



The LifeWatch ERIC Biodiversity
& Ecosystem eScience Conference
PLOVDIV, BULGARIA 7-10 JULY 2026

From krill to seabirds: integrating morphology and metabarcoding to reveal trophic links in Australasian gannets

Presenter: Marina Querejeta

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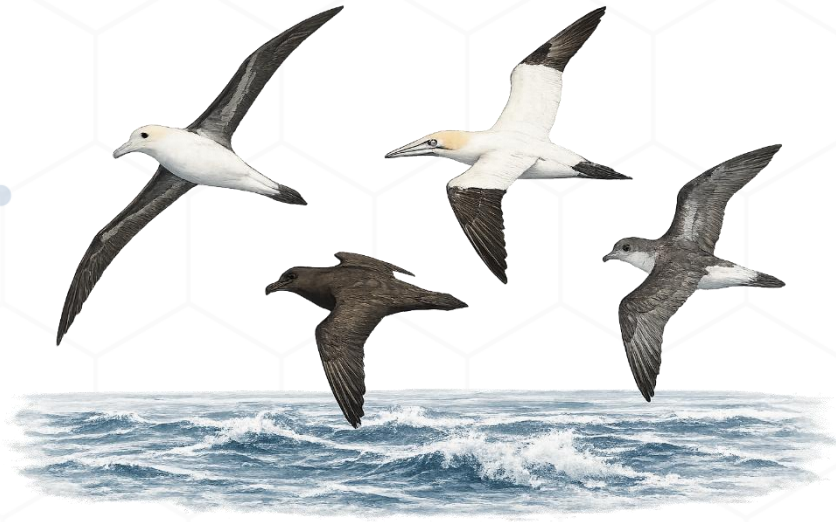
Co-authors: Nigel Adams, Marie-Caroline Lefort, Erin Doyle, Todd Landers & Stéphane Boyer

10th July 2026



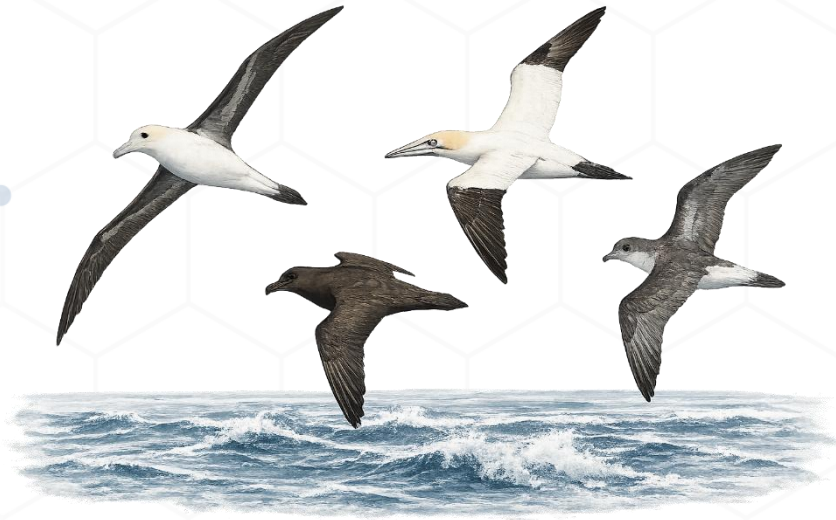
Seabirds as important top predators in marine ecosystems

Seabirds → strong influence on **prey populations** & **energy dynamics** across trophic levels

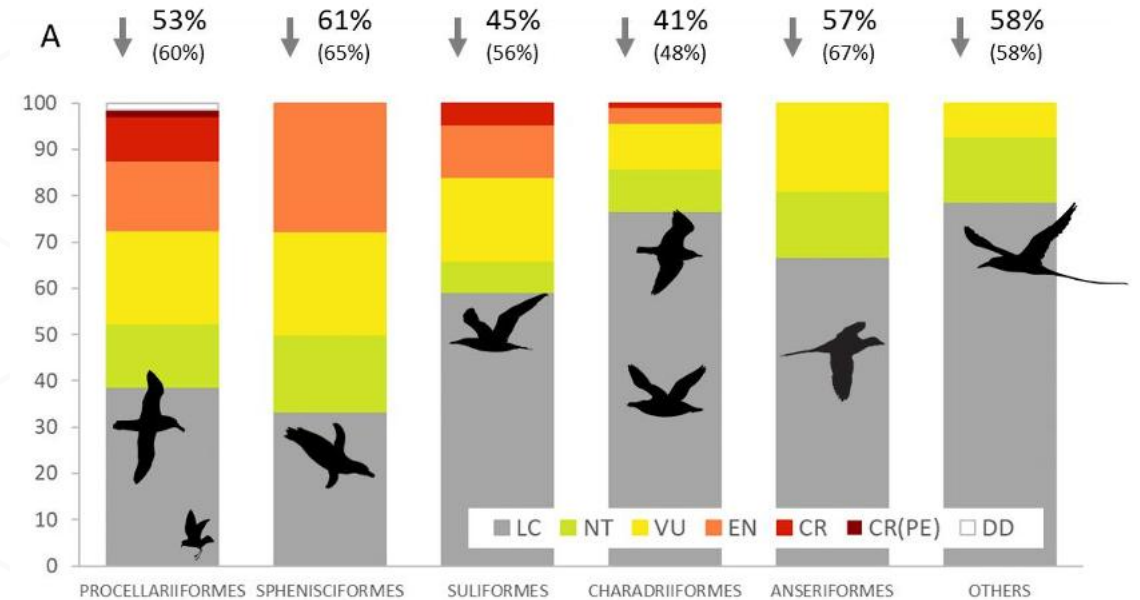


Seabirds as important top predators in marine ecosystems

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Seabirds rank among the **most threatened groups of birds globally**

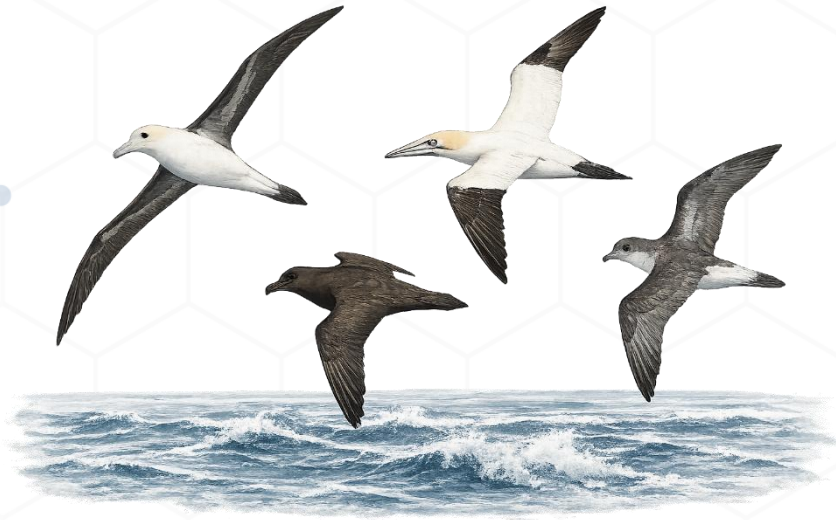


Phillips et al., 2022

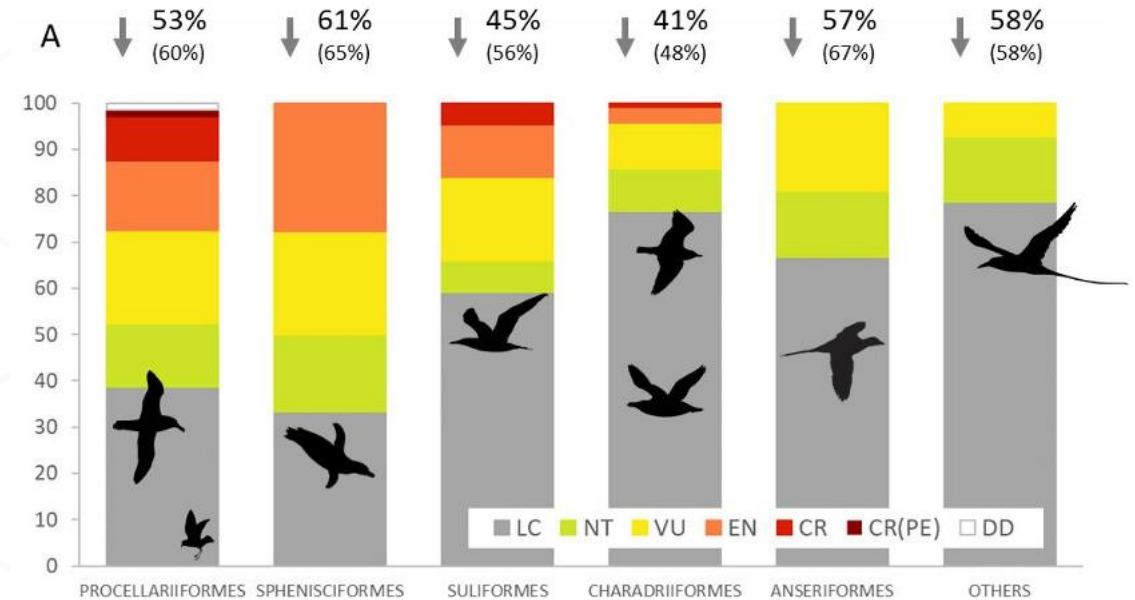
One third of seabird species threatened globally.

Seabirds as important top predators in marine ecosystems

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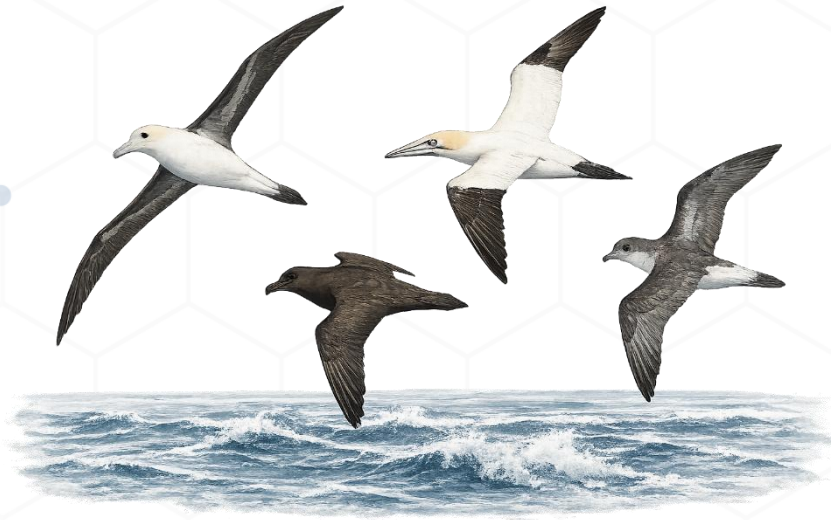


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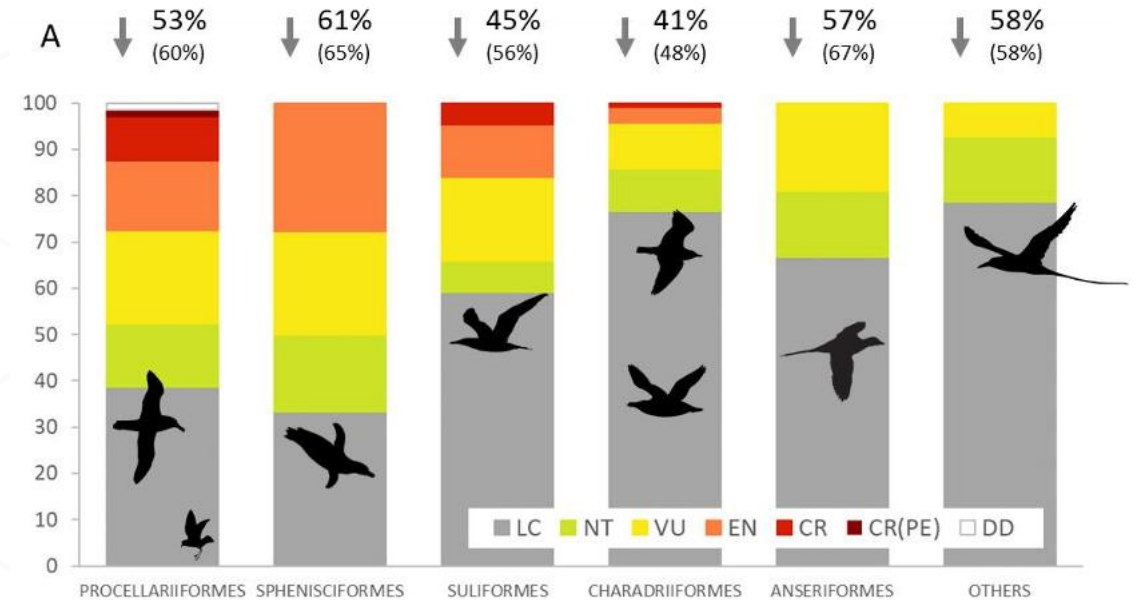
Understanding **seabirds' trophic role** not only sheds light on marine **energy flows** but also underpins **seabird conservation strategies**

Seabirds as important top predators in marine ecosystems

Seabirds → strong influence on **prey populations & energy dynamics** across trophic levels



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Phillips et al., 2022

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Australasian gannets (*Morus serrator*)

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Diet was already studied morphologically



Small schooling fish & squid (Schuckard et al. 2012)

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Small schooling fish & squid (Schuckard et al. 2012)



Reconstruction of the complete **foraging links** is necessary to develop **protection & conservation strategies** & inform utility of **seabirds as indicators of perturbations to ecosystem functioning and energy flow**

Objectives

Describe the **food web** around Australasian gannets (*Morus serrator*) in the Hauraki Gulf, North Island, NZ

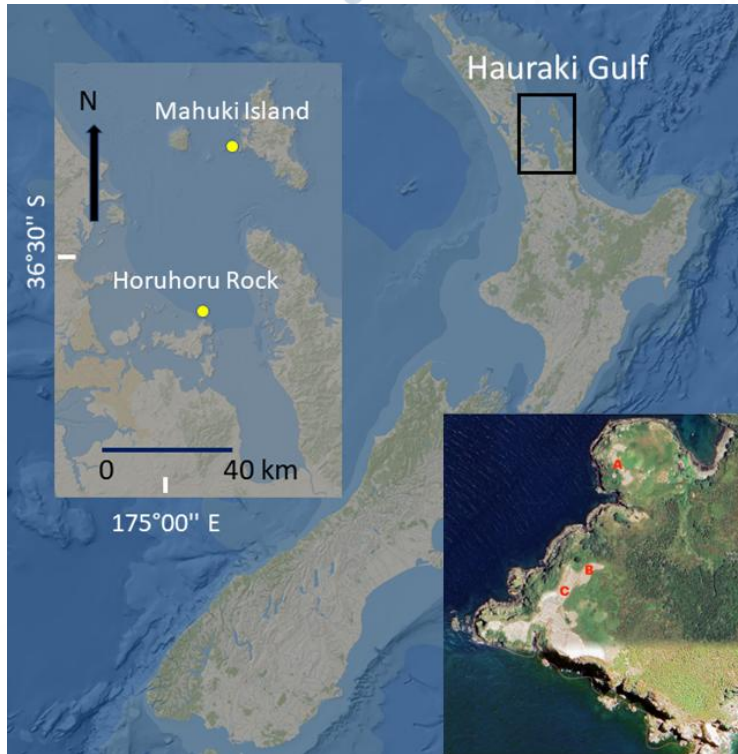
- (1) Evaluate **quality** and **completeness** of the approaches
- (2) Characterise **gannet and gannet's prey diets**
- (3) Reconstruct **direct and indirect trophic linkages**
- (4) Identify **ecological drivers of dietary variation**

How did we do this?

Integrative methodology



Study area: Hauraki Gulf, NZ



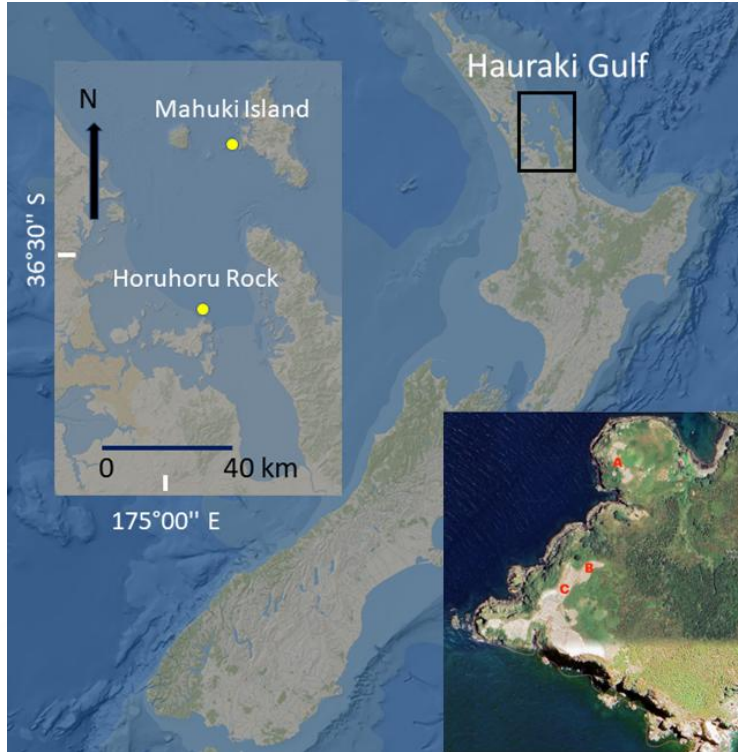
How did we do this?

Integrative methodology

Collection of **53 gannets**



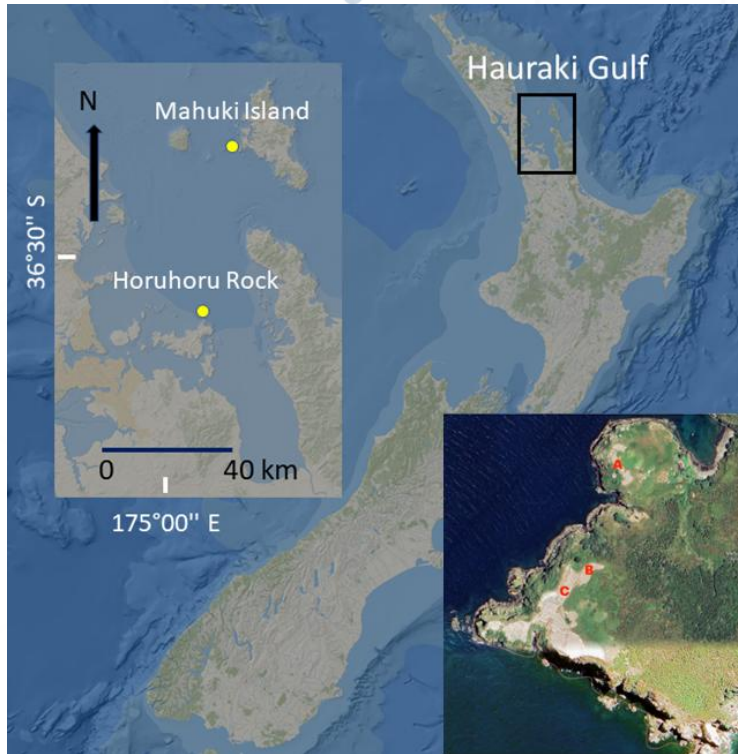
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How did we do this?

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Collection of **53 gannets**

Regurgitation

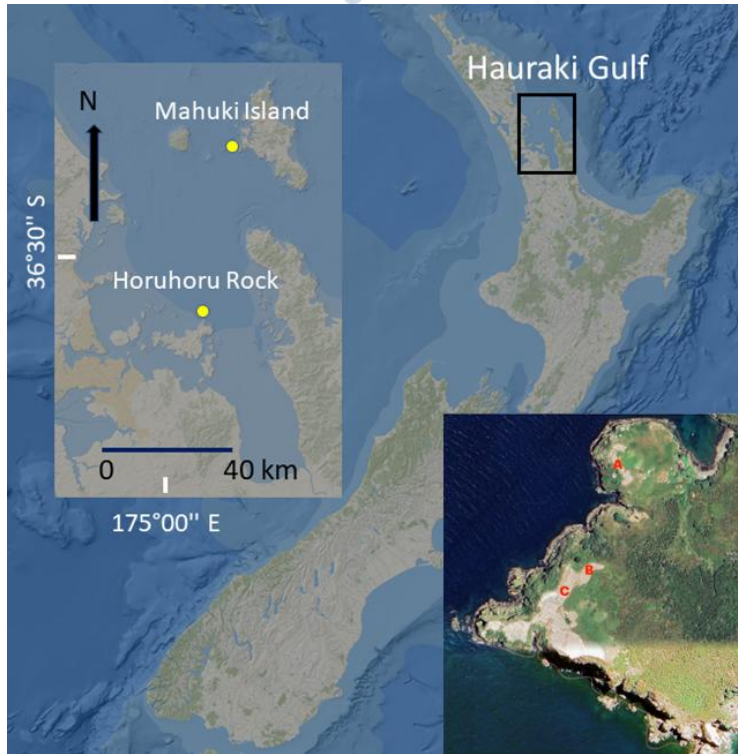
Dissection of **primary prey**
(Prey Stomachs PS)



How did we do this?

Integrative methodology

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Collection of **53 gannets**



Regurgitation



Dissection of **primary prey**
(Prey Stomachs PS)



N = 123



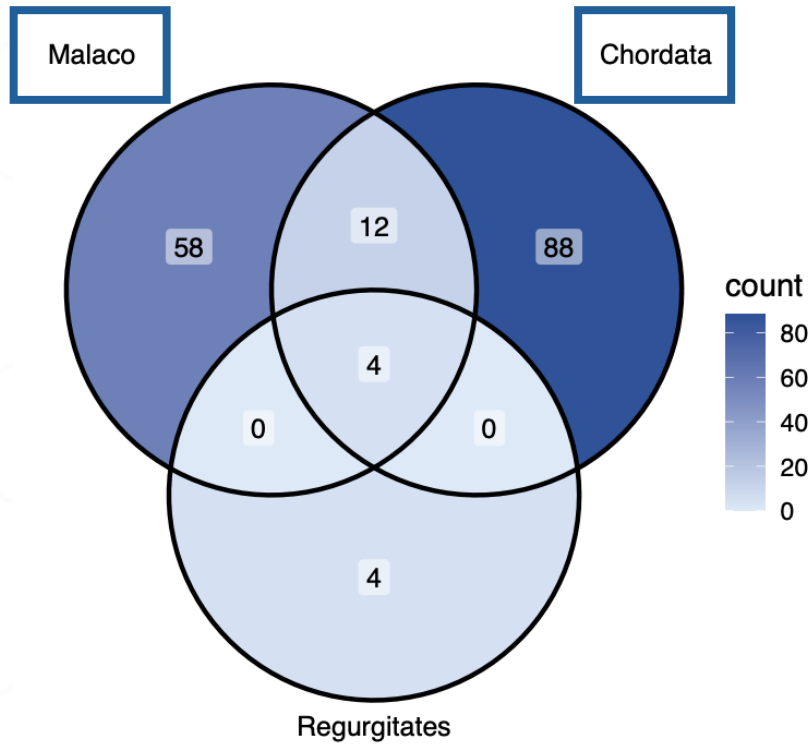
Collection of **70 faeces**
(collected birds FC & random FR)



Metabarcoding 16S "Malaco" & "Chord" primers (Deagle et al. 2005 & 2009) **of primary & secondary prey**

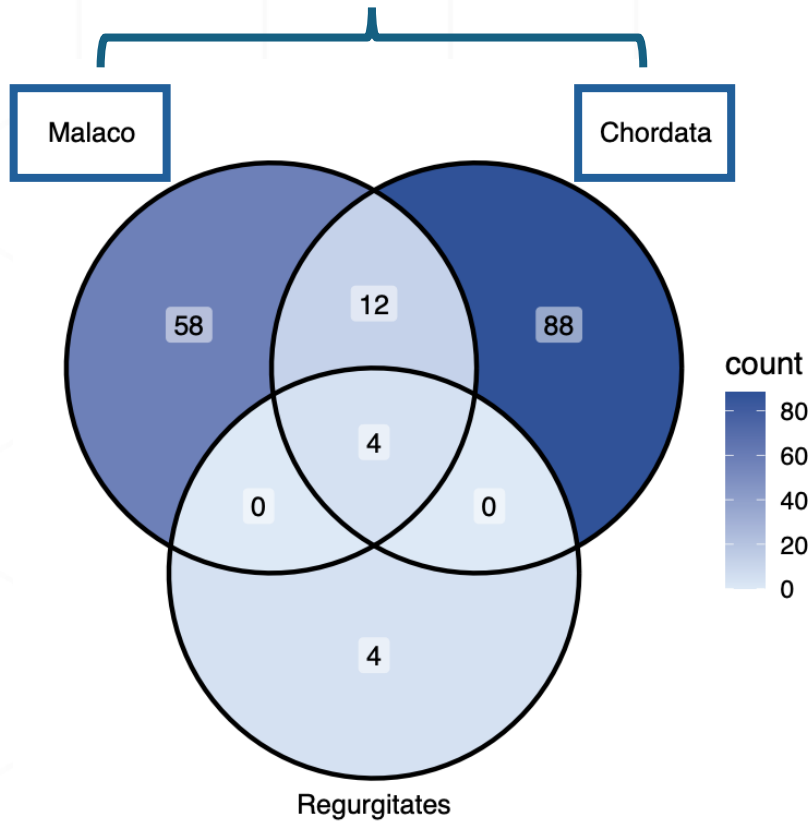
Quality & completeness of the combined morphological and metabarcoding approach

Prey species by approach

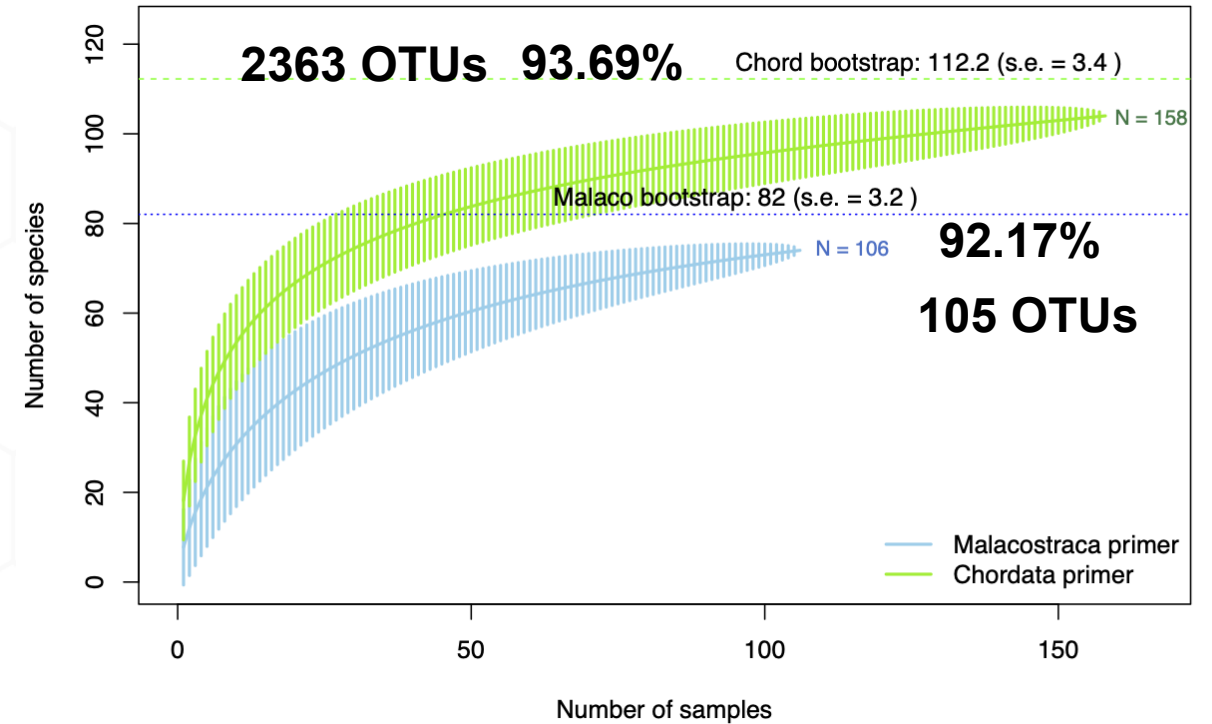


Quality & completeness of the combined morphological and metabarcoding approach

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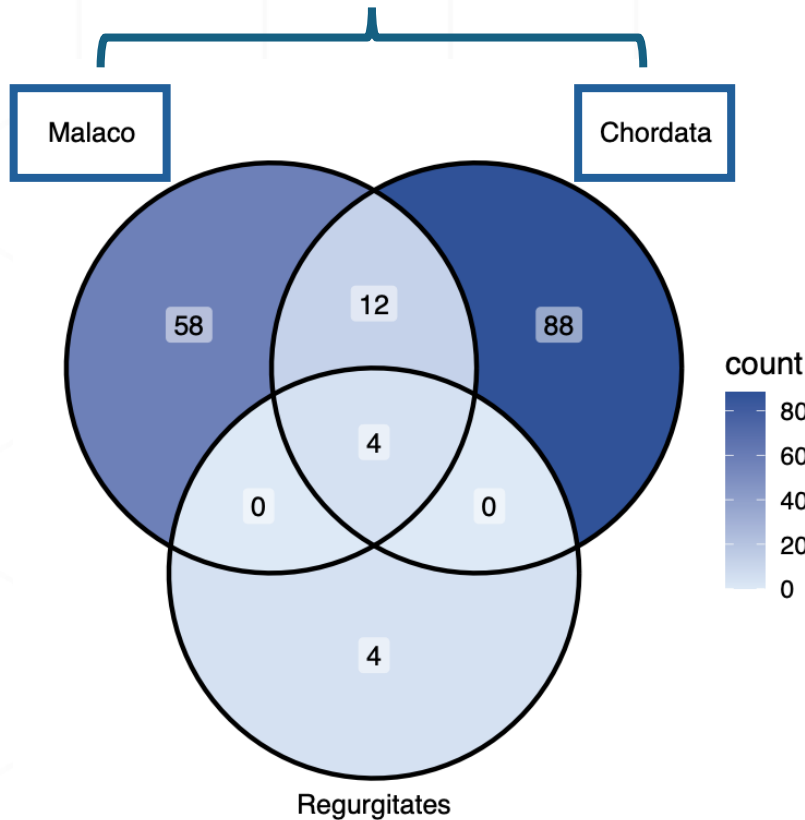
Accumulation curve by primer



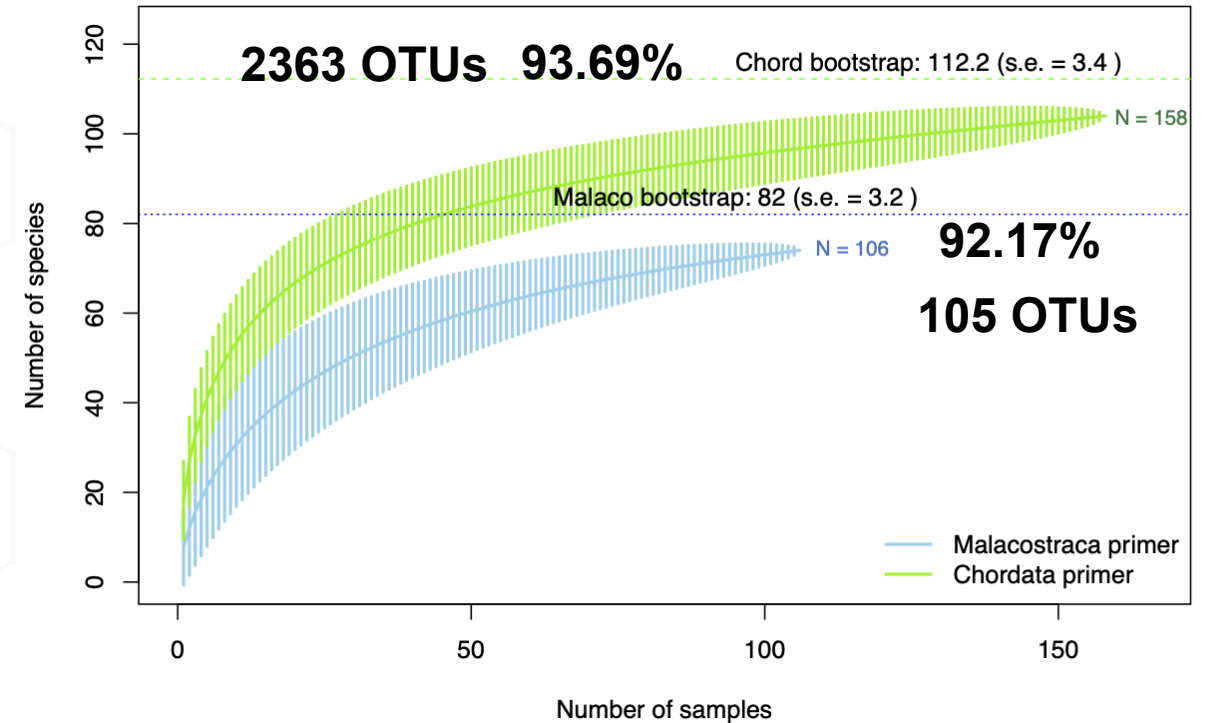
Higher resolution of Chord primer → **primer mismatches** & limited **reference libraries** (Miya et al. 2015; Querejeta et al., 2023)

Quality & completeness of the combined morphological and metabarcoding approach

Prey species by approach



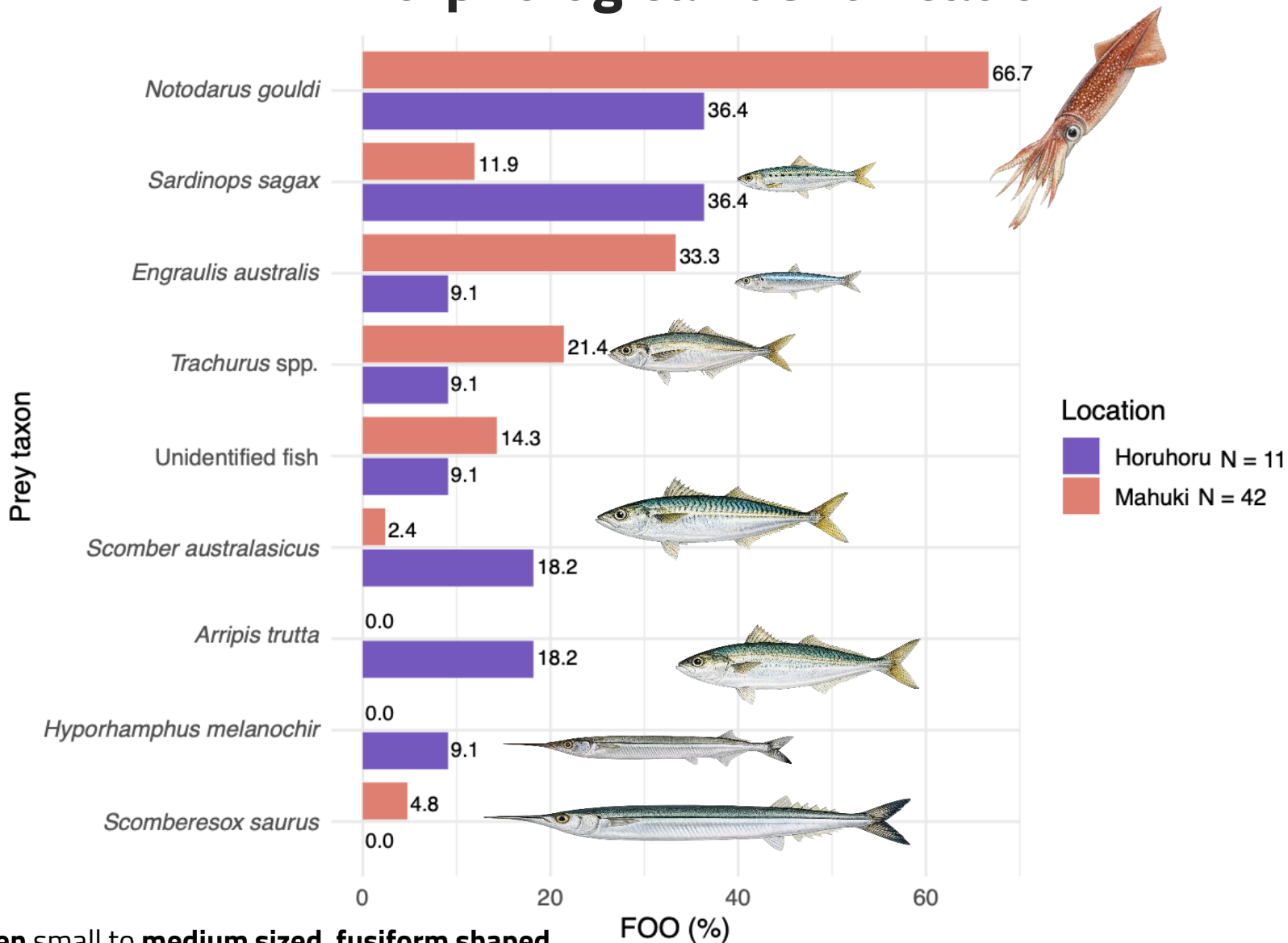
Accumulation curve by primer



Higher resolution of Chord primer → **primer mismatches** & limited **reference libraries** (Miya et al. 2015; Querejeta et al., 2023)

Our combined approach generated **high-quality datasets** suitable for downstream analyses

Major gannet prey items through morphological identification

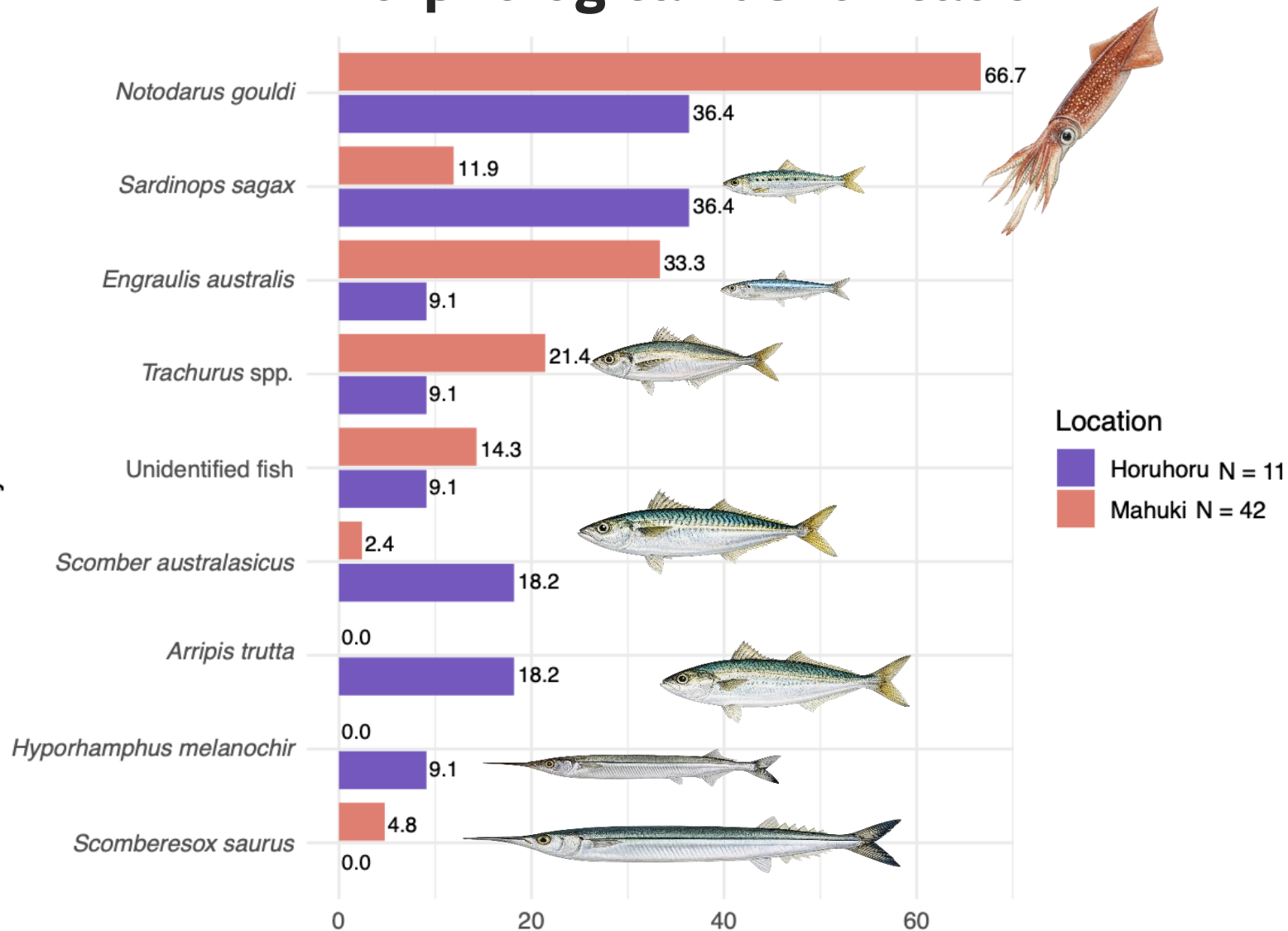


Diet dominated by **seven** small to **medium sized, fusiform shaped, schooling fish** and **one squid species**.

Major gannet prey items through morphological identification



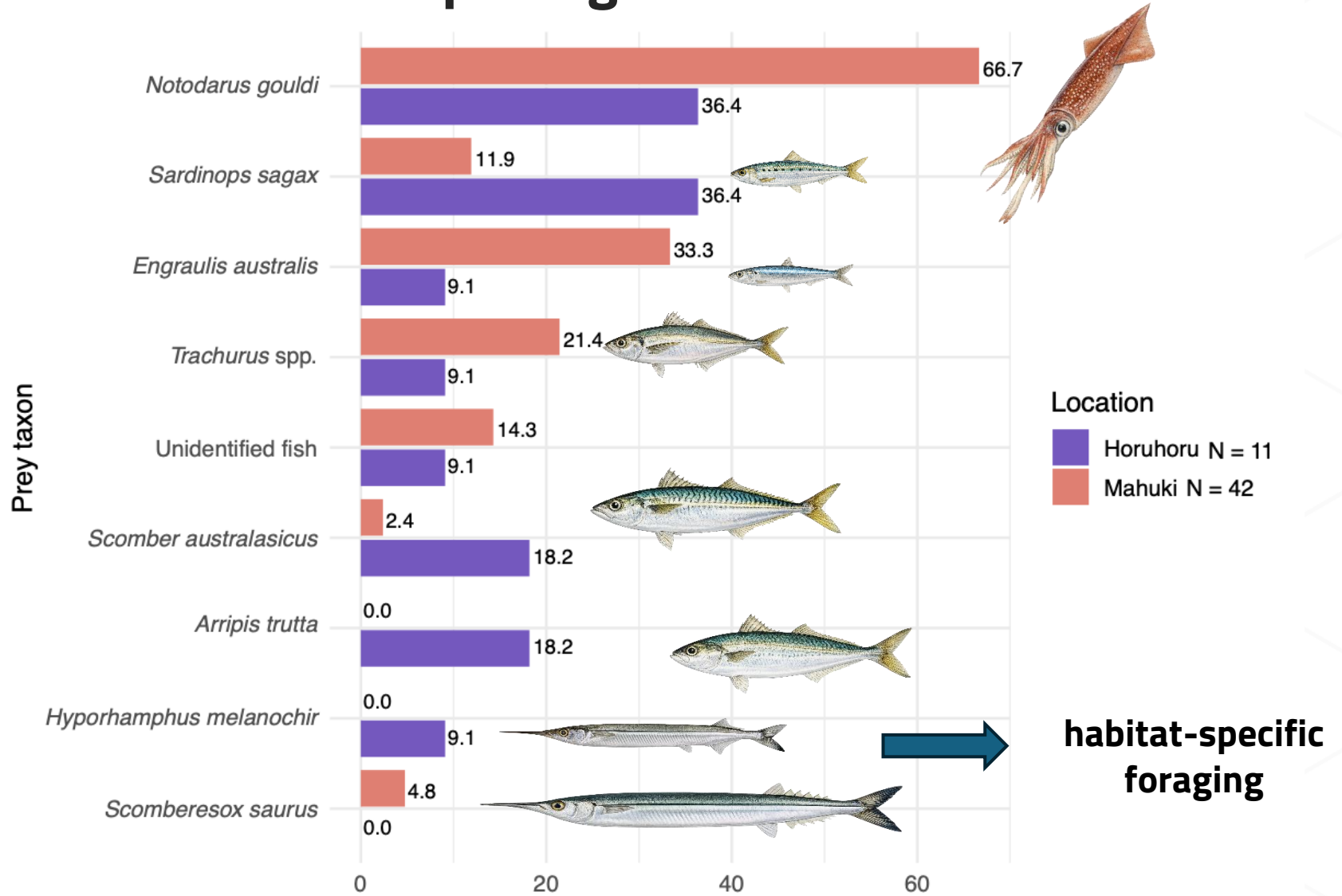
Prey taxon



Diet dominated by **seven** small to **medium sized**, **fusiform shaped**, **schooling fish** and **one squid species**.

→ **plunge-diving foraging ecology**

Major gannet prey items through morphological identification

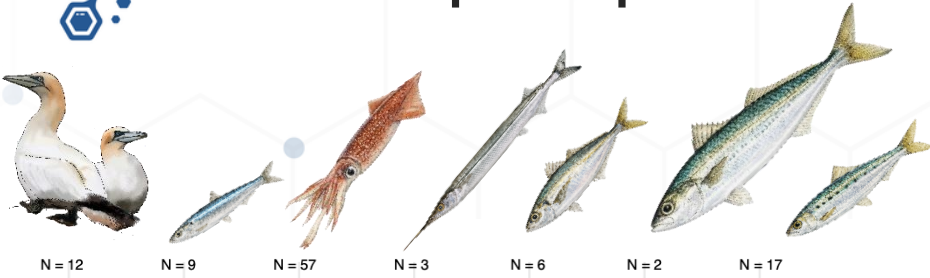


Diet dominated by **seven** small to **medium sized**, **fusiform shaped**, **schooling fish** and **one squid species**.

Characterise gannet diet & gannet's prey diet



"Malaco" primer pair



N = 12

N = 9

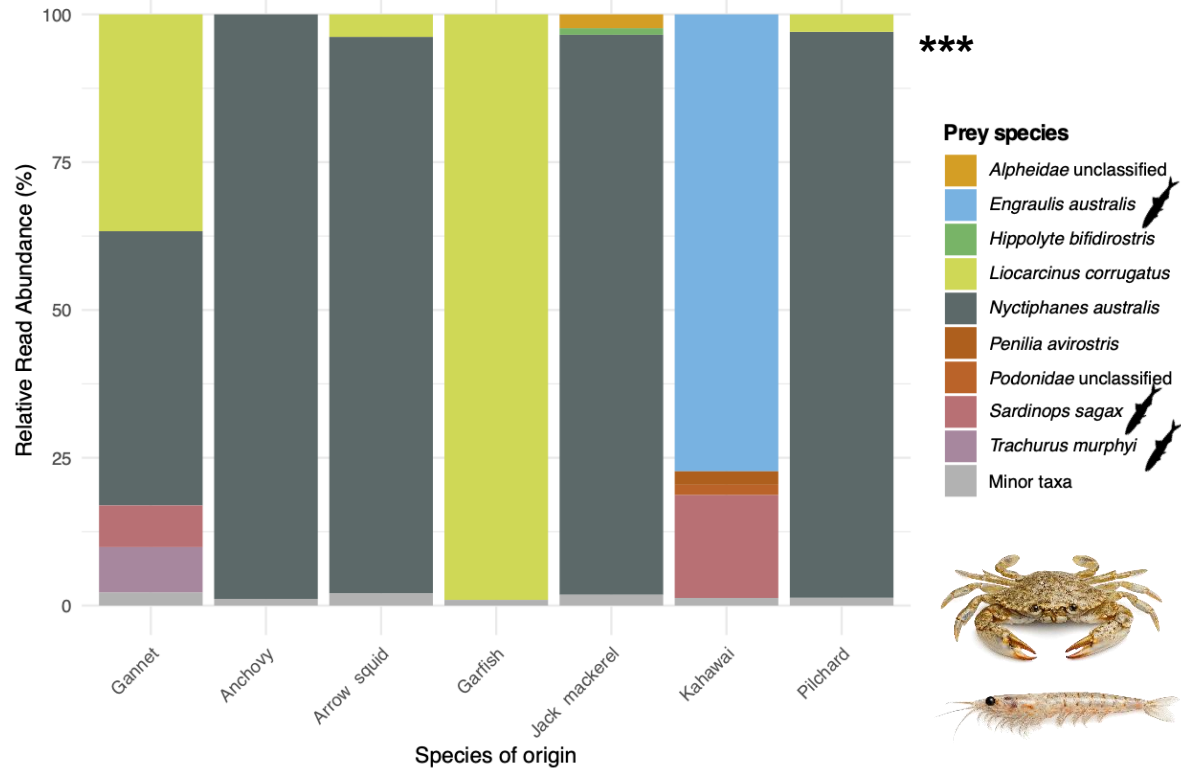
N = 57

N = 3

N = 6

N = 2

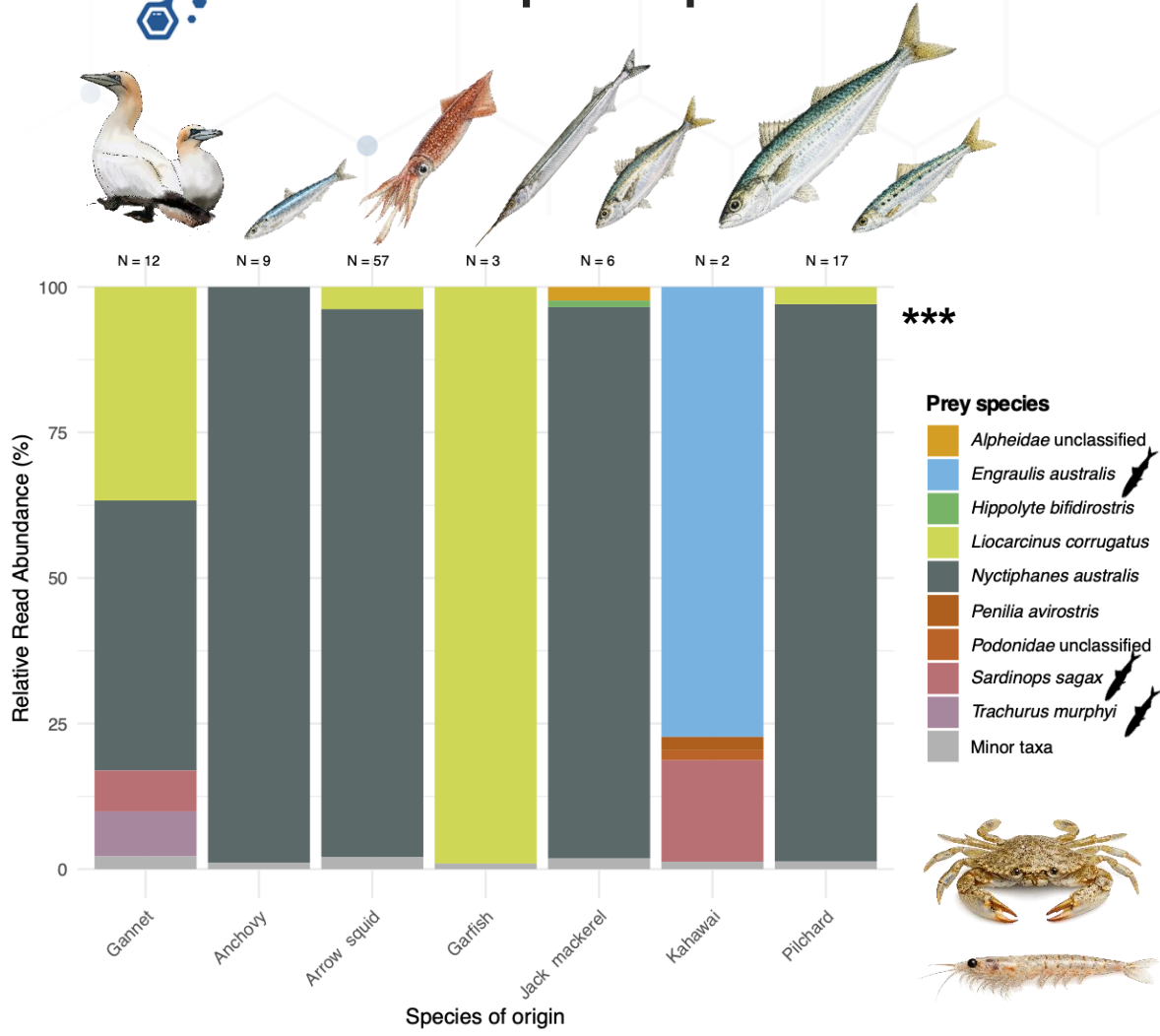
N = 17



The swimming crab (*Liocarcinus corrugatus*) & krill (*Nyctiphanes australis*) as the **most important crustacean prey items**

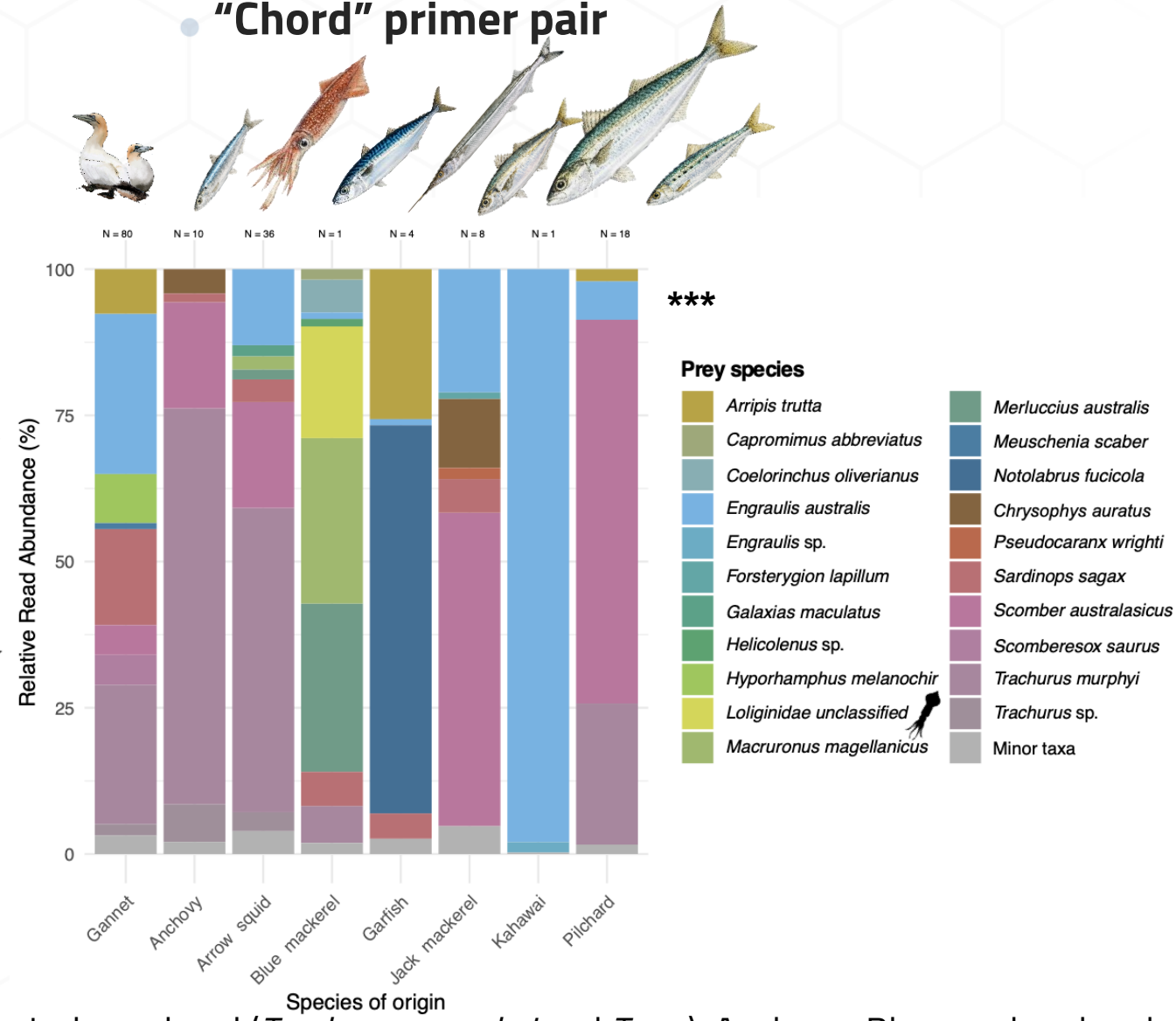
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BEeS 2026
"Malaco" primer pair



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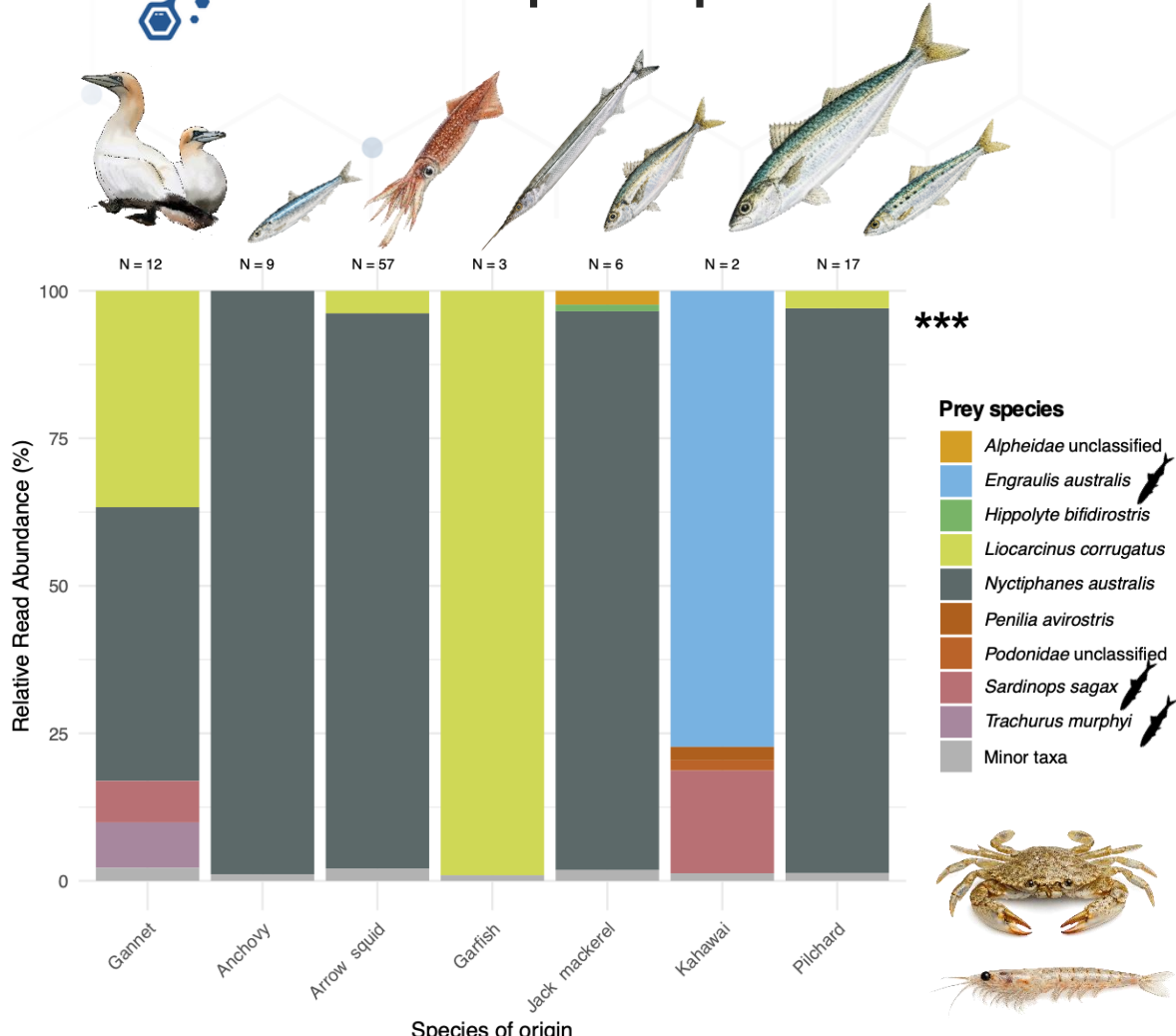
"Chord" primer pair



Jack mackerel (*Trachurus murphyi* and *T. sp.*), Anchovy, Blue mackerel and Pilchard present in more than **80% of the samples**

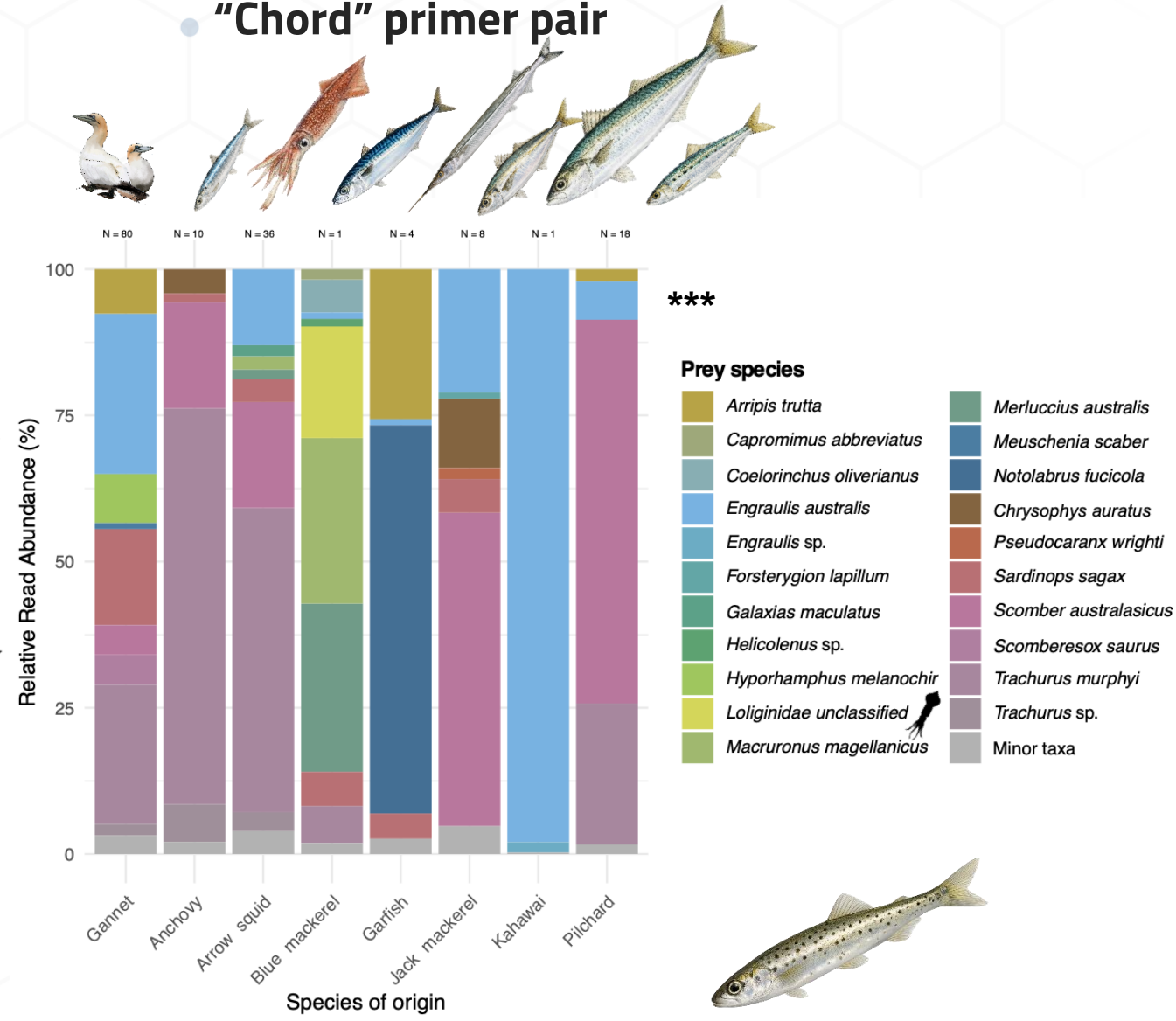
Characterise gannet diet & gannet's prey diet

BEEs
2026
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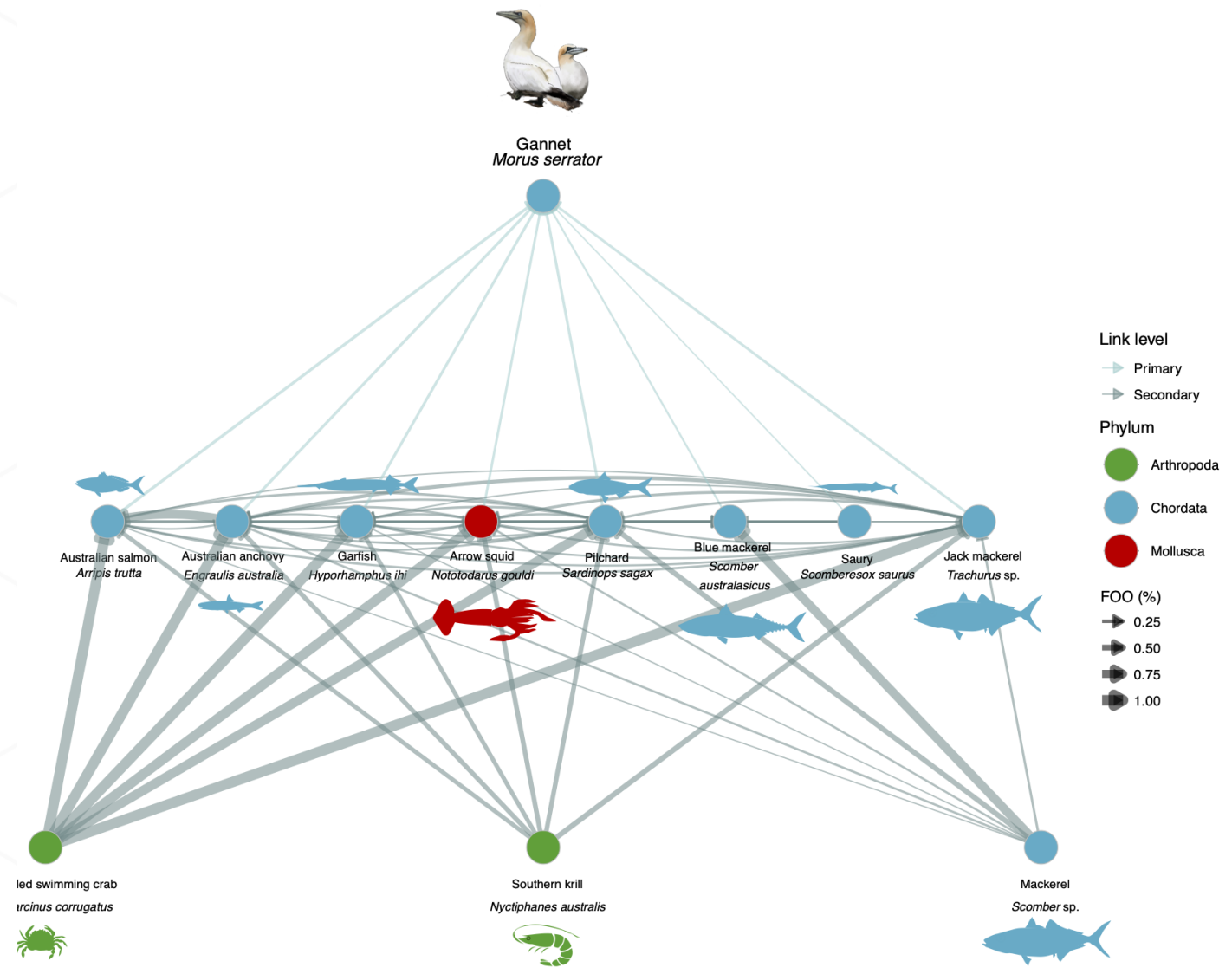
The swimming crab (*Liocarcinus corrugatus*) & krill (*Nyctiphanes australis*) as the **most important crustacean prey items**

"Chord" primer pair



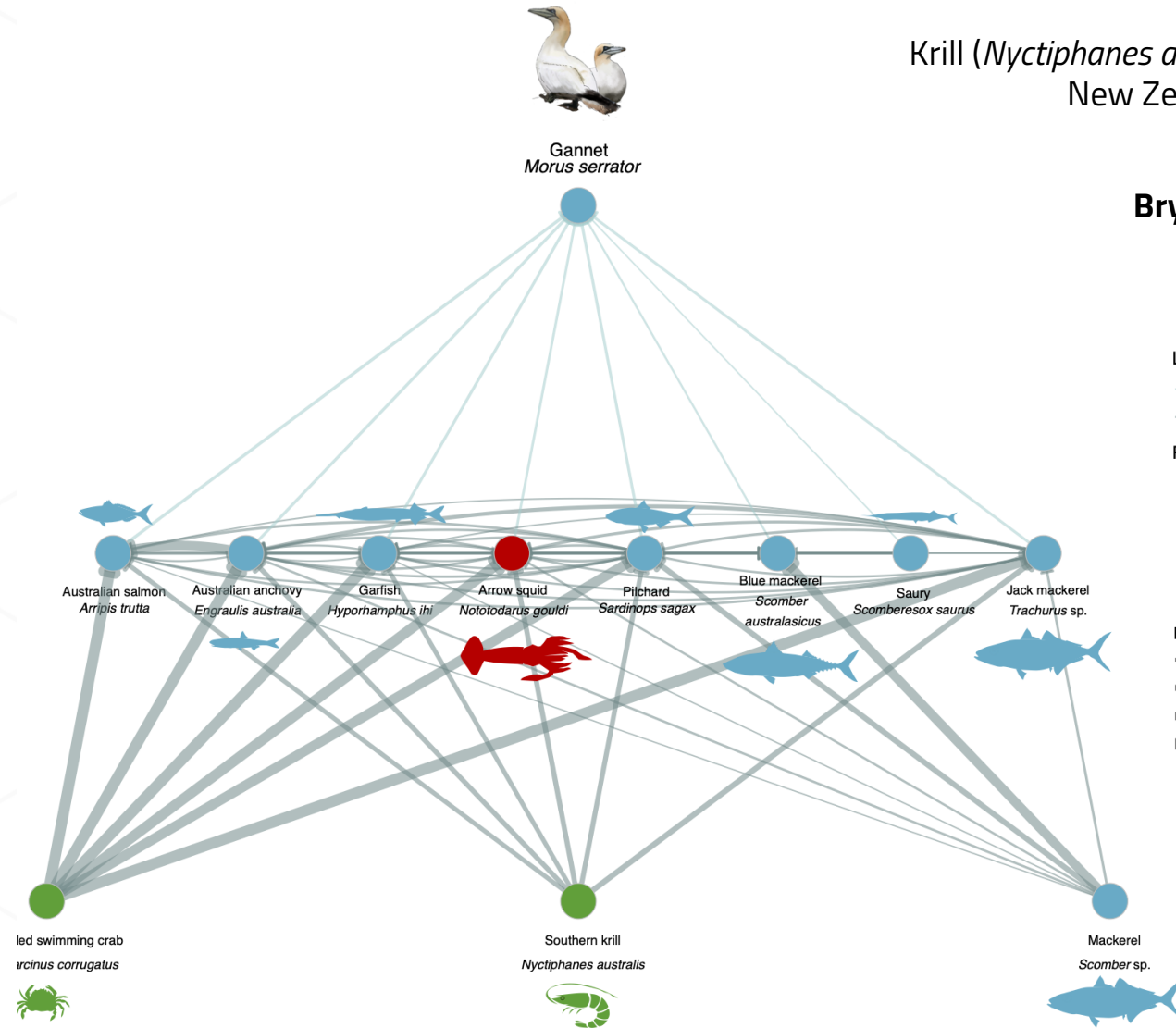
Whitebait (*Galaxias maculatus*) → **river-derived DNA** entering coasts

Gannet-centred food web



First attempt to reconstruct **prey-of-prey** interactions

Gannet-centred food web



Krill (*Nyctiphanes australis*) → **keystone component** of New Zealand coastal food webs

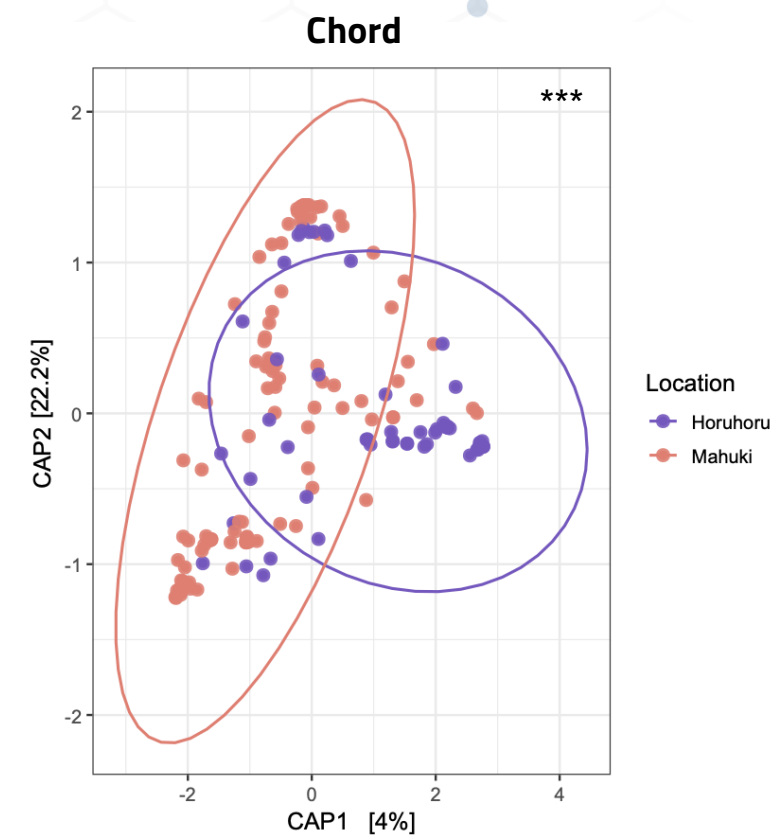
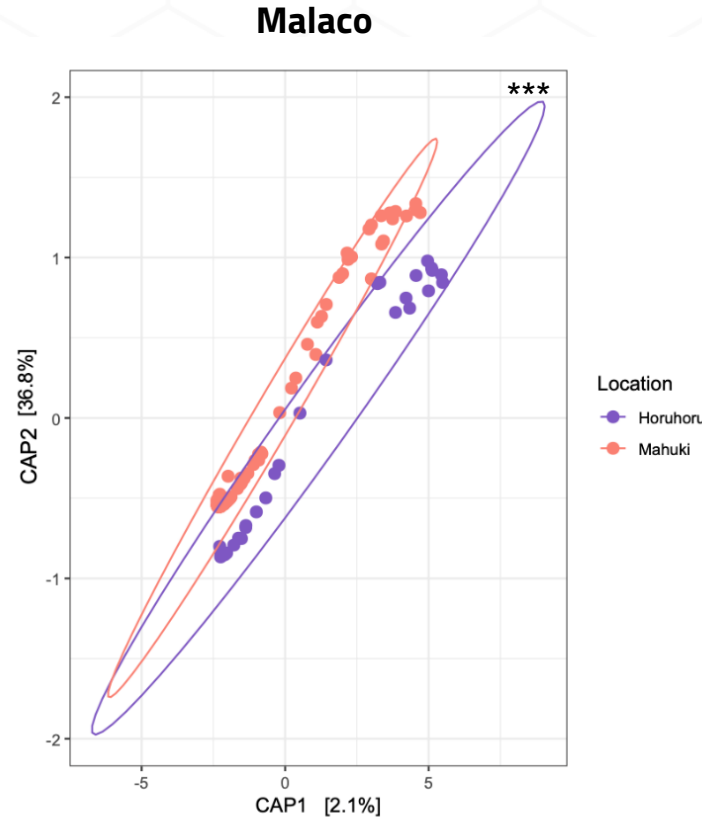
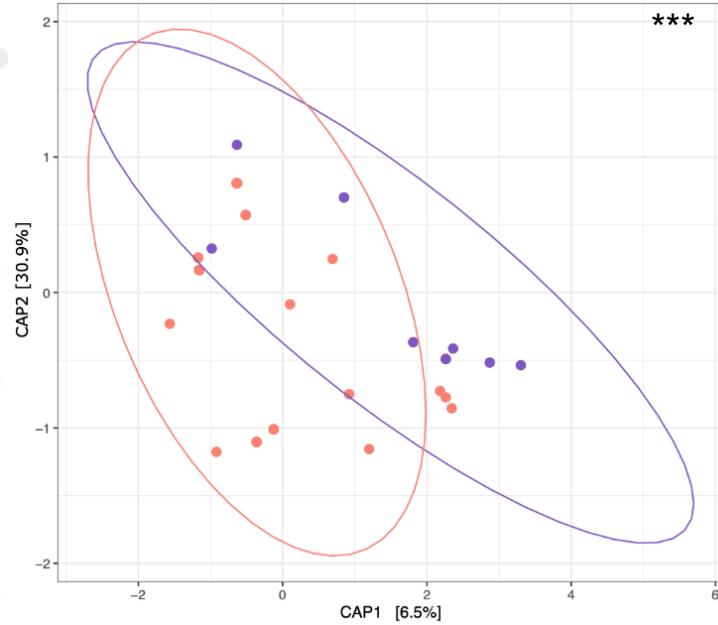
Bryde's wale



Visser et al. 2020

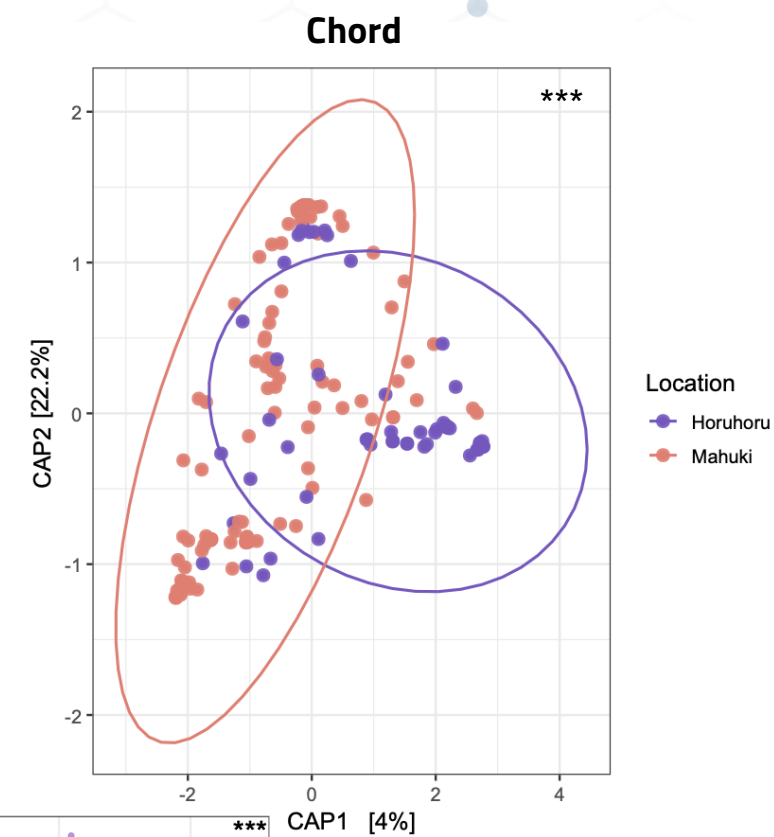
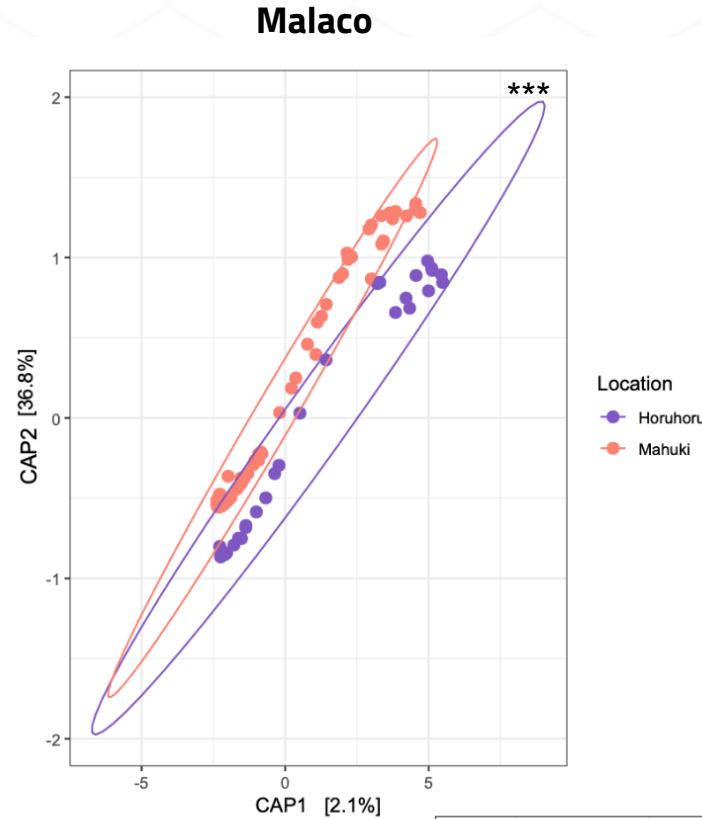
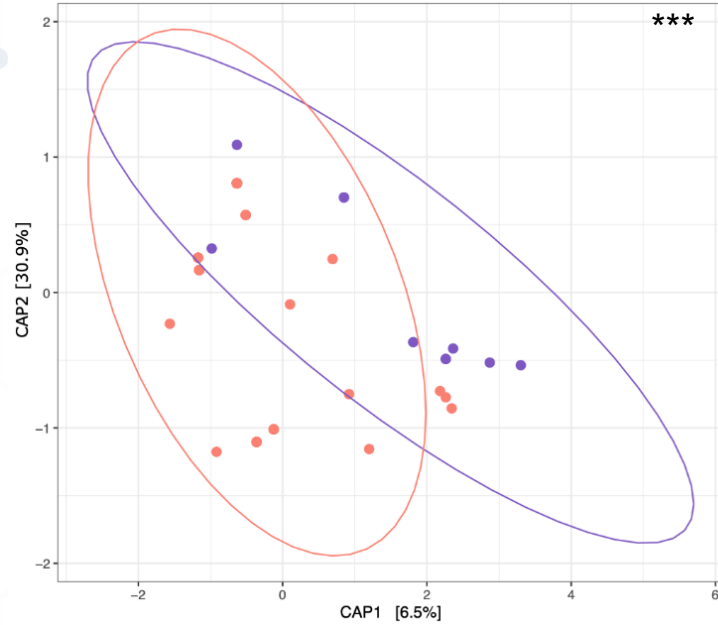
First attempt to reconstruct **prey-of-prey interactions**

Gannet-centred food web & its drivers of change

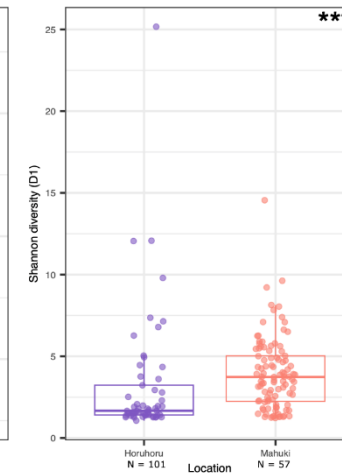
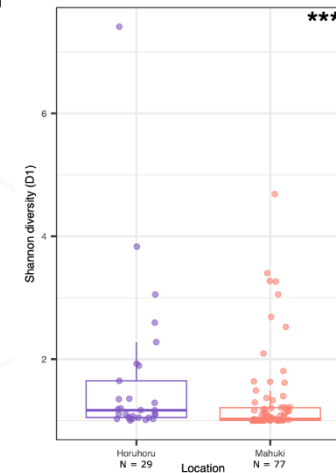


Important effect of **colony location** → **gannet foraging behaviour** responds strongly to **local oceanographic conditions** & **prey availability**

Gannet-centred food web & its drivers of change

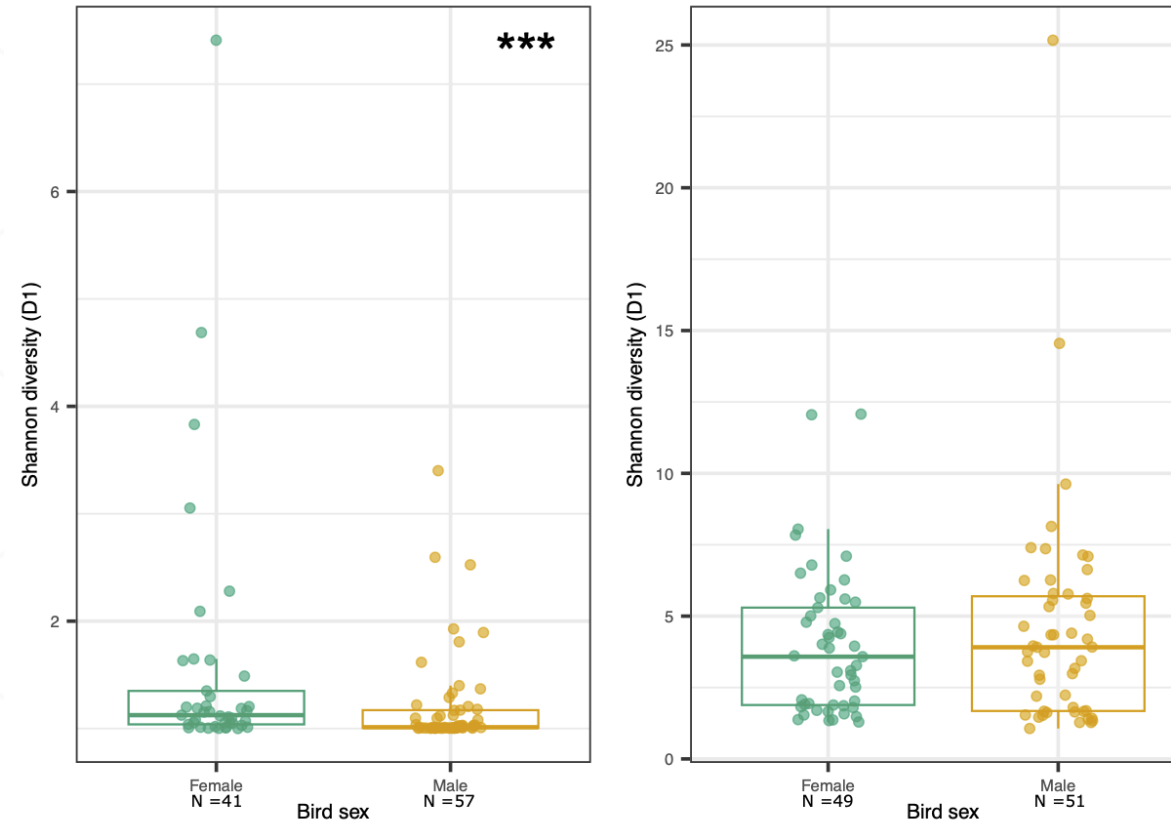


Important effect of **colony location** → gannet **foraging behaviour** responds strongly to **local oceanographic conditions** & **prey availability**



Gannet-centred food web & its drivers of change

Sex effect in crustacean diversity



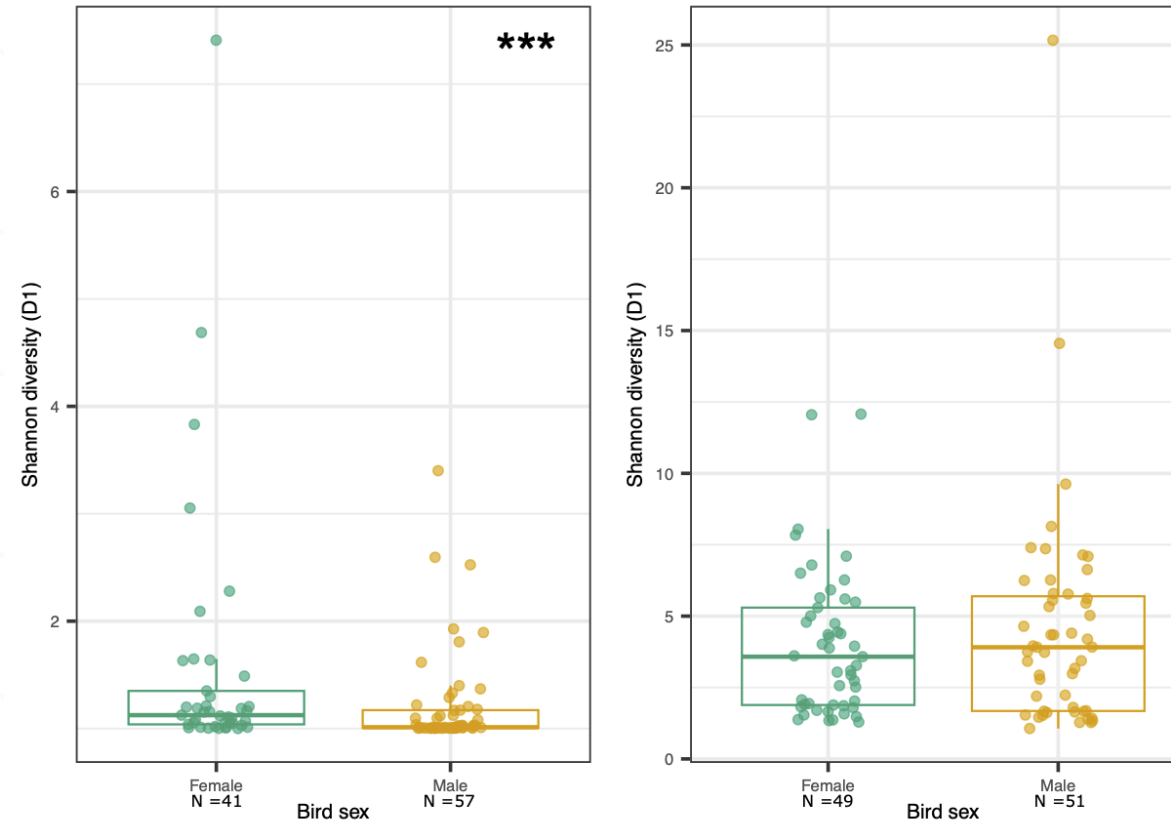
Females **feed on a higher diversity of crustaceans**
but not fish & squids

+ **Beak & Wing** effect

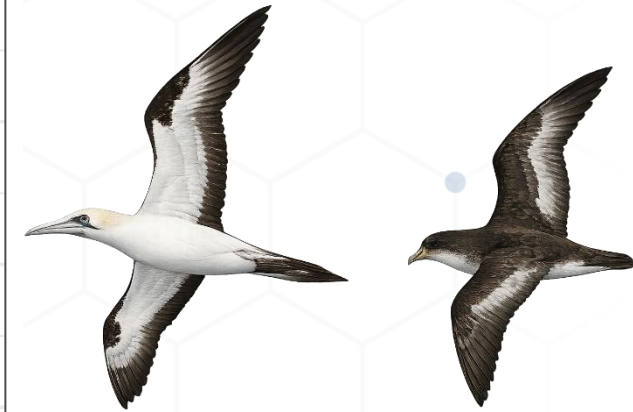


Gannet-centred food web & its drivers of change

Sex effect in crustacean diversity

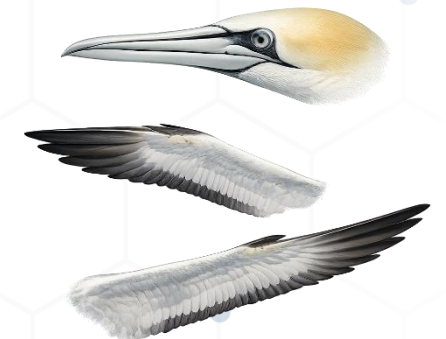


Pacific boobies (Van Oordt et al. 2018)



Juan Fernandez petrel (Clay et al. 2023)

+ **Beak & Wing** effect



Females **feed on a higher diversity of crustaceans**
but not fish & squids



- Integrated morphology and metabarcoding revealed a **multi-trophic food web centred on Australasian gannets**.
 - **Few key prey taxa** (especially *Nyctiphanes australis* and small pelagic fishes) underpin **ecosystem connectivity**.
- **Colony location and individual morphology** shape prey composition across trophic levels.
 - **Climate change & marine heatwaves** are likely to alter **prey availability and trophic interactions**.
- **Australasian gannets act as natural ecosystem samplers**, providing a powerful tool for marine biodiversity and ecosystem monitoring.



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THANK YOU!

Questions?

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