Salmon prey assemblages and oceanographic conditions along the California Current shelf ecosystem

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Goals:

Examine the spatial coherence of salmon forage assemblages along the CCLME.

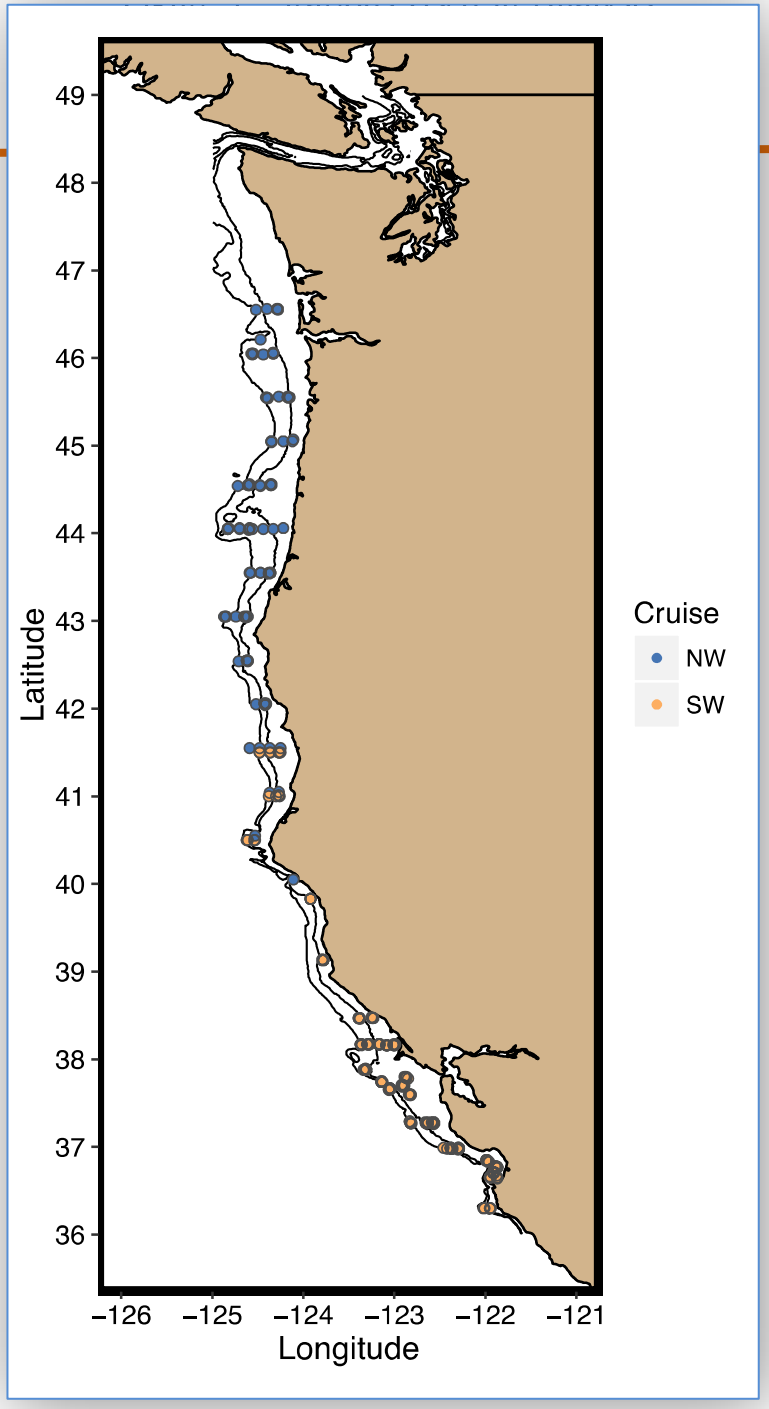
and

Characterize the environmental conditions that are associated with spatial differences in assemblages.

Survey design

Methods:

- Standardized sampling
- mid-water trawl (30m)
- 2011-2015 (NW = 86, SW = 213)
- May-mid July



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Outline

1. Selection of prey species

1. Characterize differences in assemblages with NMDS

1. Environmental conditions associated with variability in forage assemblage

Selection of prey species

Methods:

- Size (<= 50mm)
- <= 5 trawls
- Occur in literature

- Krill (see Santora talk)

Taxon	CommonName
Abraliopsis	Blacktip Squid
Agonidae	Poacher
Ammodytes	Pacific Sandlace
Atheresthes	Arrowtooth Flounder
Citharichthys	Sanddab
Cottidae	Sculpin
Doryteuthis	Market Squid
Engraulis	Northern Anchovy
Glyptocephalus	Rex Sole
Gonatus	Armhook Squid
Liparidae	Snailfish
Lyopsetta	Slender Sole
Merluccius	Pacific Hake
Microgadus	Pacific Tomcod
Microstomus	Dover Sole
Myctophidae	Myctophids
Natantia	Shrimp
Octopoda	Octopus
Ophiodon	Lingcod
Osmeridae	Smelt
Oxylebius	Painted Greenling
Pandalus	Pandalid Shrimp
Pleuronectidae	Butter/Rock Sole
Pleuronichthys	Turbot
Psettichthys	Sand Sole
Ronquilus	Ronquil/Prickleback
Sardinops	Pacific Sardine
Sebastes	Rockfish
Sergestidae	Sergestid
Zaniolepididae	Combfish

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Characterize differences in assemblages with NMDS

Methods:

- NMDS
- 3 axes

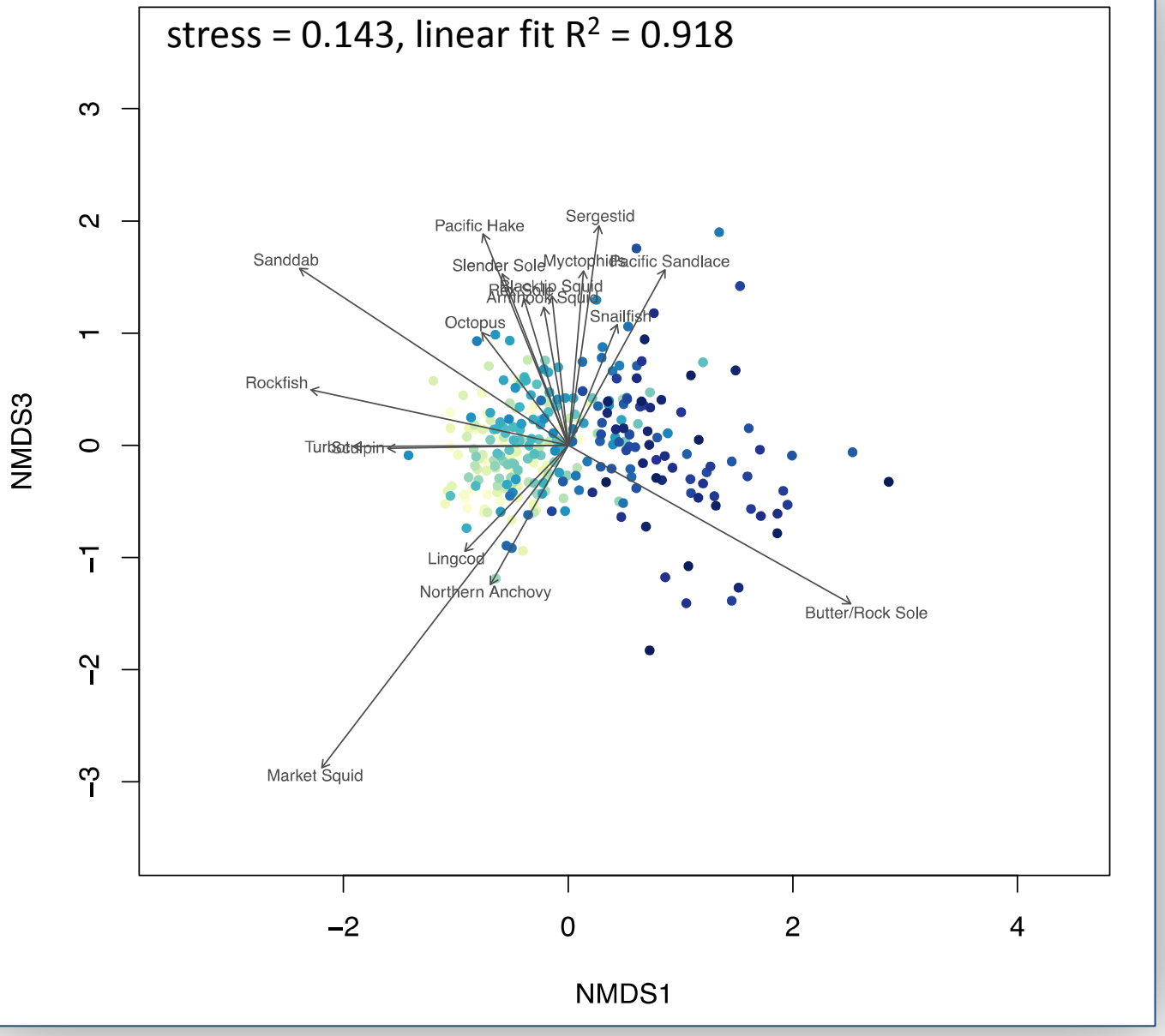
Results:

Southern species

Market squid
Rockfishes
Sanddabs

Northern species

Butter/Rock sole



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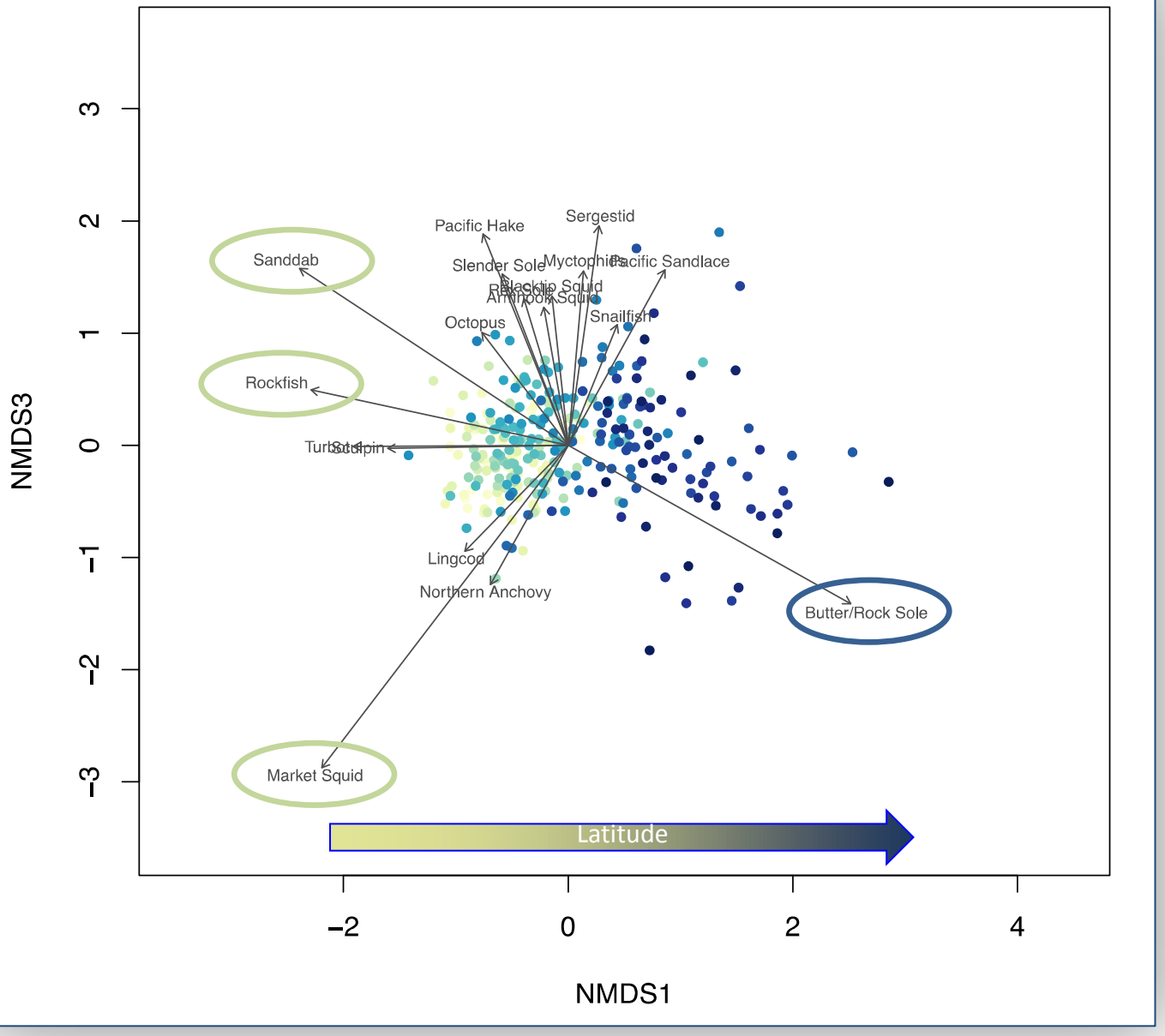

Characterize differences in assemblages with NMDS

Methods:

- NMDS
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Results:

Southern species

- Market squid
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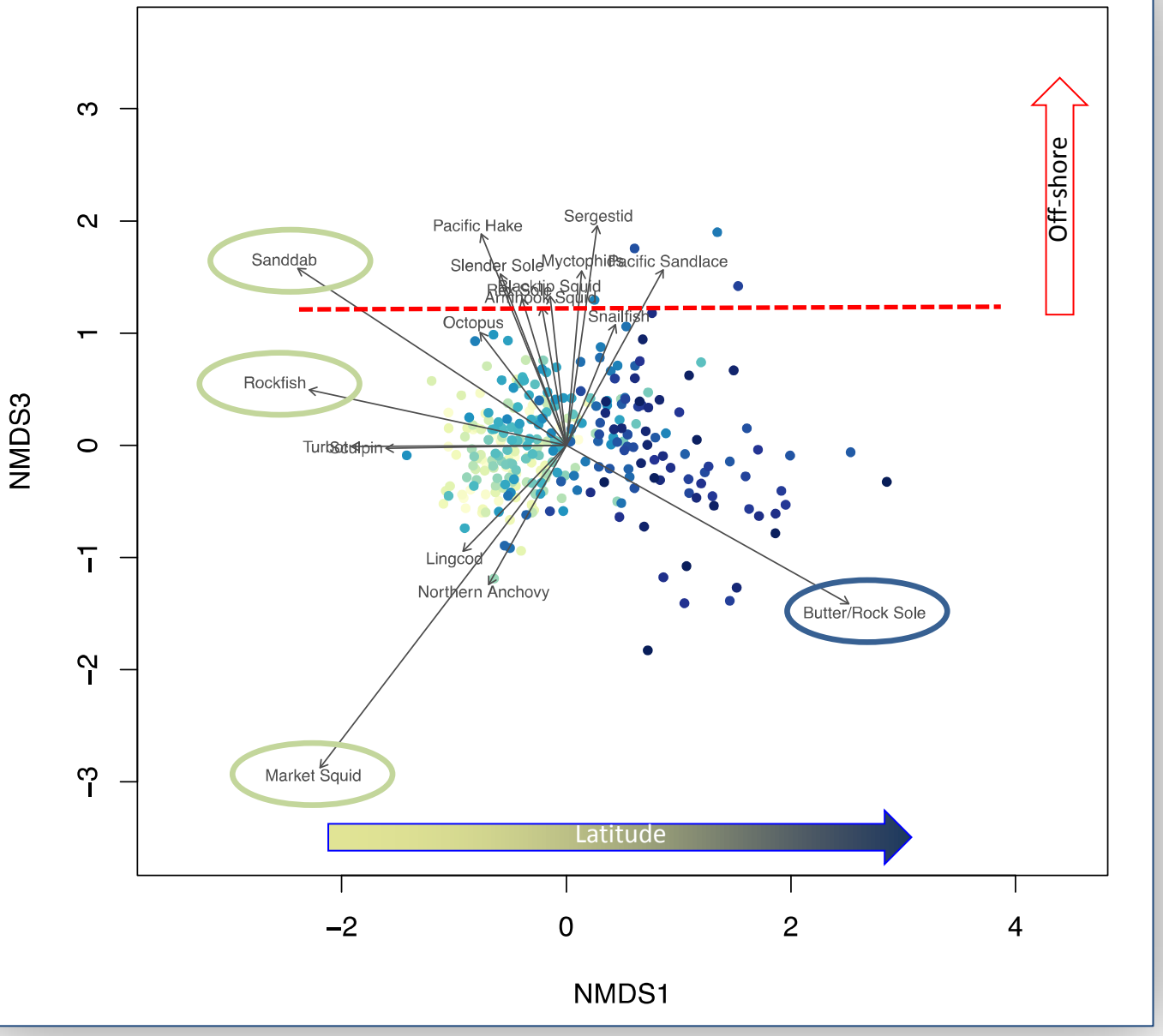
Northern species

- Butter/Rock sole

Off-shore critters

- Pacific Hake
- Sergestid
- Backtip squid
- YOY sanddab



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1. Environmental conditions associated with variability in forage assemblage

Environmental conditions associated with variability in forage assemblage

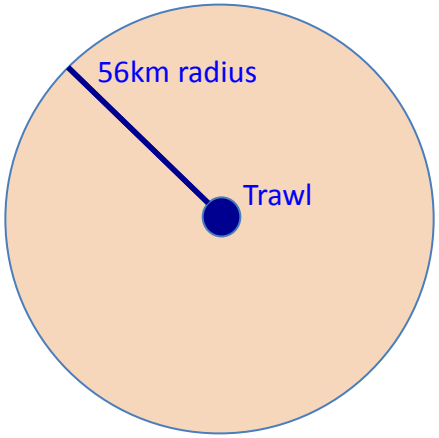
A priori conceptual model including variables:

Preconditioning: Upwelling 4 months prior sampling (**Bakun's**)

Preconditioning: Depth of 26.0 Isopycnal 4 months prior (**ROMS**)

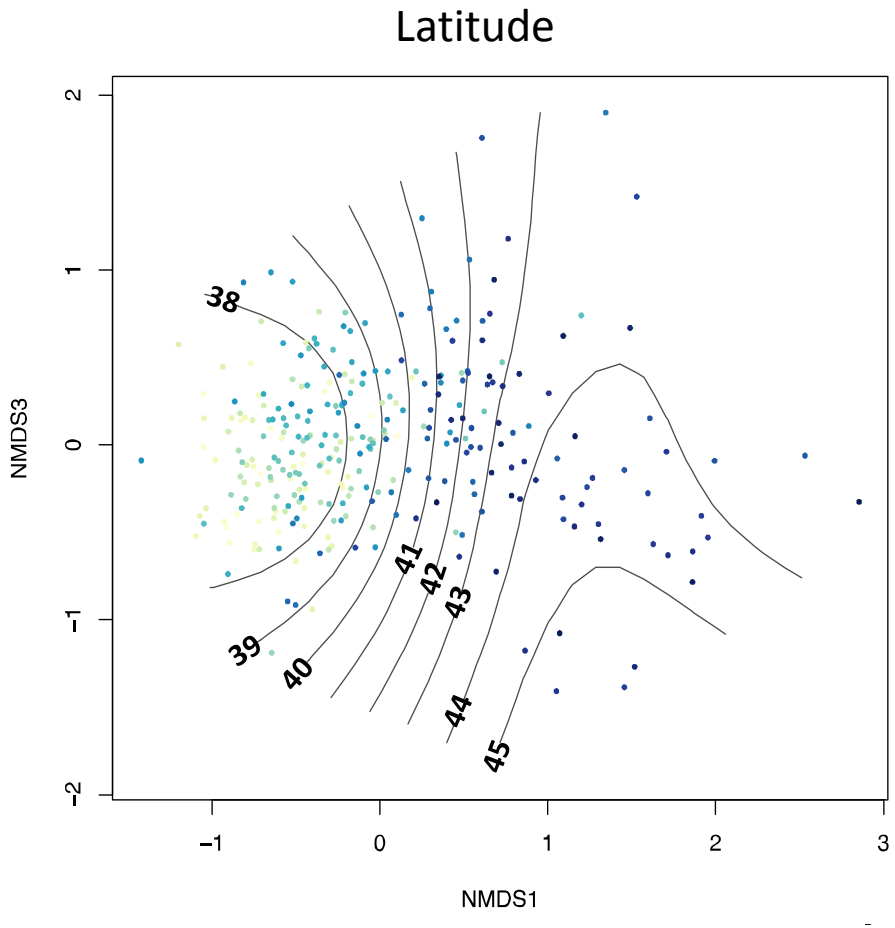
In season: North and East transport during sampling (**ROMS**)

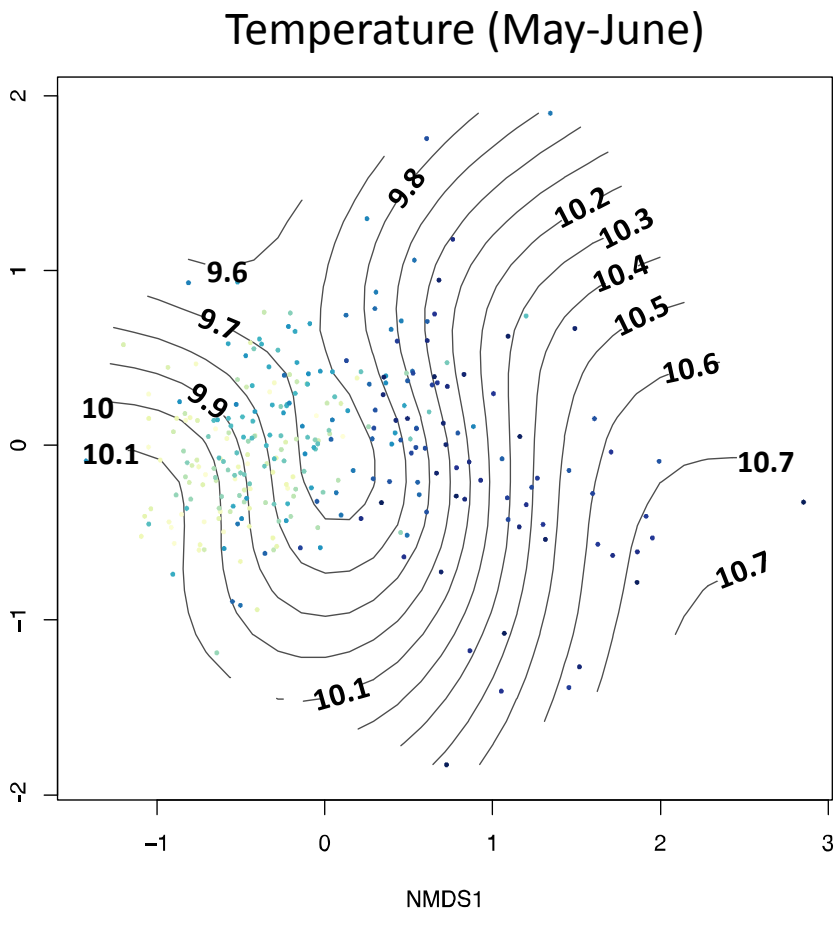
In season: SST during sampling (**ROMS**)



CART analysis to split the assemblages

Environmental conditions associated with variability in forage assemblage





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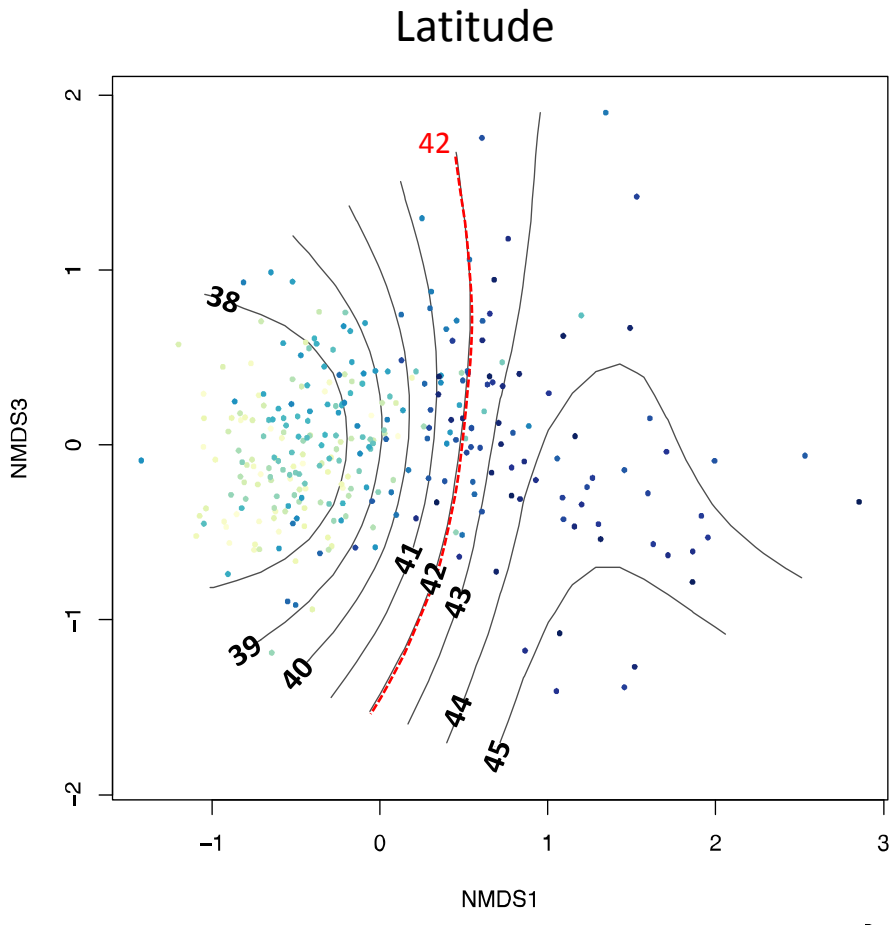

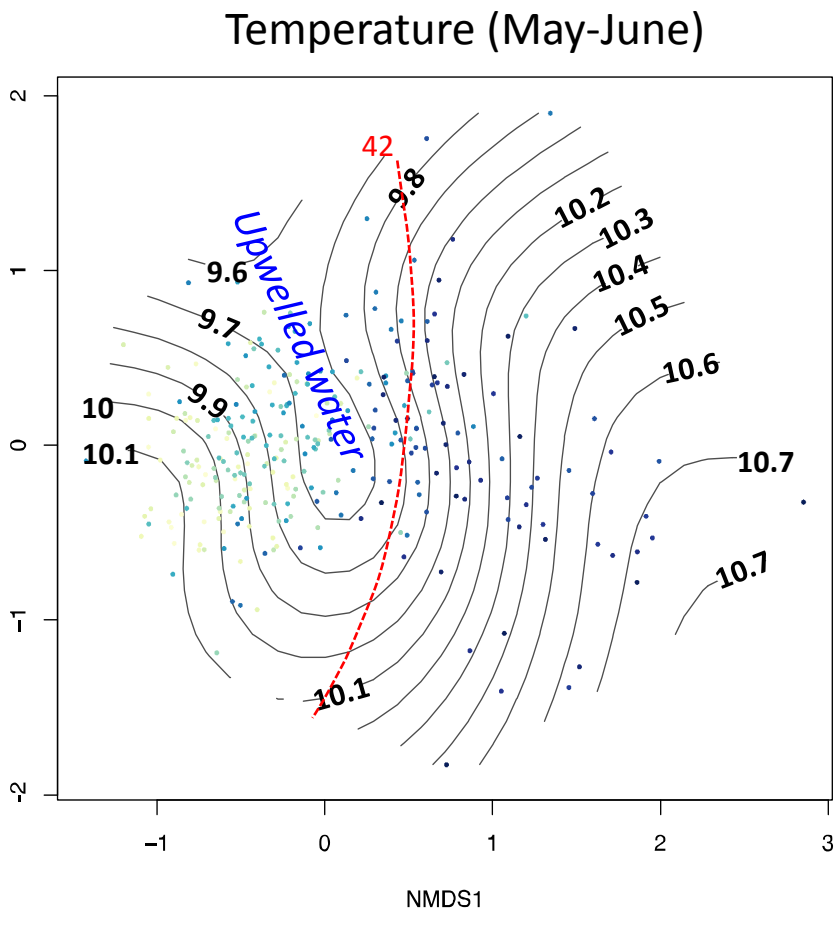

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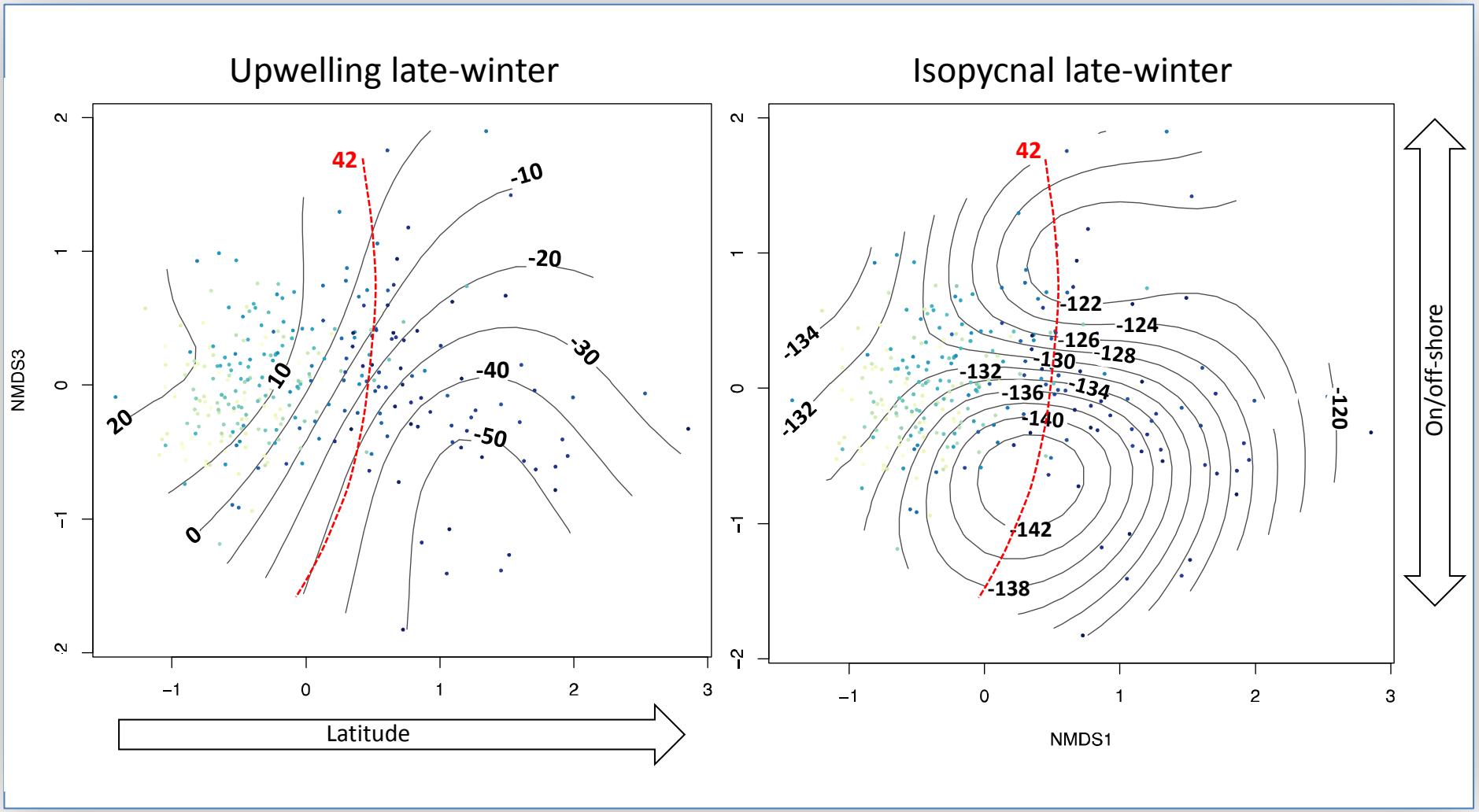
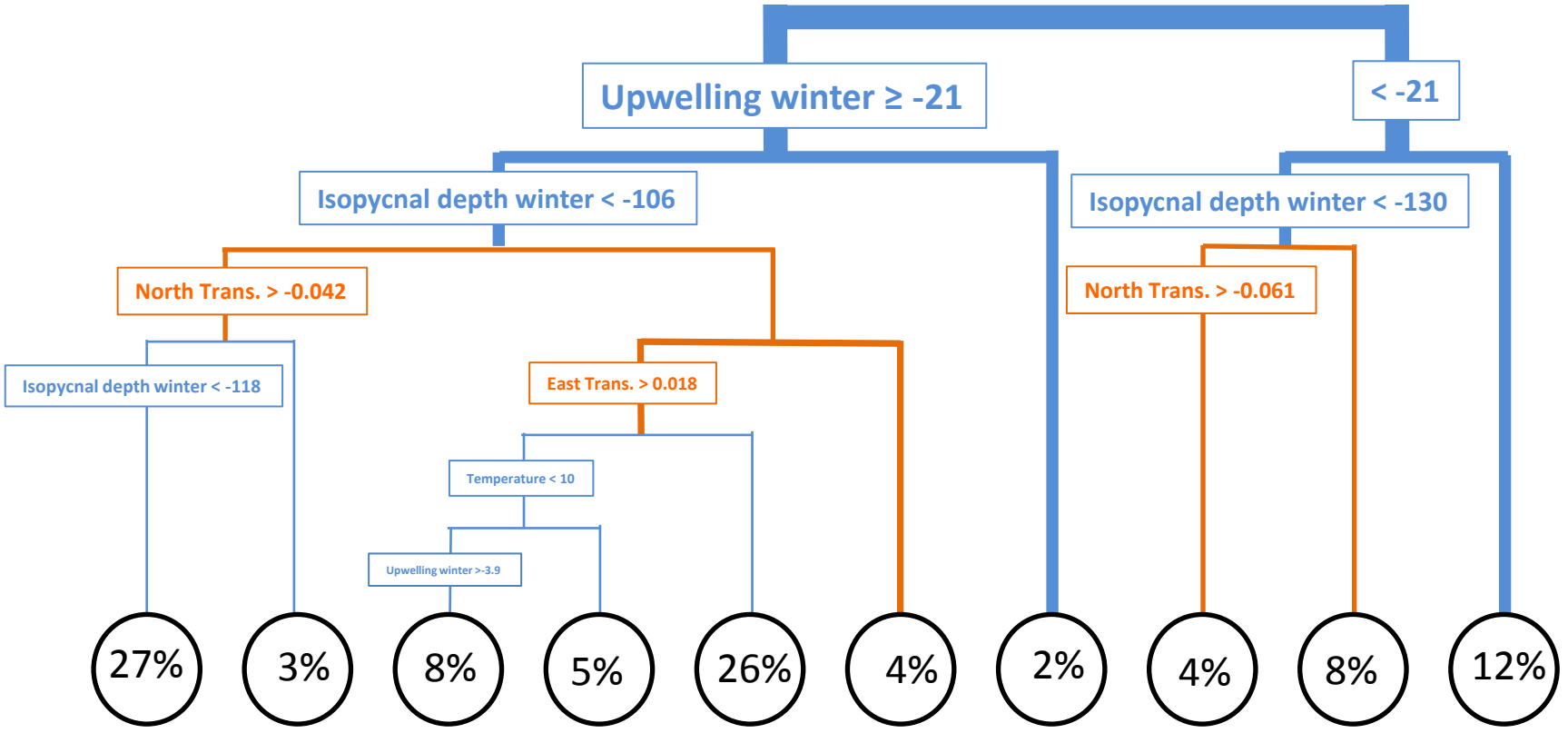


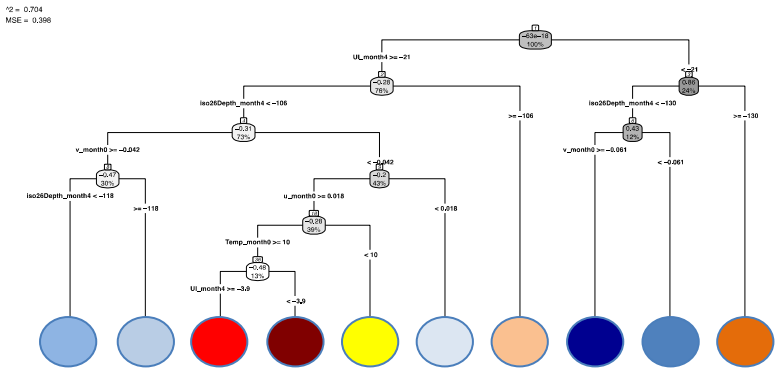
CART: Upwelling in late-winter is related to latitudinal differences in forage assemblages

Axis 1 (Latitudinal): Divisions related to prior upwelling (preconditioning, in season).

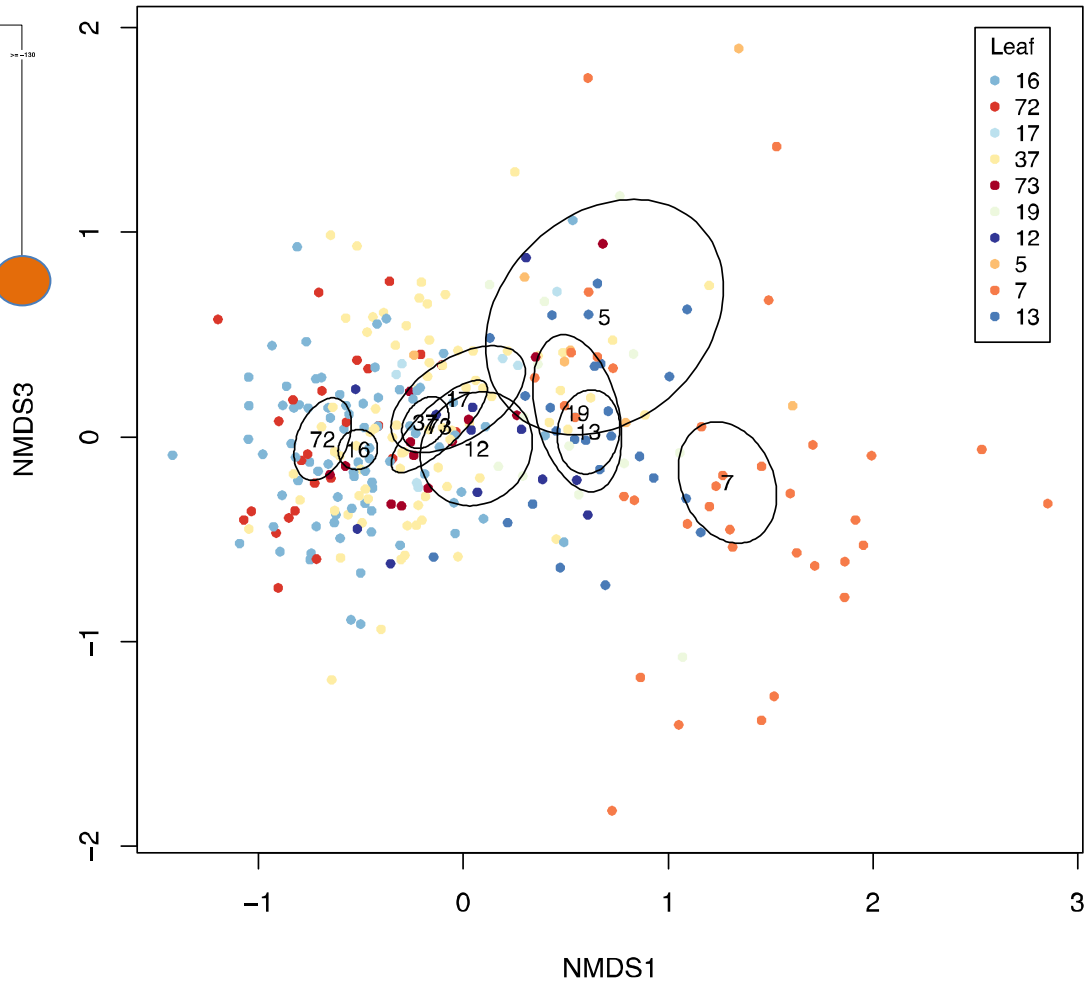
***r* = 0.70**



There are three distinct assemblages



Determine significance of the 10 groups by fitting ellipses to each group's axis 1 and 3 scores.



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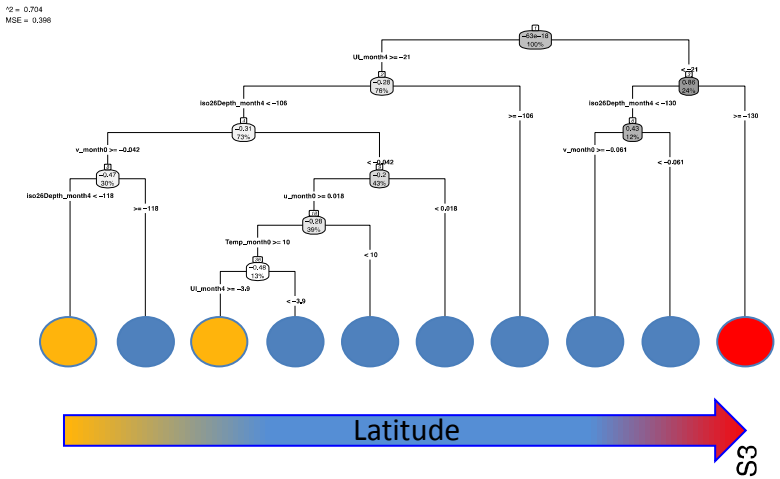

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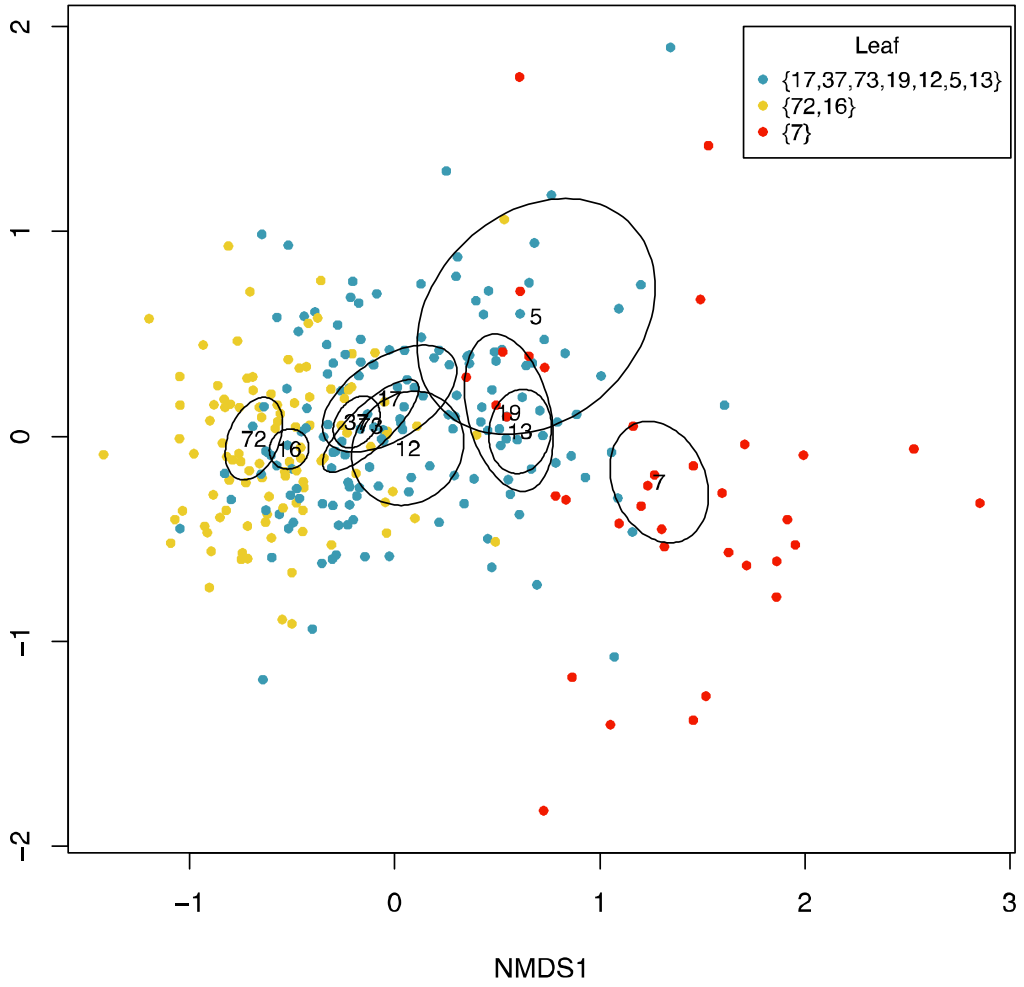

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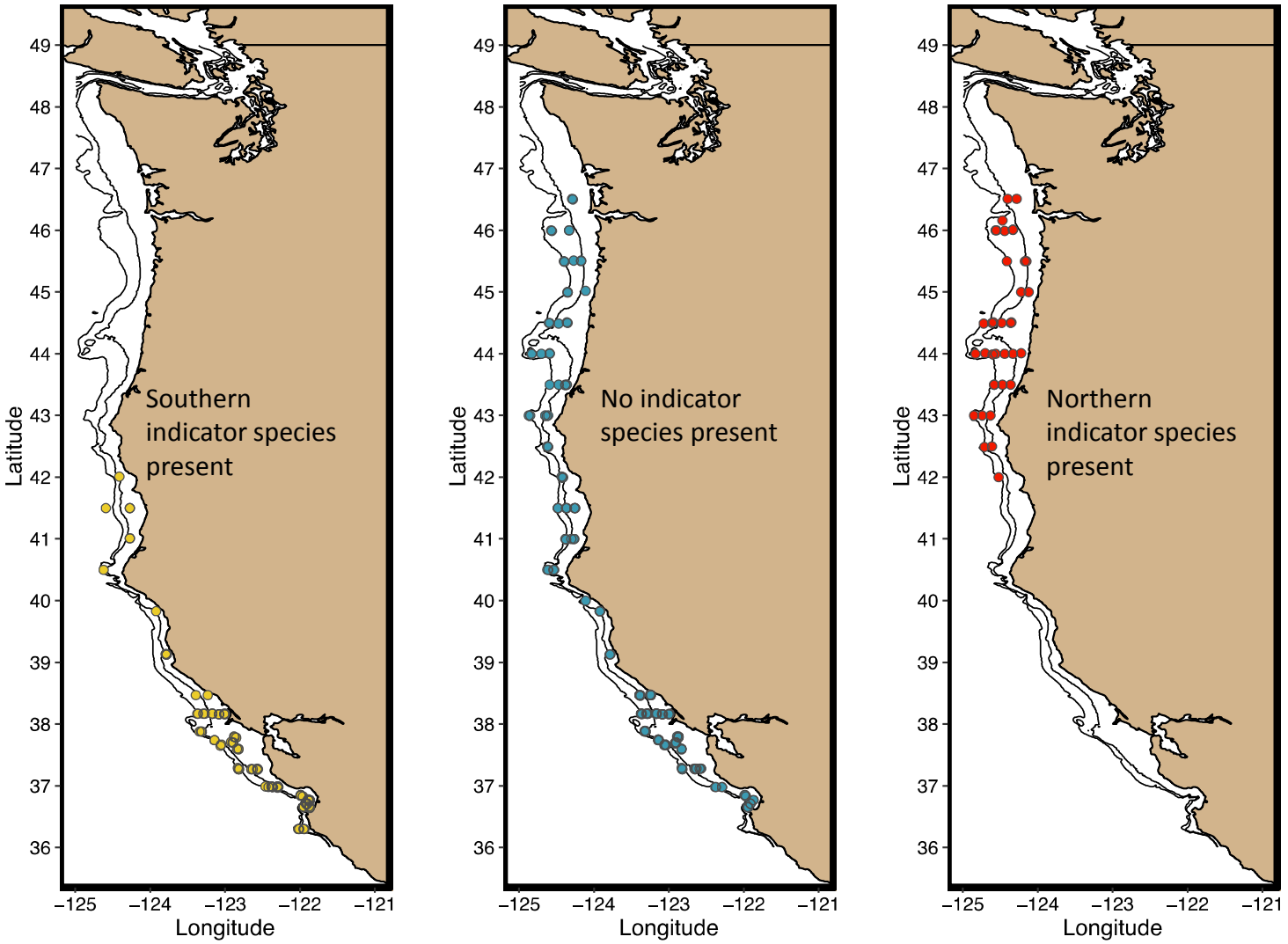

Conclusions

1. There is a distinct latitudinal cline in forage assemblages with a somewhat dramatic switch ~42-43 degrees

1. Northern and southern assemblages are oppositely related to intensity of upwelling four months prior.

2. On/Off-shore forage species are mostly correlated to the distribution of isopyncnal depth in late winter.