

The global contribution of diel and seasonal vertical migrants to the biological carbon pump

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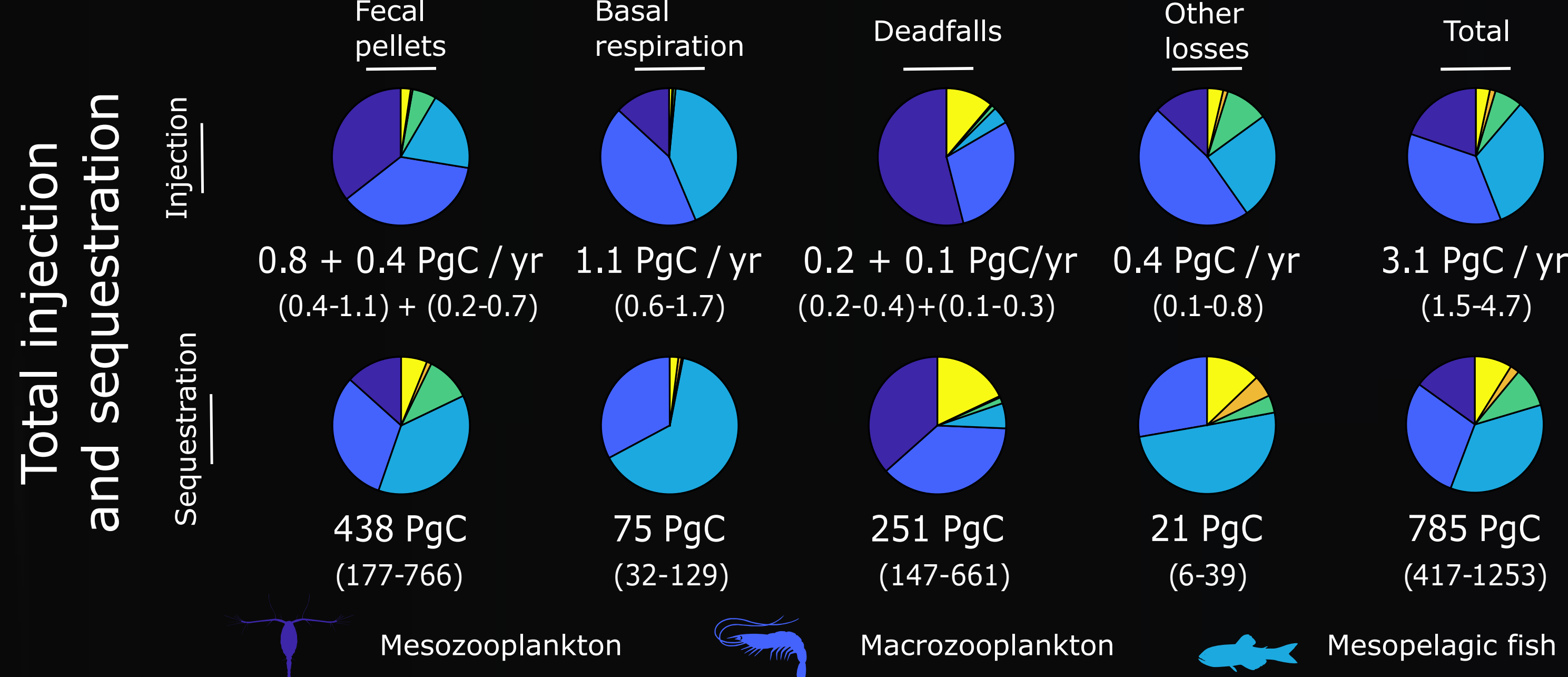
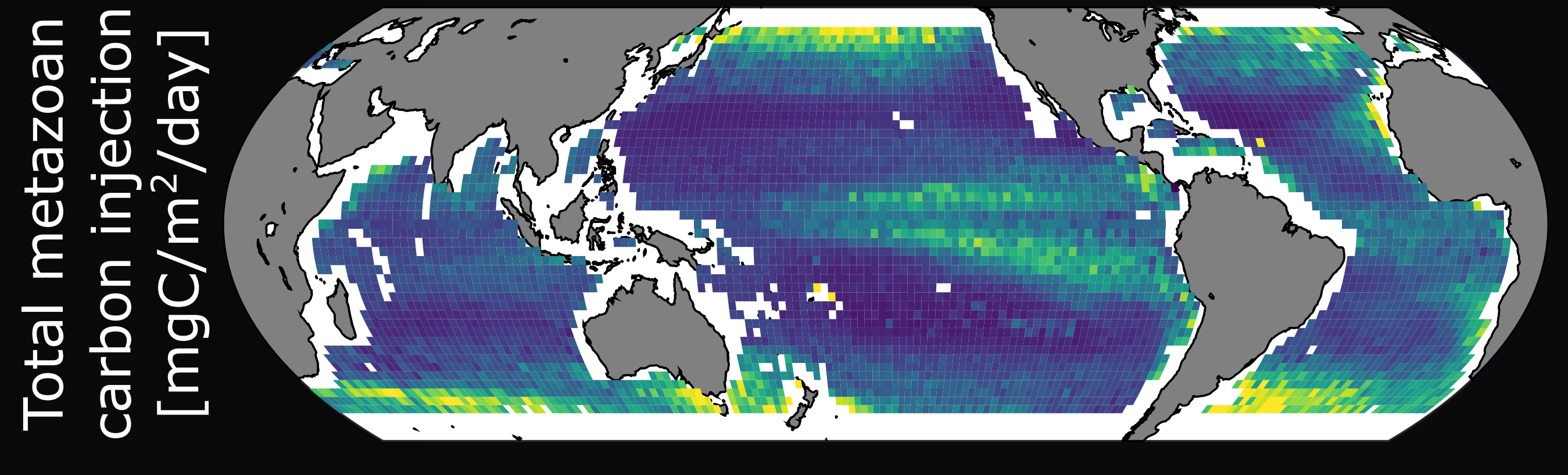
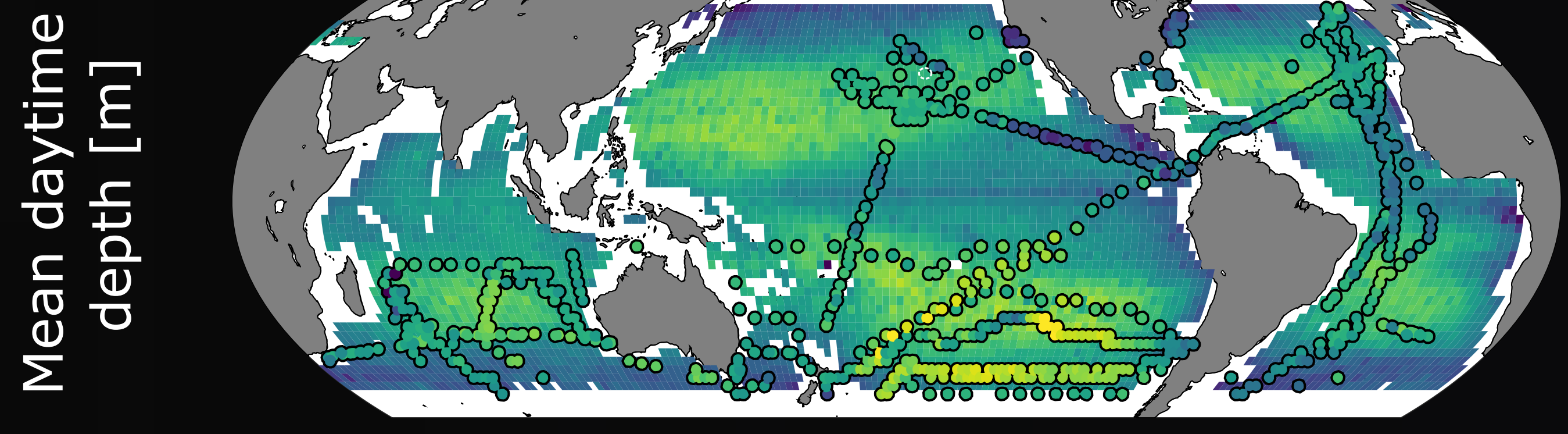
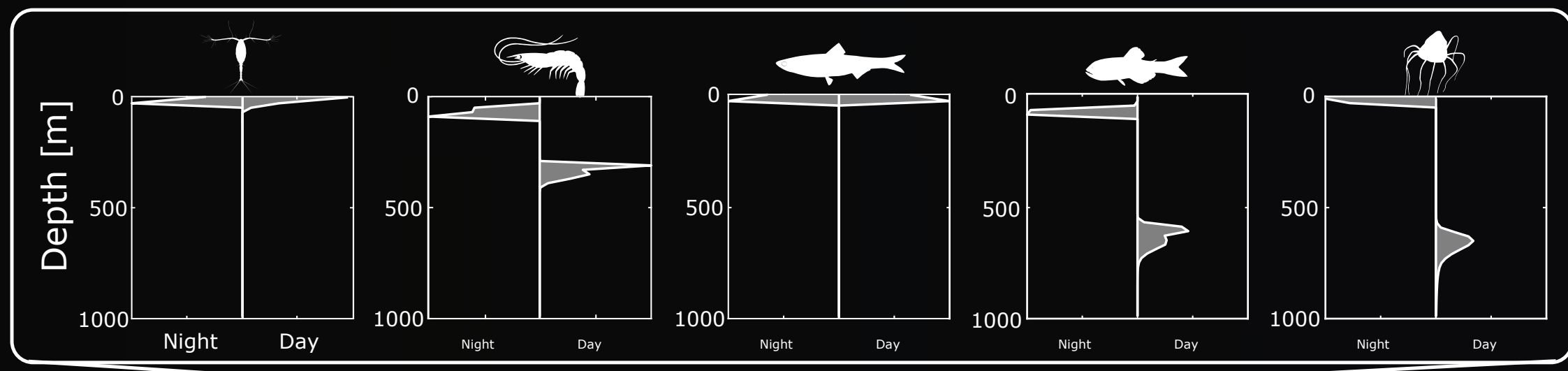
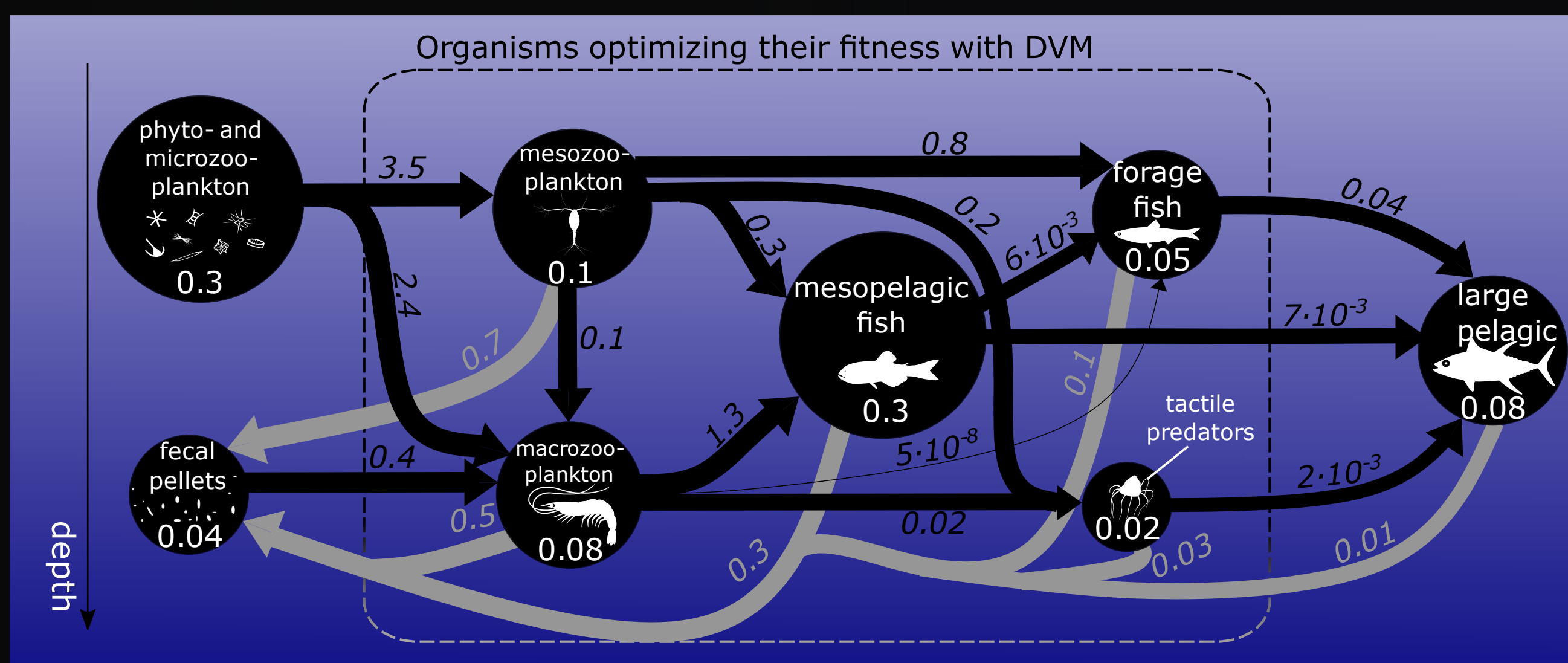
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Goal: How much carbon is **exported** and **sequestered** by the different functional groups performing diel vertical migrations in the pelagic, and by copepods performing seasonal vertical migrations?
Global biological carbon pump: ~10 PgC/yr exported, ~1200 PgC sequestered

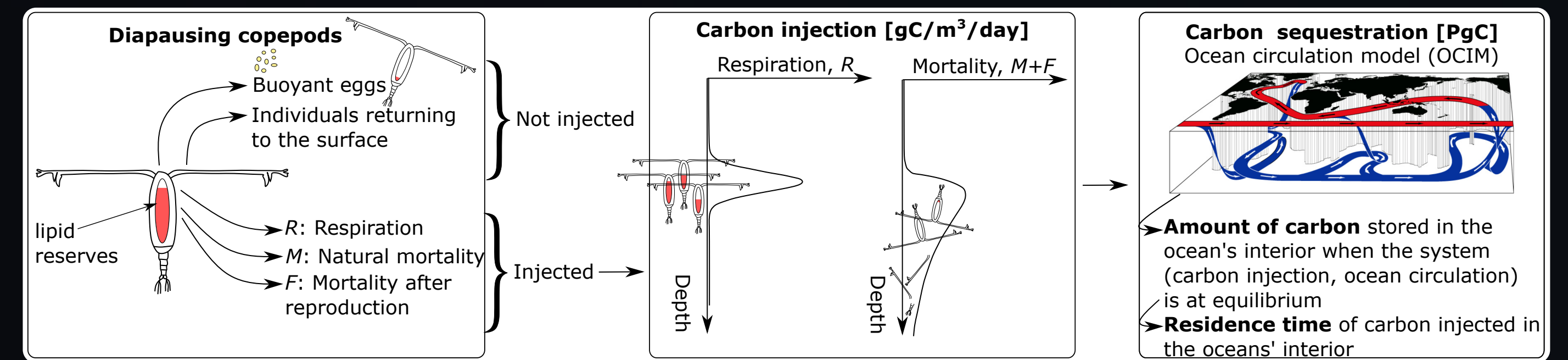
Diel Vertical Migration

- Mechanistic food-web model of a pelagic water column
- DVM behavior computed with game theory



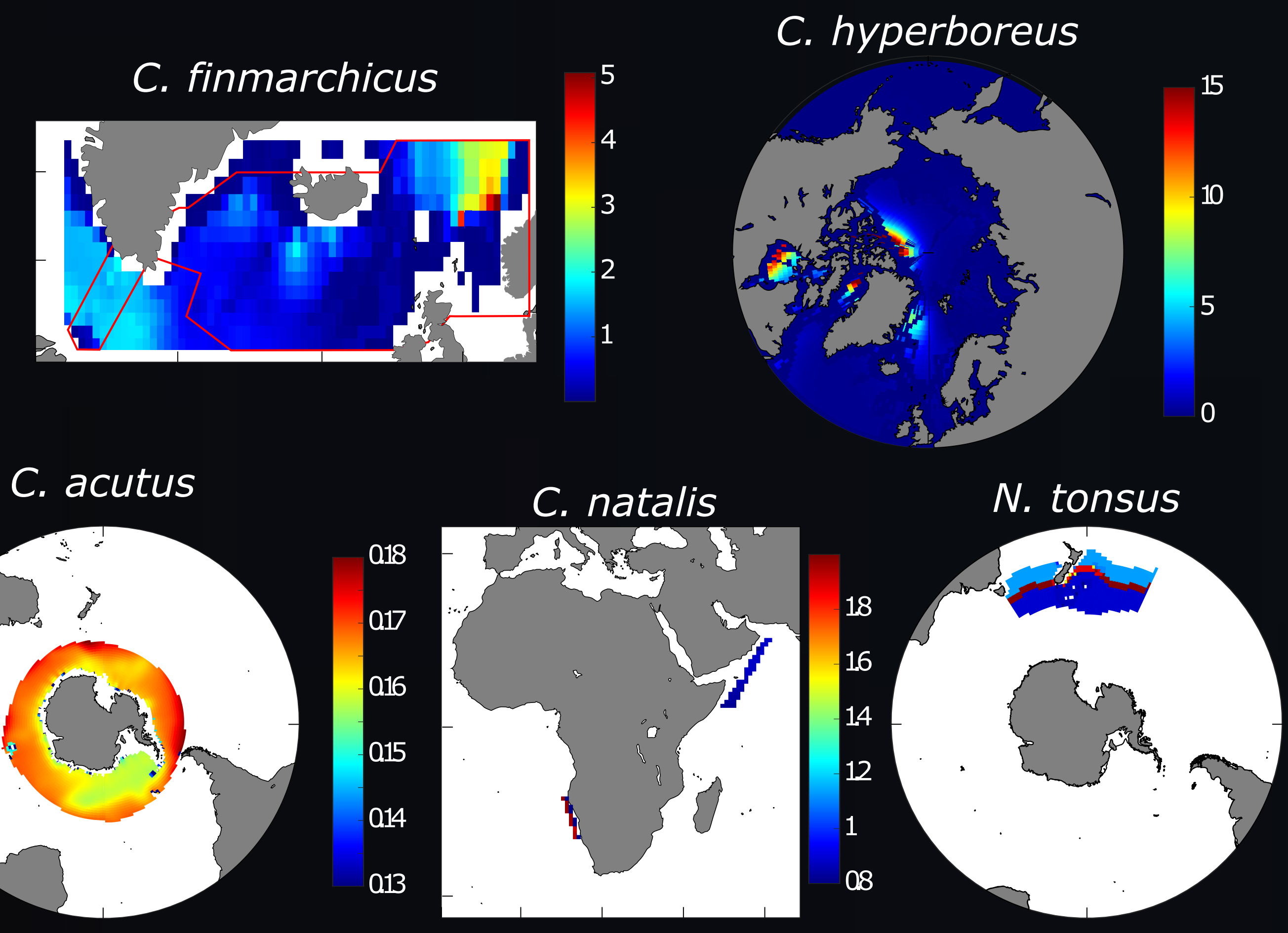
Seasonal Vertical Migration

- Focus on 5 species with enough abundance data: *Calanus finmarchicus*, *Calanus hyperboreus*, *Calanoides acutus*, *Calanoides natalis*, *Neocalanus tonsus*



Carbon export during diapause [gC/m²/year]

Carbon exported and sequestered during diapause



Species	Area [10 ⁶ km ²]	Abundance [# / m ²]	Biomass [GgC]	Injection [GgC / yr]	Sequestration [PgC]
<i>C. hyperboreus</i>	16	500 - 11,500	38 - 59	12 - 28	7.5 - 15.5
<i>C. finmarchicus</i>	3.8	15,000 - 40,000	4.9 - 12	2.5 - 7.8	1.2 - 4.0
<i>N. tonsus</i>	6.57	5,000 - 27,000	19 - 26	17 - 24	2.7 - 7.5
<i>C. acutus</i>	30.7	800 - 1,300	6 - 19	4 - 14	1.5 - 6.8
<i>C. natalis</i>	0.69	15,000 - 127,500	1.1 - 4.4	0.3 - 1.4	0.1 - 0.7

Conclusion

- Fish are responsible for ~12% of total carbon export, and ~30% of total carbon sequestration
- Fish are very important to the biological carbon pump!
- Diapausing copepods export relatively little carbon, but they sequester carbon very efficiently

References:
 Pinti J., DeVries T., Visser A.W., et al. (2023) Model estimates of metazoans' contributions to the biological carbon pump. *Biogeosciences* 20: 997-2009
 Pinti J., Jónasdóttir S., Record N.R., Visser A.W. (2023) The global contribution of seasonally migrating copepods to the biological carbon pump. *Limnology and Oceanography*: 1-14.