

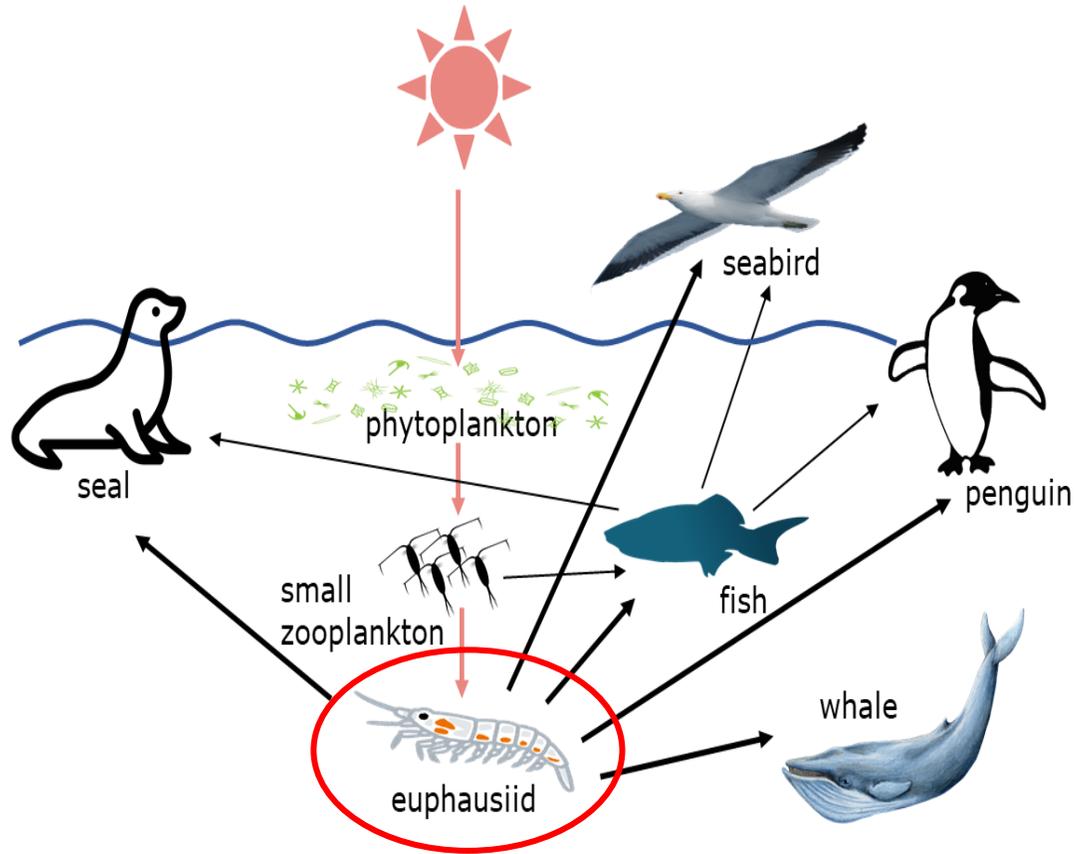
**Feeding ecology of three euphausiid species in the low-latitude eastern Indian and South Pacific Oceans inferred from 18S V9 metabarcoding**

**Fanyu Zhou, Junya Hirai, Koji Hamasaki, and Atsushi Tsuda**

**Atmosphere and Ocean Research Institute,  
The University of Tokyo**



**SCOR MetaZooGene Symposium 2022**



Euphausiids in the marine food web

➤ Well known as **“krill”**:

Occupy ~5—10% of the total zooplankton biomass

➤ **A key role in biological pump:**

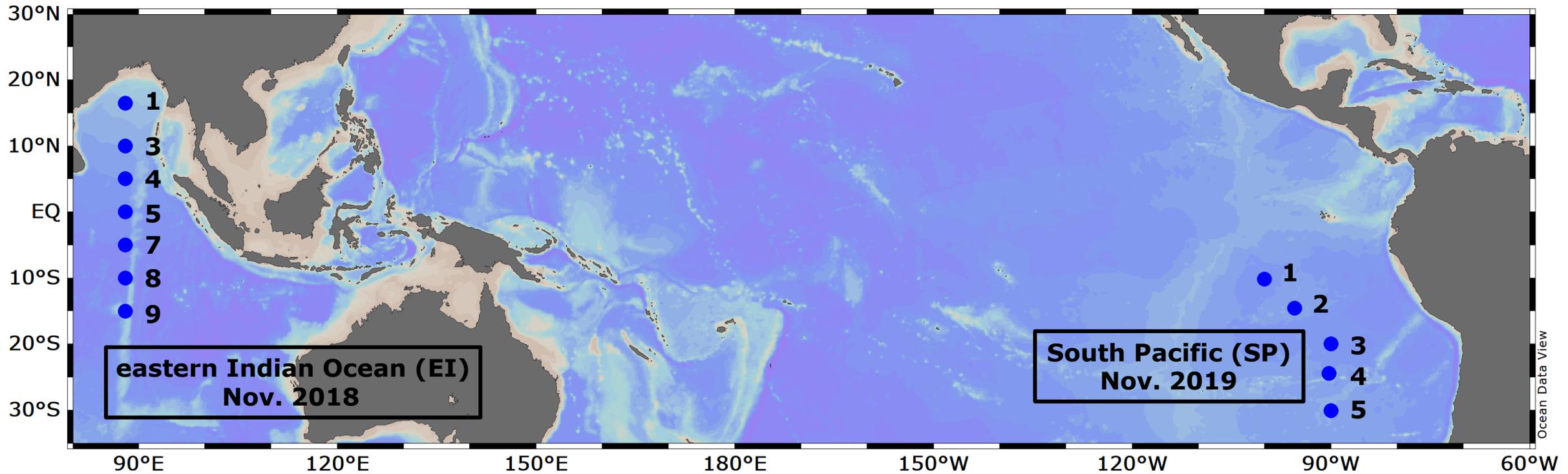
Accelerate the transportation of carbons to the deep ocean

➤ **A critical link** of lower and higher trophic levels:

Feed on phytoplankton (diatom, dinoflagellates) and small zooplankton;

Prey for fish, seabirds, marine mammals

**Knowledge gaps of euphausiid feeding habits in the low-latitude ecosystems**



➤ **Euphausiid** samples:

500 m to the surface at night by oblique tows of Matsuda-Oozeki-Hu Trawl (MOHT);

➤ **Filter samples** of seawater (5 L):

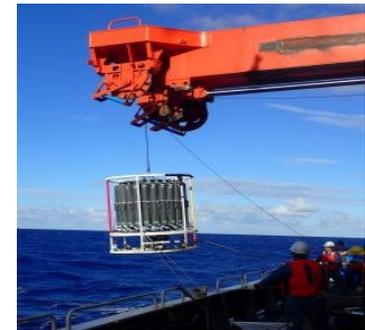
at 0, 10, 100 m, SCM depth as **prey availability**



MOHT

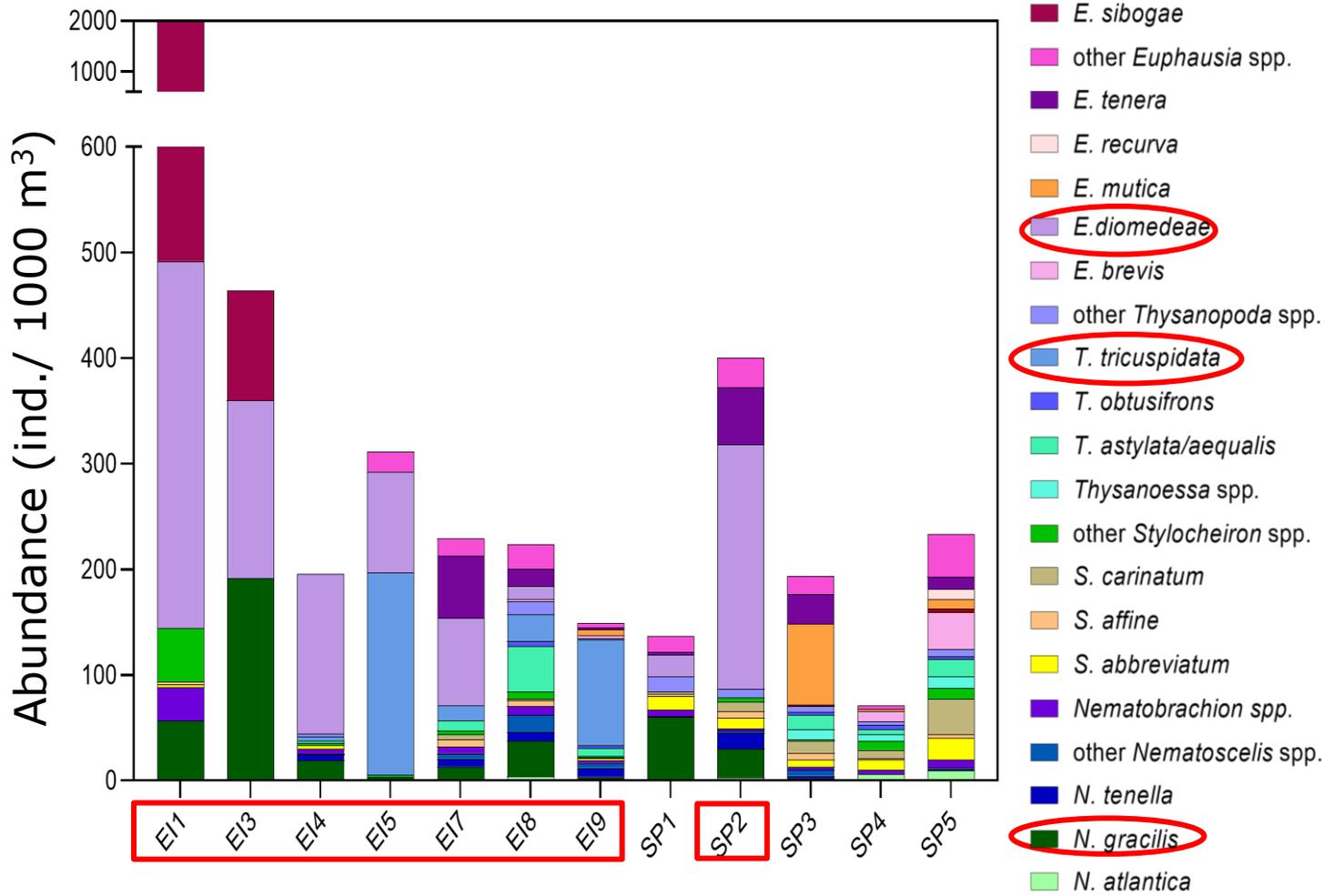
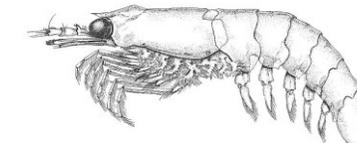


Caught zooplankton



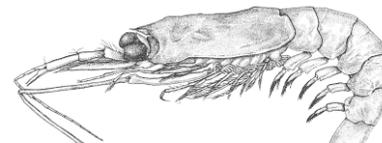
CTD collecting seawater

# Decide target euphausiid species:

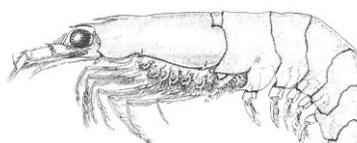
*Euphausia diomedea* (EI1–7, SP2)

The most dominant;  
Widely distributed



*Nematoscelis gracilis* (EI3, 8, SP2)

Always co-existed  
with *E. diomedea*



*Thysanopoda tricuspidata* (EI5, EI9)

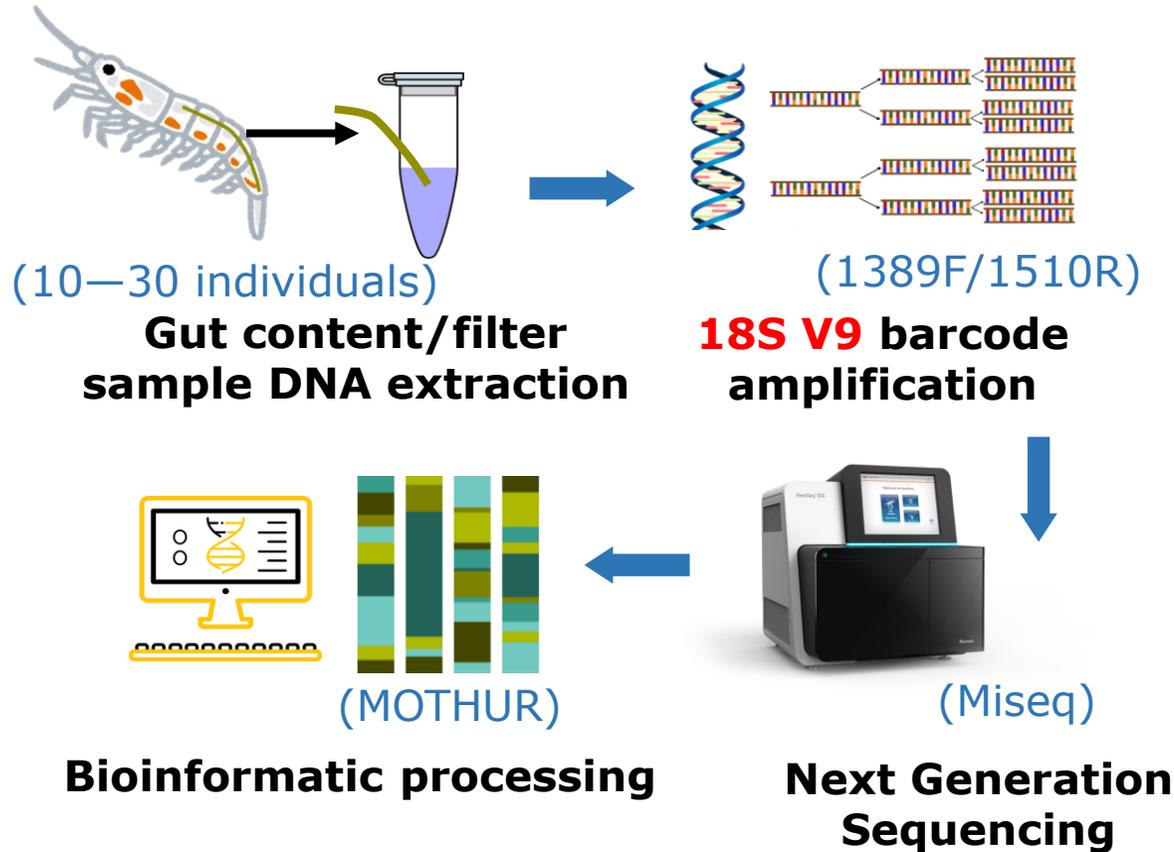
Sporadically abundant

(Photos from Baker et al. 1990)

To investigate the **detailed diet** and potential specific feeding habit of three target species of euphausiids using DNA metabarcoding

## Questions:

- A **flexible diet** would support the **wide-range distribution** of certain species?
- **Different prey preference** favors the **co-existence** of euphausiid species?



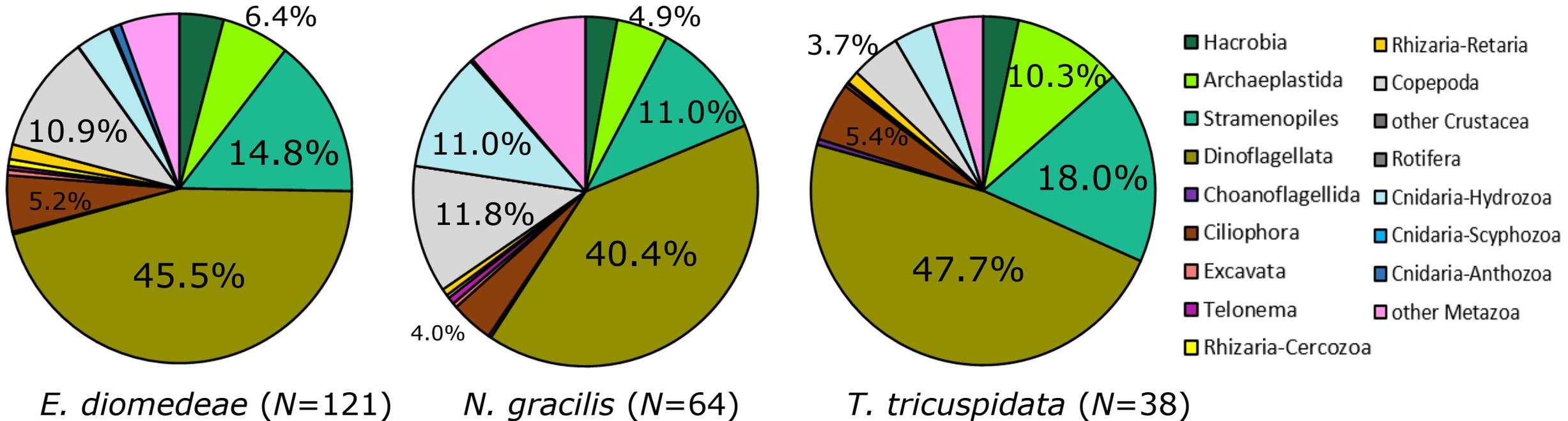
- High quality sequences clustered into OTUs using 99% similarity threshold
- Remove host (euphausiid), fungi/parasite, unclassified OTUs

- Calculate relative abundances (sequence read%) of different prey supergroups
- **Identify dominant prey OTUs for each euphausiid species at every station**

OTUs have a >1% mean proportion and a >1/3 occurrence frequency

Recover the euphausiid gut content/prey availability by 18S V9 metabarcoding

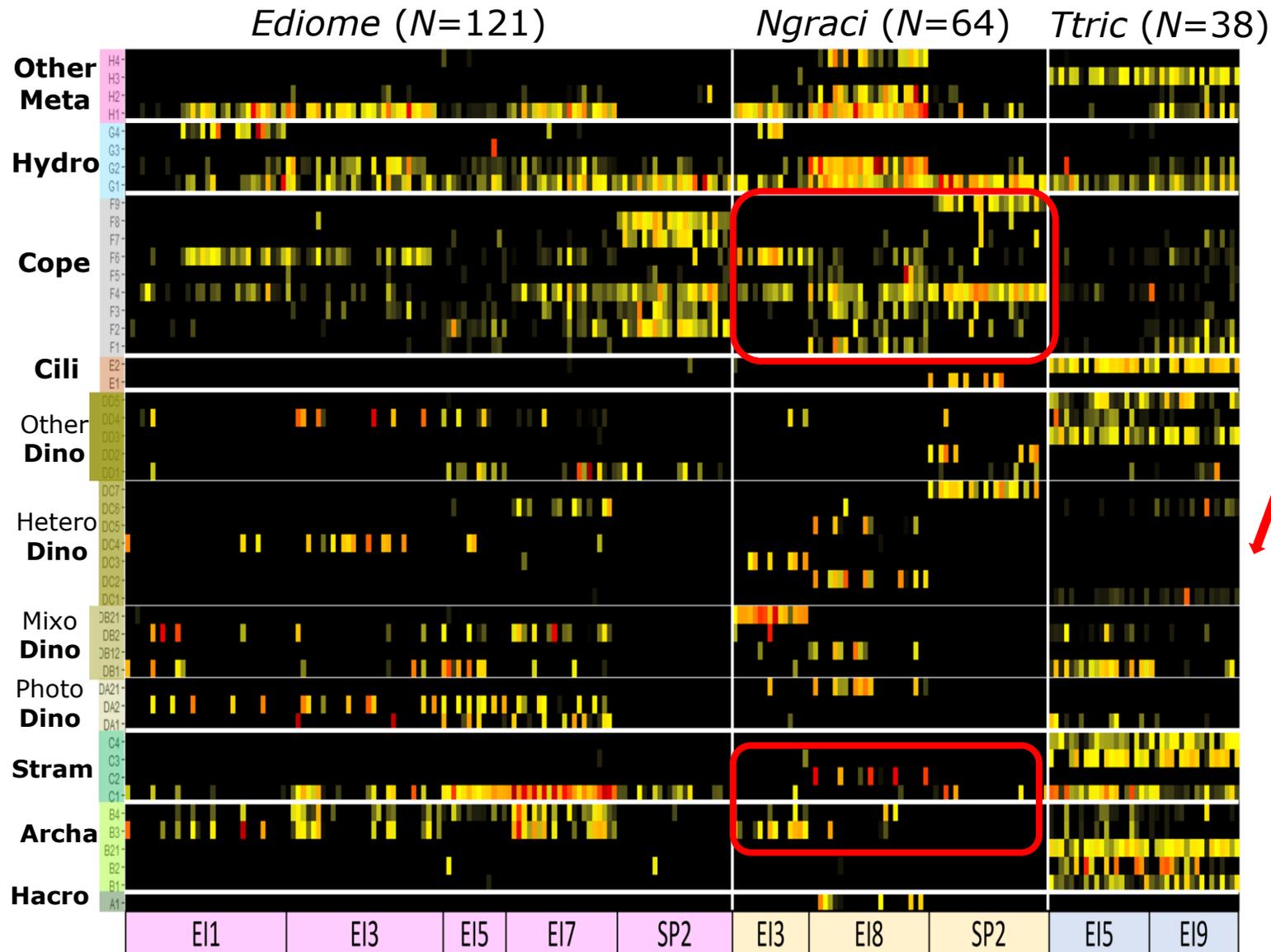
# Gut content composition of 3 species:



Average gut content composition of three target species (sequence read%)

- **All omnivorous:** Dinoflagellata, Stramenopiles (Diatomea and Ochrophyta), Archaeplastida (green algae), Copepoda (Calanoida and Cyclopoida), Ciliophora
- ***N. gracilis* was more carnivorous** than the other two species

# Diet differences between 3 species:

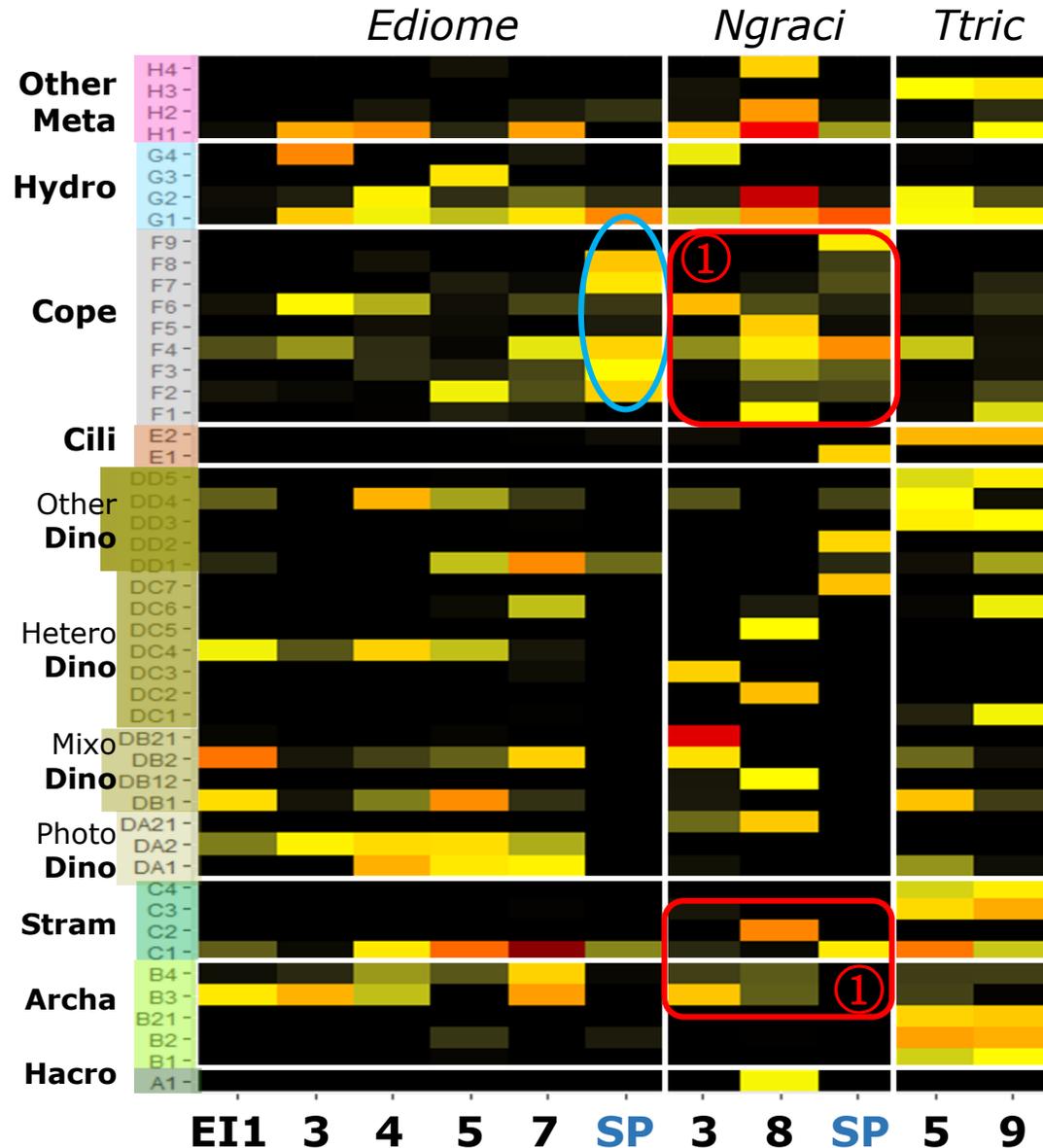


## Highlights:

- ① carnivorous *N. gracilis*:  
Less microalgae/pelagophyte/diatom  
**Stronger Copepod OTU** intake
- ② Three species utilized distinctive **Dinoflagellate** OTUs.
- ③ *E. diomedea* ate more Copepods than *T. tricuspida* that mainly fed on green algae, diatoms, and Ciliate prey OTUs

**Regional diet variation of the same species**

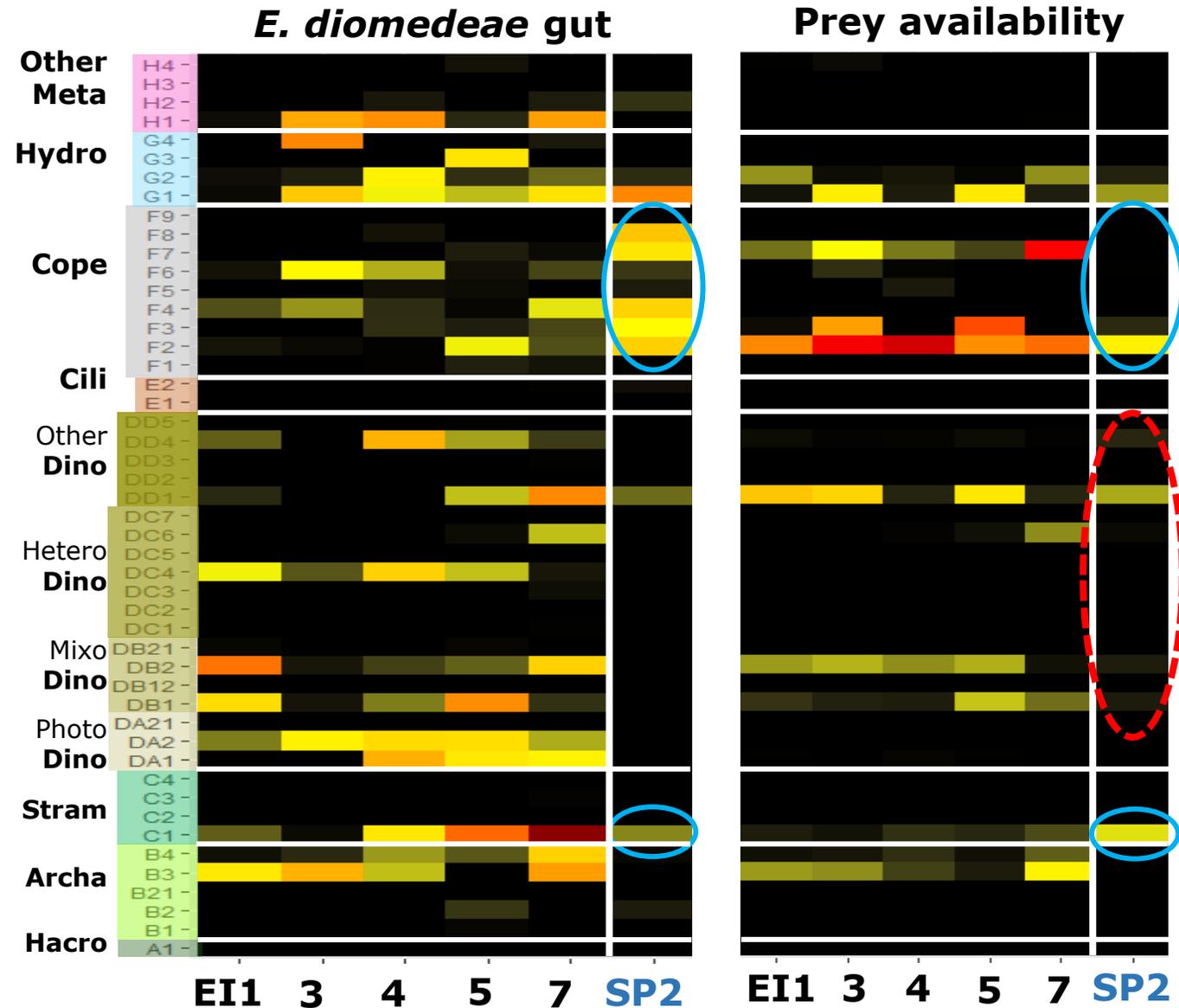
# Regional diet variation of the same species:



## Highlights:

- ① carnivorous *N. gracilis*:  
Less microalgae/pelagophyte/diatom prey;  
**Stronger Copepod OTU** intake
- ② **Three species** utilized **distinctive Dinoflagellate** OTUs.
- ③ *E. diomedea* ate **more Copepods** than *T. tricuspidata* that mainly fed on **green algae, diatoms,** and **Ciliate** prey OTUs
- ④ **Regional diet variation of the same species:**  
A diet shift of *E. diomedea* at **SP** from **dinoflagellate/pelagophytes/green algae** to Copepods;  
A relatively **constant diet** for *T. tricuspidata*

# Prey availability shapes the diet?



The more/less in the environment  
 ↓  
 The more/less in the gut ❌

The common dinoflagellate preys was less in SP than EI

Insufficient dinoflagellate preys  
 ↓  
 prey switch to the copepods (rather than the Pelagophytes)

Species	Feeding habit	Distribution pattern
<i>E. diomedea</i>	Omnivorous, <b>plastic</b> diet	Dominate the low latitudes
<i>N. gracilis</i>	<b>More carnivorous</b>	Co-existed with <i>E. diomedea</i>
<i>T. tricuspidata</i>	<b>Constant</b> diet	Sporadically abundant

➤ **More carnivorous *N. gracilis*:**

*Nematoscelis*: elongated thoracic limbs → typical **raptorial feeders**;

➤ **Diet shift of *E. diomedea*:**

A potential preference on Copepod than the Pelagophytes when lack of dinoflagellate

➤ **A higher primary productivity** could **additionally supply food** for some **minor species** and change the euphausiid community structure

- ✓ A **plastic feeding ecology** would support the **wide-range distribution** of *E. diomedea*;
- ✓ **Different prey preferences** favor the **co-existence** of euphausiid species



**Feeding ecology** is a significant factor that could **influence the euphausiid community structure** in the low-latitude marine ecosystem



**Thank you**

