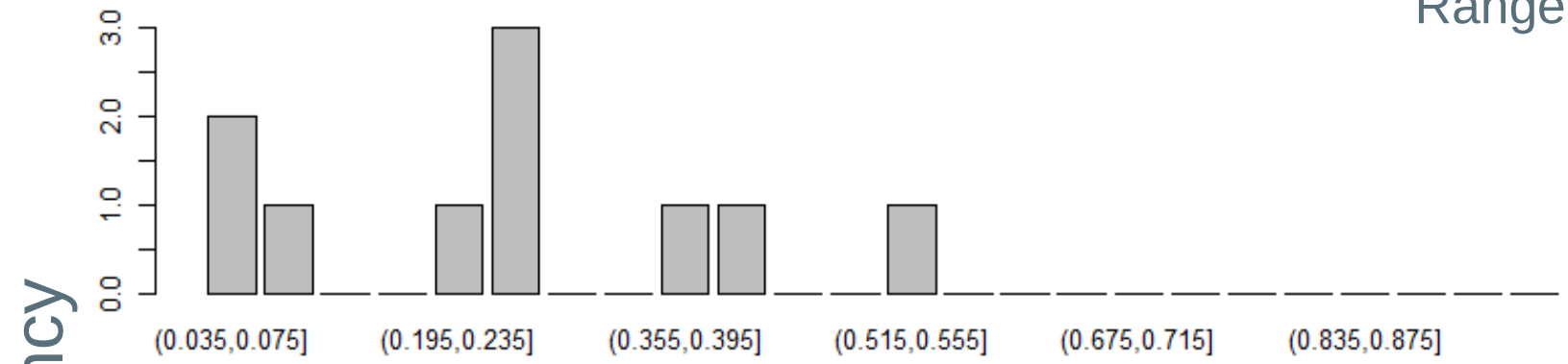


WEST



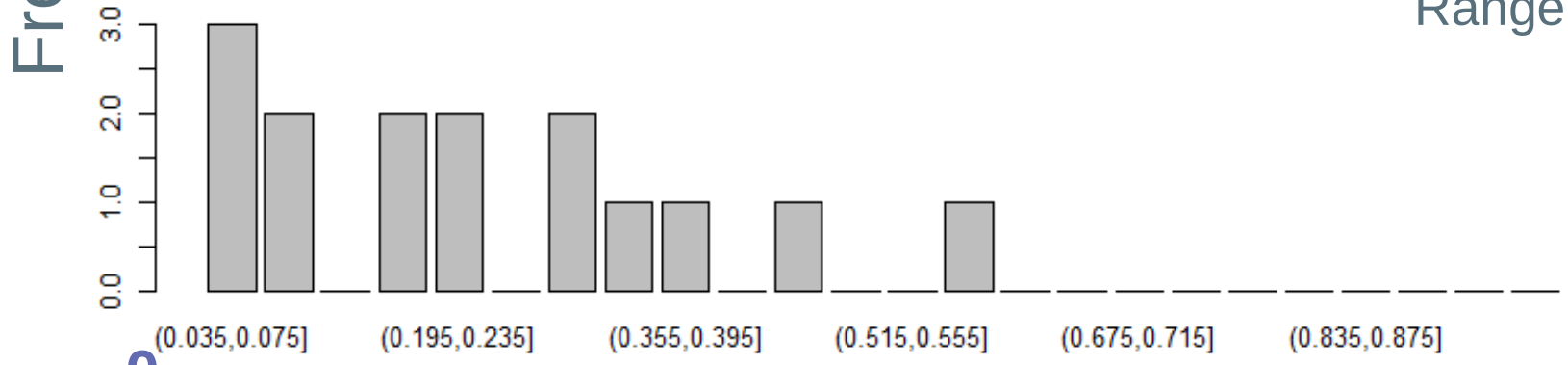
EAST

East Avg/Std - 0.25 ± 0.15
Range – 0.06-0.54 (n=10)



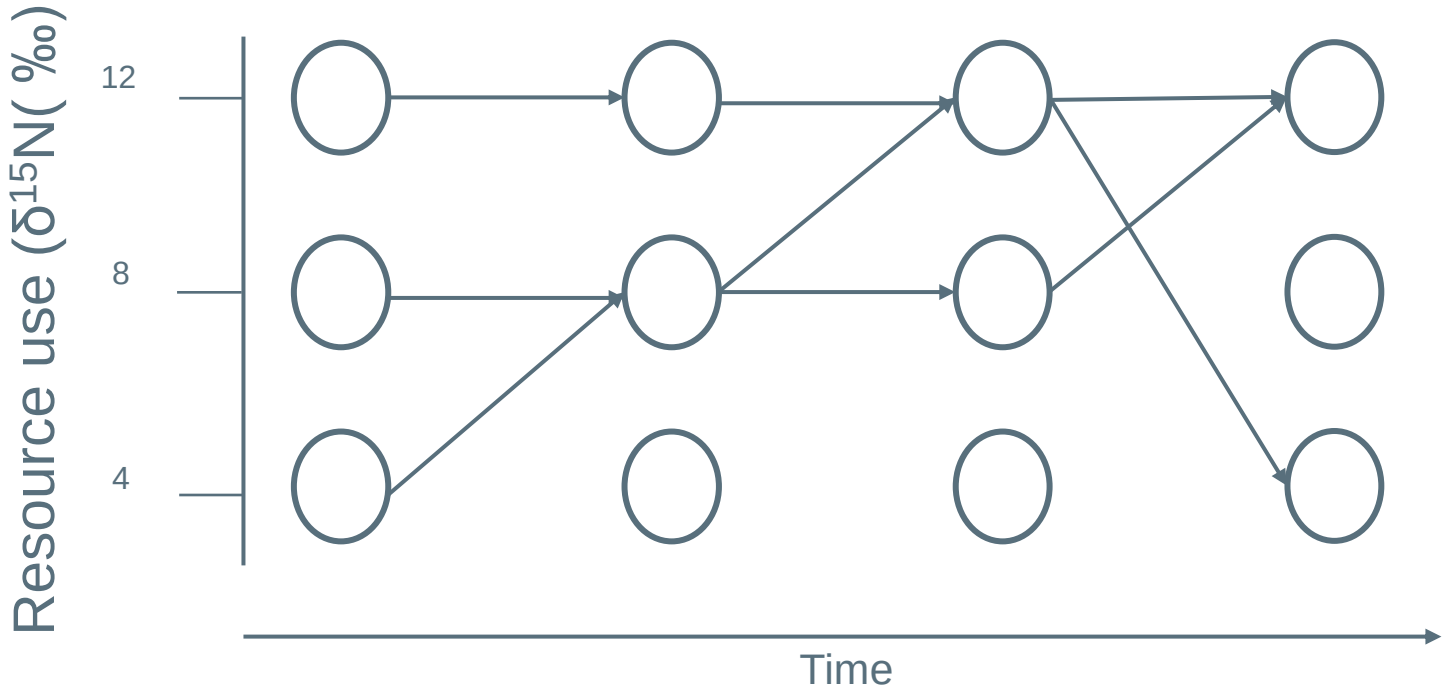
WEST

West Avg/Std - 0.23 ± 0.15
Range – 0.03-0.59 (n= 15)



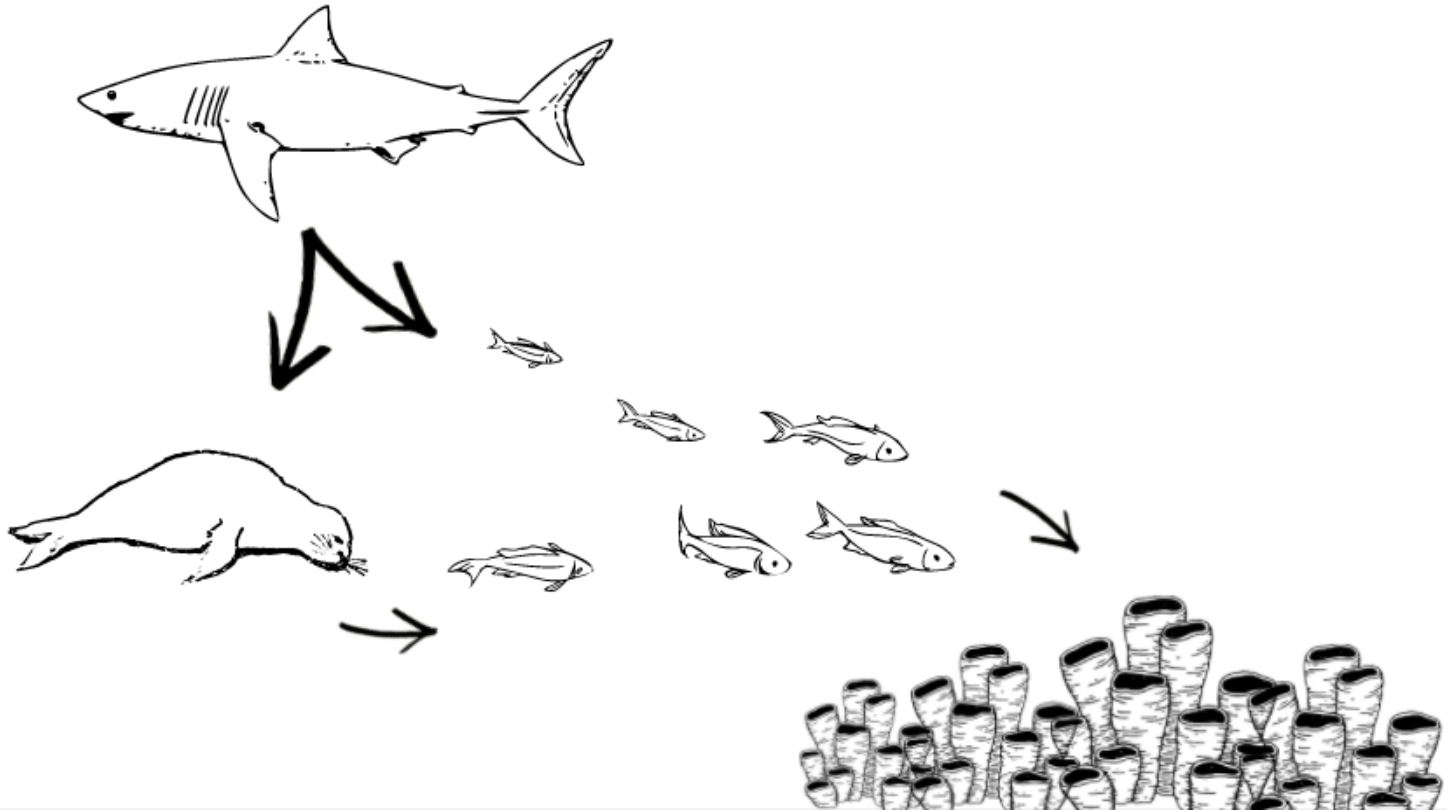
DISCUSSION

At the species level white sharks exhibit a generalist feeding strategy. However, within populations individuals demonstrate a higher frequency of specialist behaviours.



DISCUSSION

Variation in diet and movement within populations are important for understanding the role mobile marine predators play in ecosystems (Abantes and Barnett, 2011).



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Lab Manager: Reid Thrasher

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