Fine-scale vertical habitat organization of *Neocalanus plumchrus* and its light-modulated response in the western subarctic Pacific revealed by Video Plankton Recorder

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TAKE HOME MSG: ***N. plumchrus*** **does not perform conventional DVM; it fine-tunes its vertical habitat at meter scale through light-dependent compression and release around the MLD.**

"No DVM" doesn't mean "no behaviour."

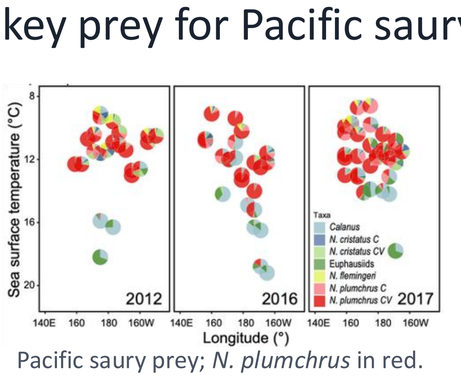
Objectives

Resolve, at 1-m scale, where *N. plumchrus* concentrates in the surface layer and what shapes it.

1. Where is the core layer, and what depth reference does it track?
2. Does the distribution change between day and night?
3. Is light the factor that modulates it?

Introduction

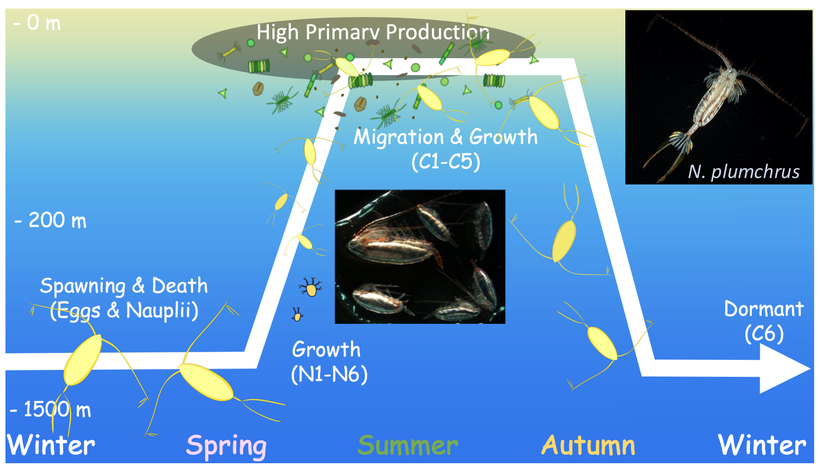
Neocalanus plumchrus is a dominant, lipid-rich copepod of the subarctic Pacific and key prey for Pacific saury[1] and sei whales[2].



Pacific saury prey; *N. plumchrus* in red.
[1]Miyamoto et al. 2020



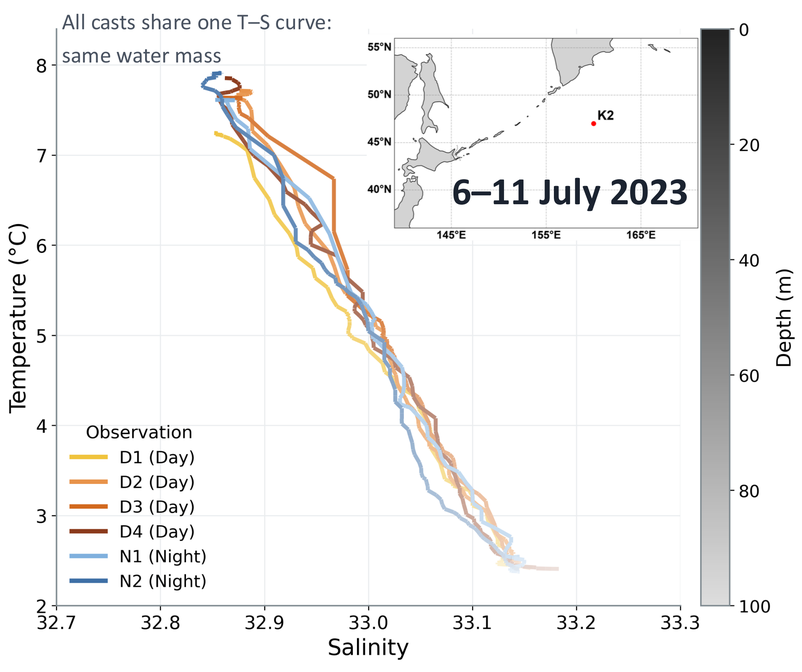
Sei whale forestomach full of *N. plumchrus*. [2]Kawamura 2005



Methods

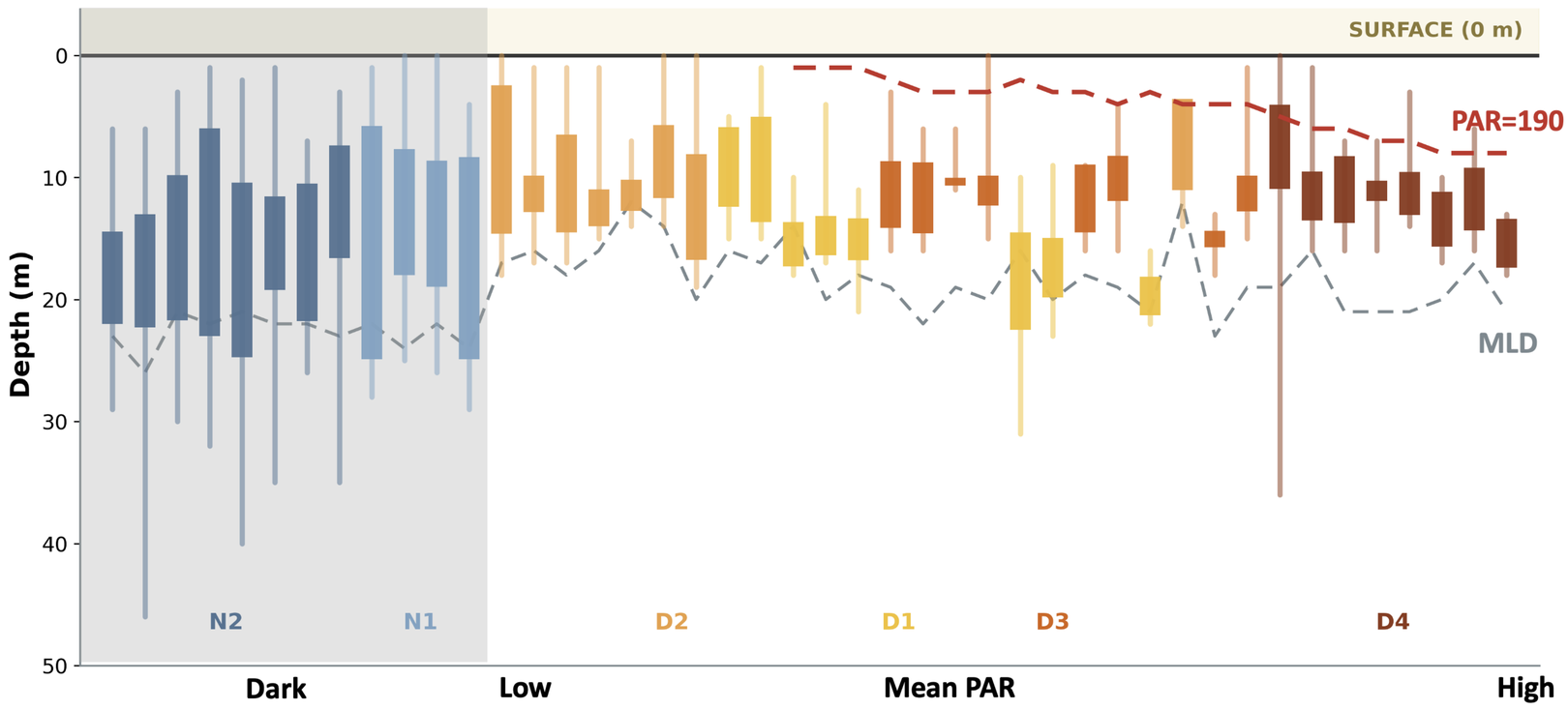
Video Plankton Recorder
Depth, Temp., Sal, Chl. *a*
36 × 36 × 73.1 mm
15 frames s^{-1}





Results

Key result: light compresses an MLD-anchored habitat

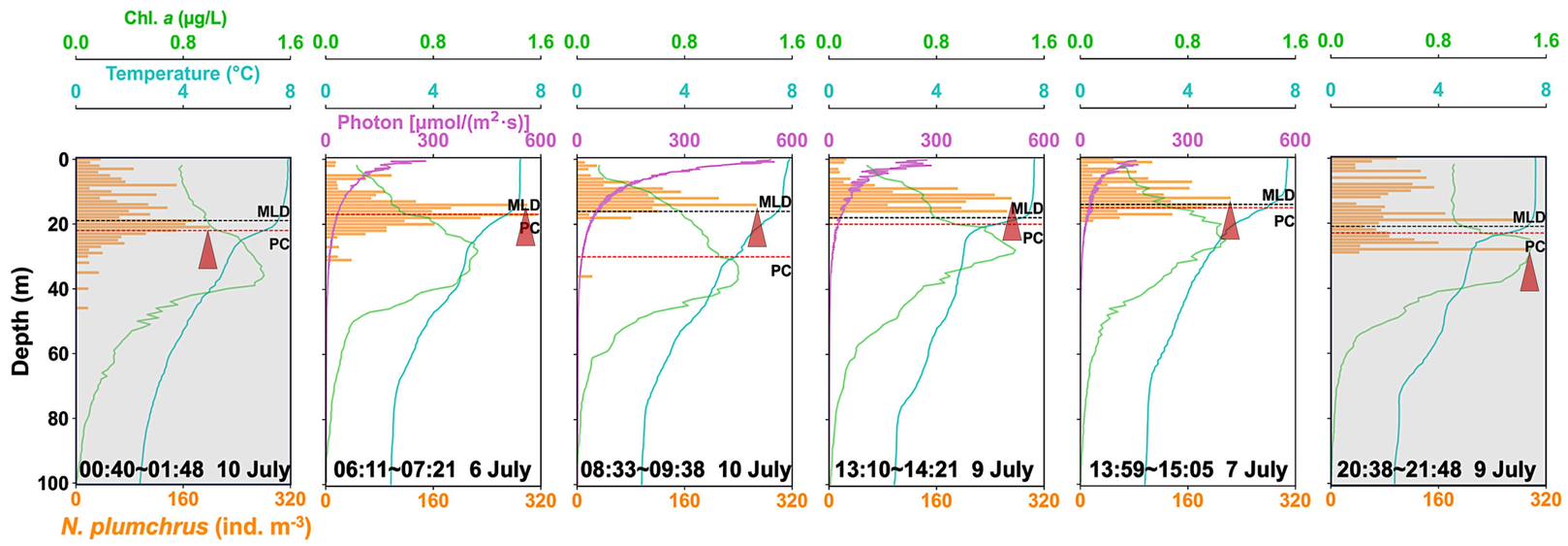


MLD sets the anchor
The core stays just above the MLD in every profile, not at a fixed depth.

Light compresses by day
High PAR keeps individuals off the bright surface, in a narrow layer.

Night releases
The core remains; the distribution broadens to the surface and below the MLD.

① The abundance peak tracks the MLD



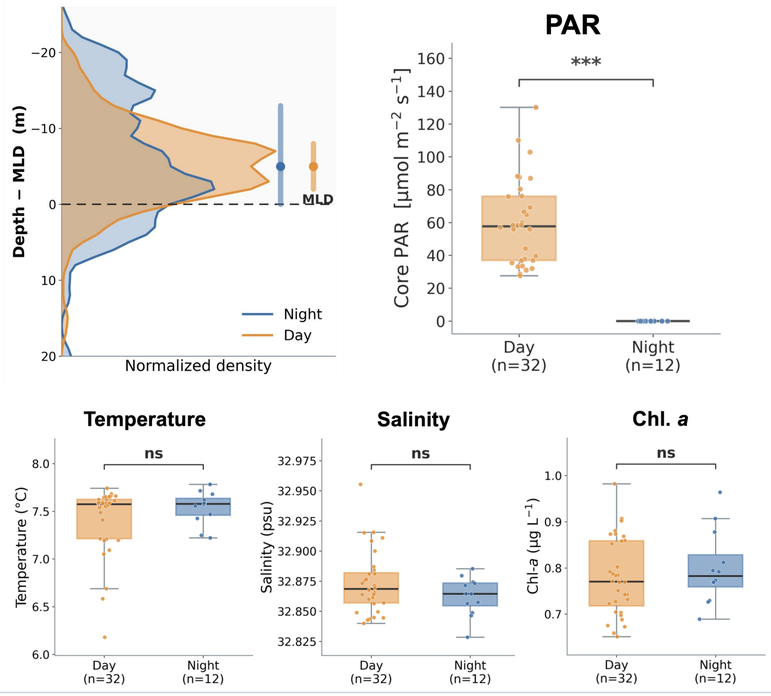
- Peak follows MLD, not a fixed depth: its depth shifts between casts, its offset from the MLD does not.
- Not at the Chl *a* maximum (≈ 20 m vs. 30–40 m).
- Sits in the upper layer of ≈ 6–8 °C.

② Day vs. night:

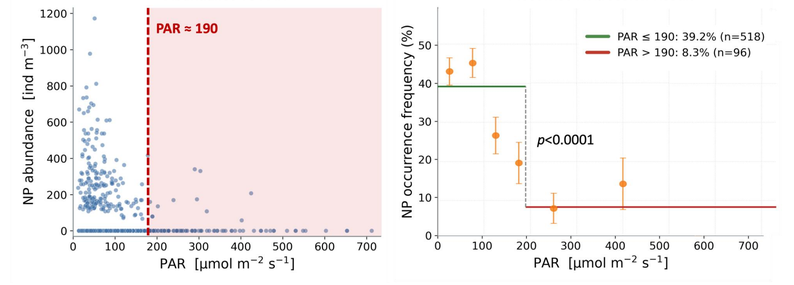
The core holds, the spread changes

Core stays anchored just above the MLD

During night, the distribution pattern broadens both upward and downward.



③ Occurrence drops above PAR ≈ 190



Daytime, within the mixed layer: occurrence falls from 39.2% to 8.3% above PAR ≈ 190 µmol m^{-2} s^{-1} (segmented regression, $p < 0.0001$).

Discussion

Why avoid strong light?
High light may raise visual-predation or UV risk near the surface.

Why stay above the MLD?
The upper mixed layer may offer better feeding and growth conditions.

The habitat is a compromise: dark enough to limit risk, shallow enough to stay productive.

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