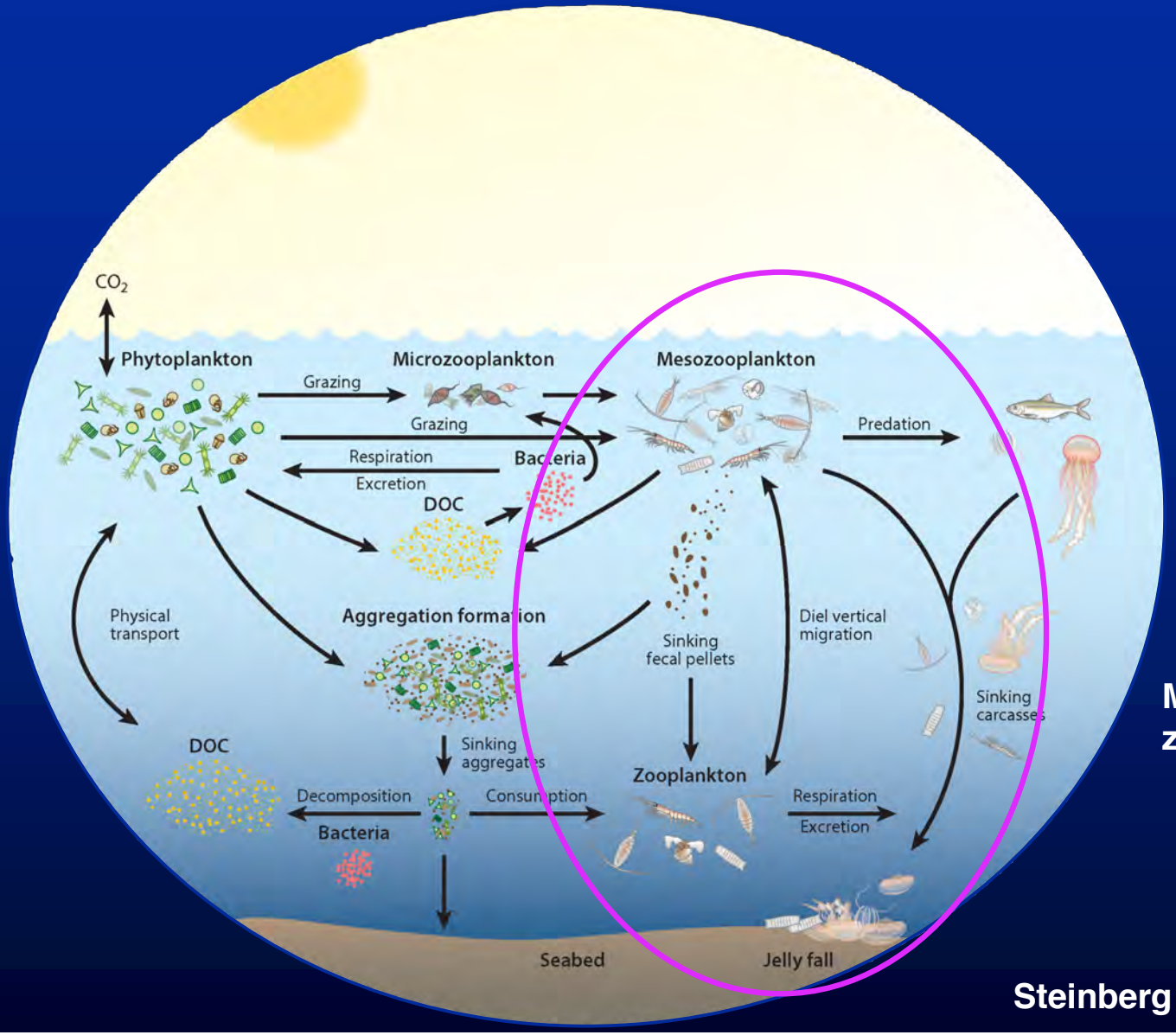
Zooplankton & the biological C pump

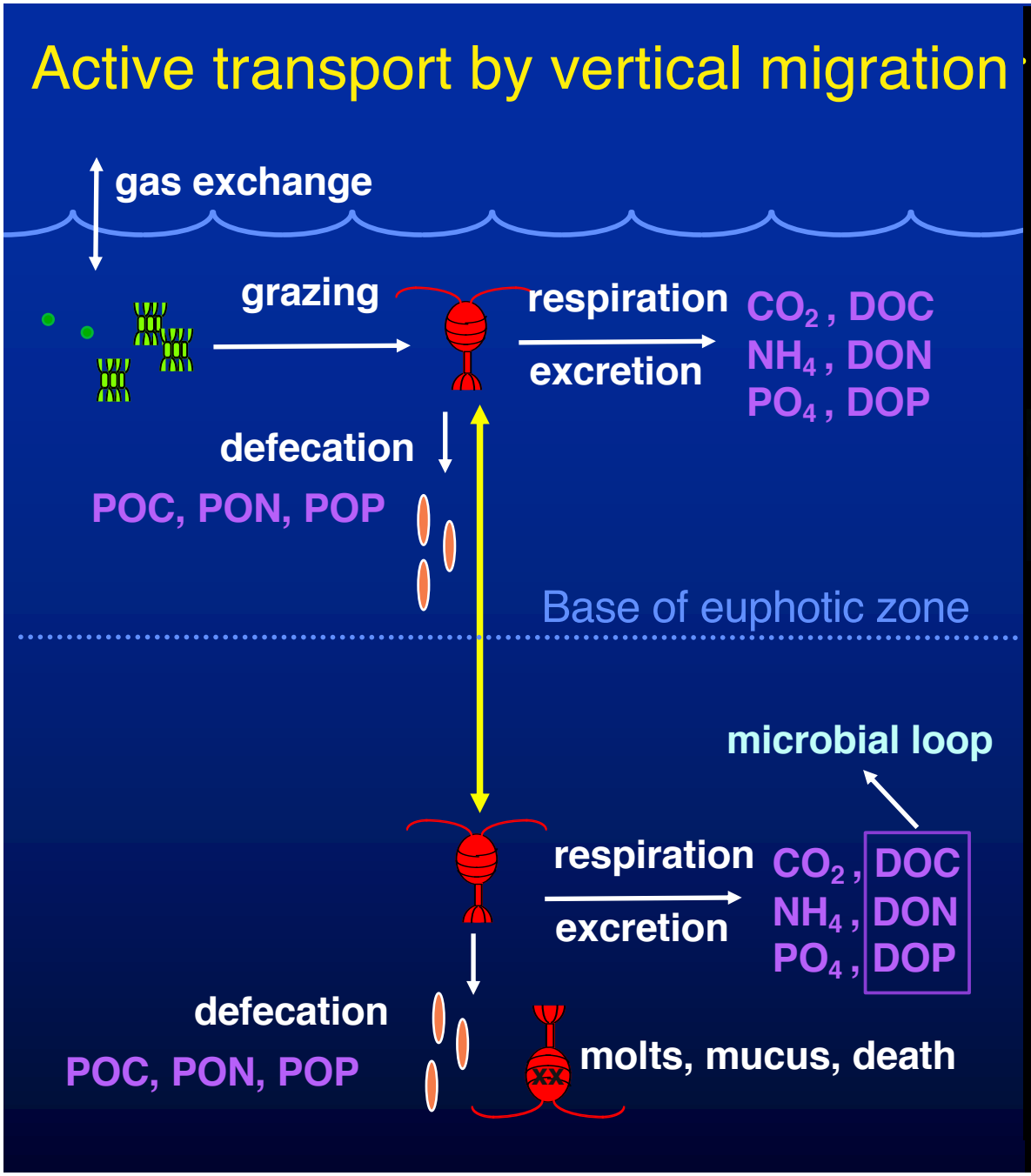


Euphotic zone

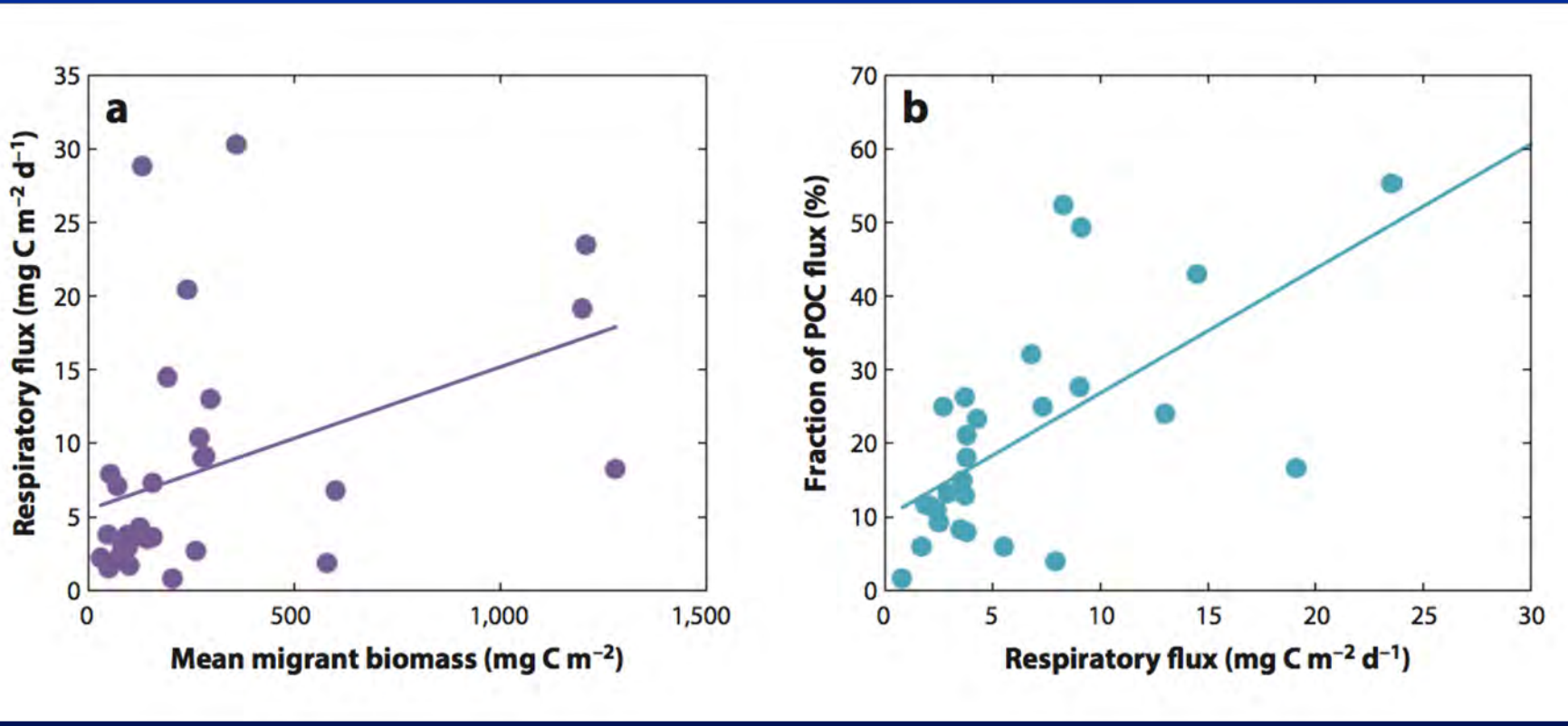
Mesopelagic zone

Steinberg & Landry (2017)

Active transport by vertical migration



Active transport by diel vertical migration around the world



Approaches:

- **-direct measurements**
- **-electron transport system**
- **-allometric/ size-based algorithms**

Steinberg & Landry (2017)

Modeled active transport by diel vertical migration

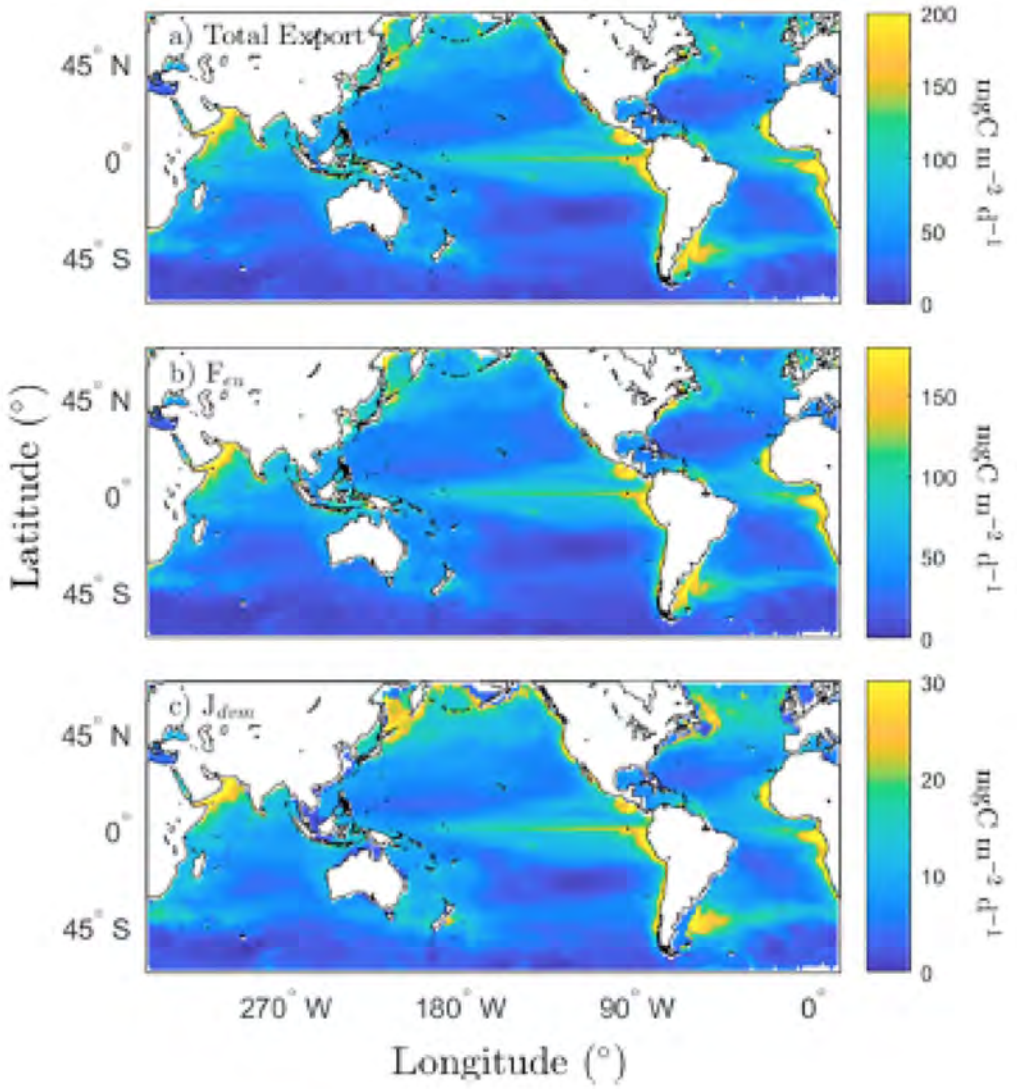


Table 3
Summary of Global Statistics

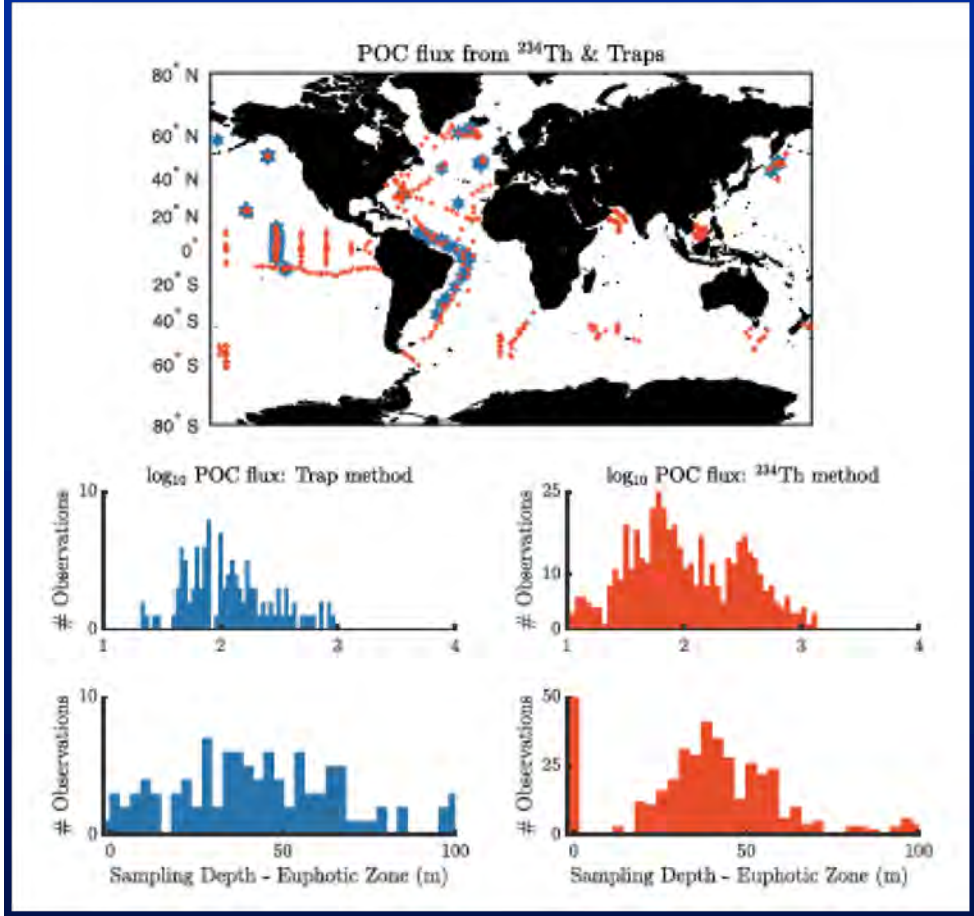
Statistic	Mean (SD)	
	$p_{dvm} = 0$	$p_{dvm} = 0.5$
NPP (mgC·m^{-2}·day^{-1})	414 (194)	414 (194)
Global export flux (PgC/year)	5.7	6.5
Export ratio	0.10 (0.04)	0.12 (0.05)
DVM export ratio		0.16 (0.04)
DVM respiration ratio		0.16 (0.06)
Respiration depression (m)		30 (18)

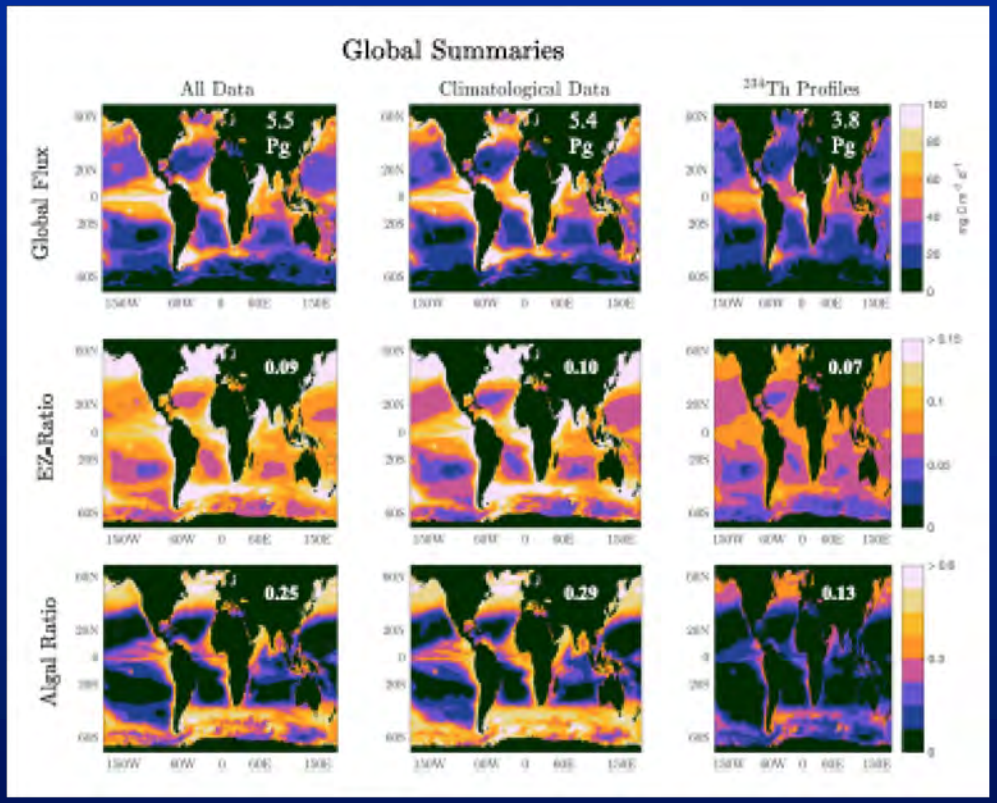
Note. Annual mean and standard deviation (SD) values include temporal variability across months in the yearly climatology and spatial variability across the global model domain. NPP = net primary production; DVM = diel vertical migration.

Archibald et al. (2019)

(also see Aumont et al. 2018)

Global POC export

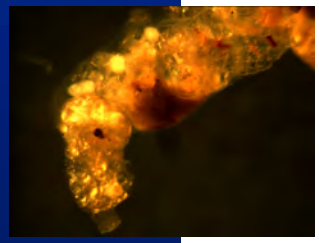


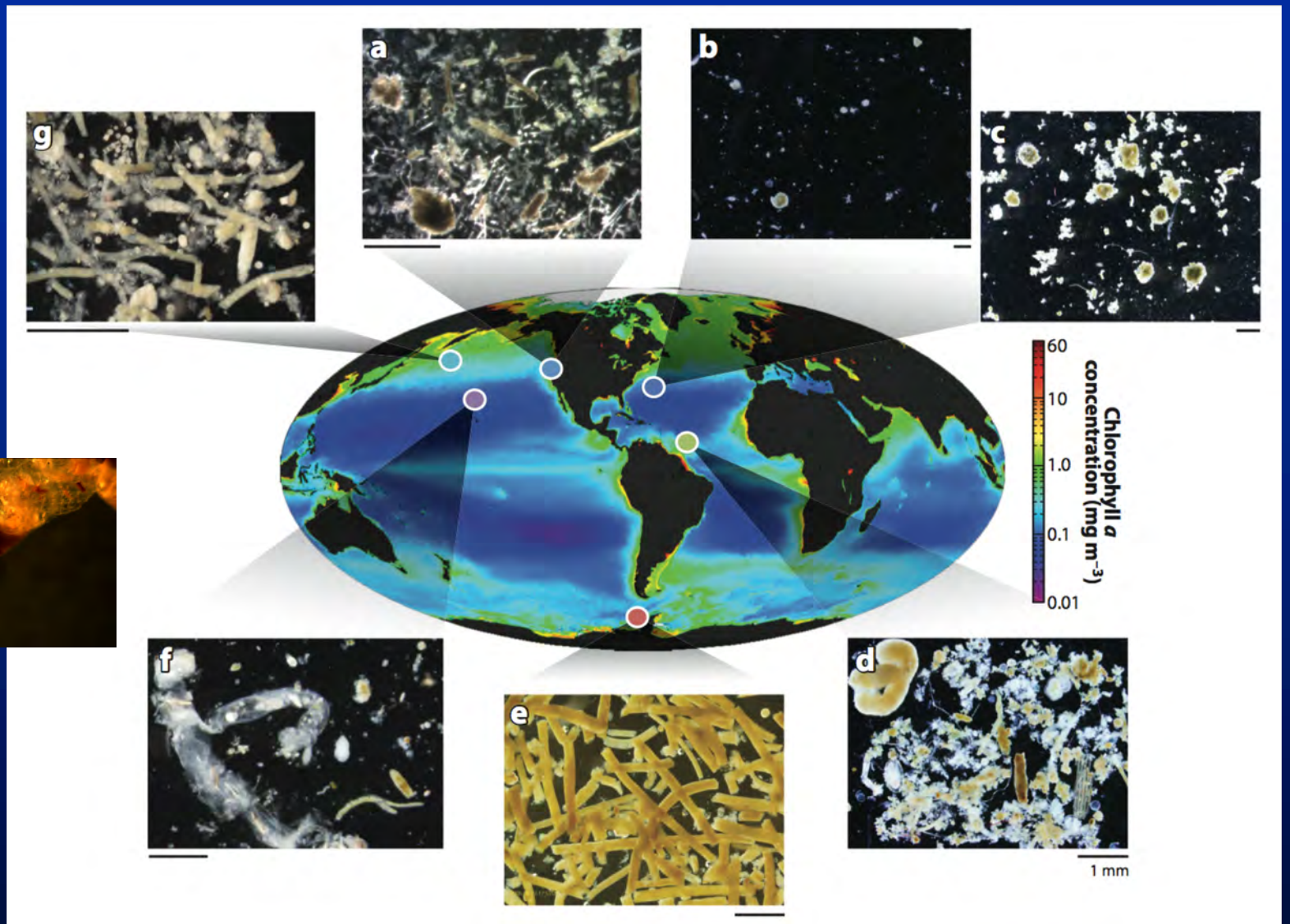


(EZ-ratio- proportion of production exported beneath the euphotic zone)

Bisson et al. (2018)

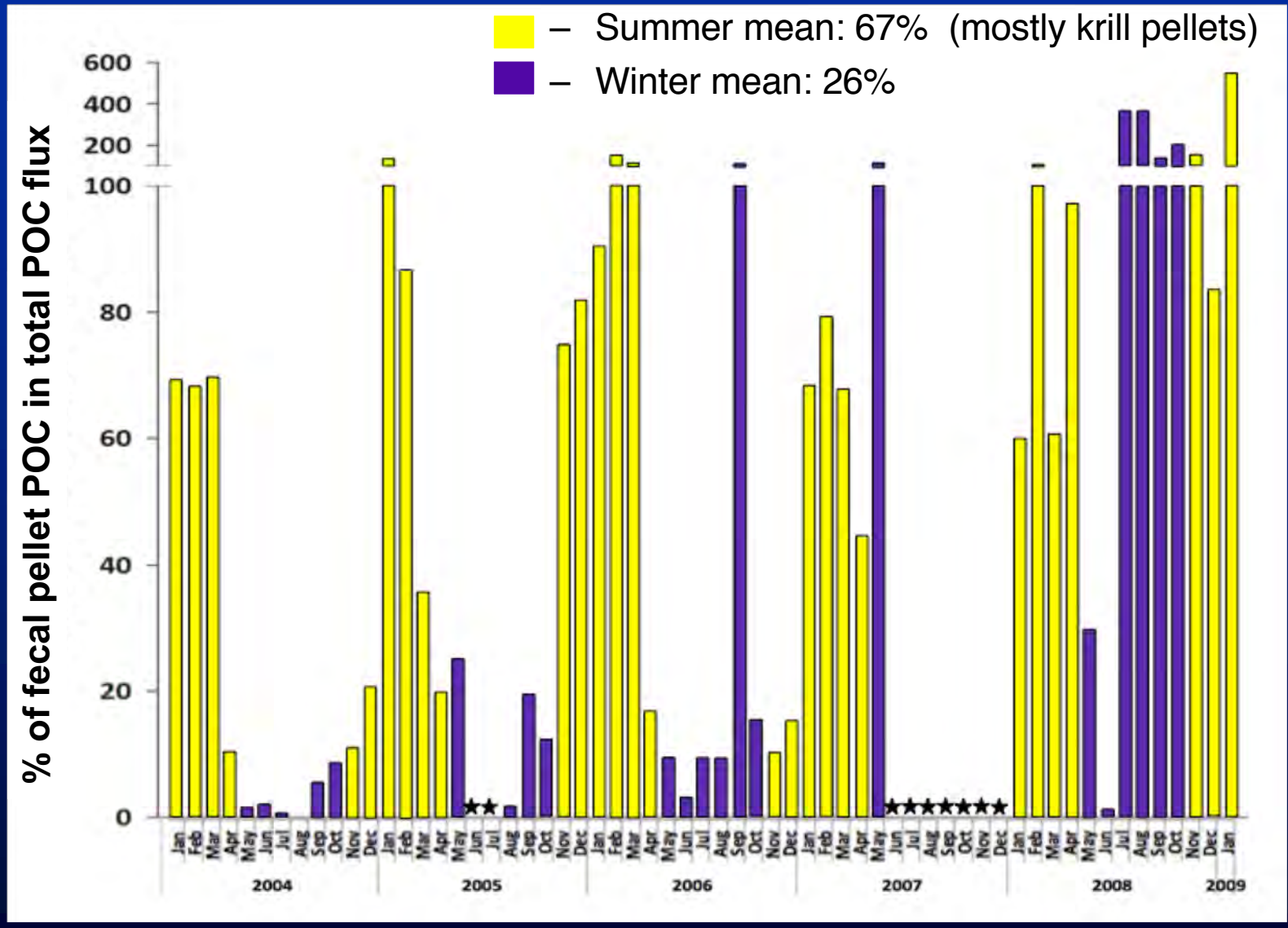
Zooplankton poop around the world





Steinberg & Landry (2017)

Zooplankton fecal pellets as proportion of total POC flux-Western Antarctic Peninsula (170 m)



Gleiber, Steinberg, & Ducklow (2012)

Zooplankton fecal pellets as vs. total POC flux-3500m trap off CA

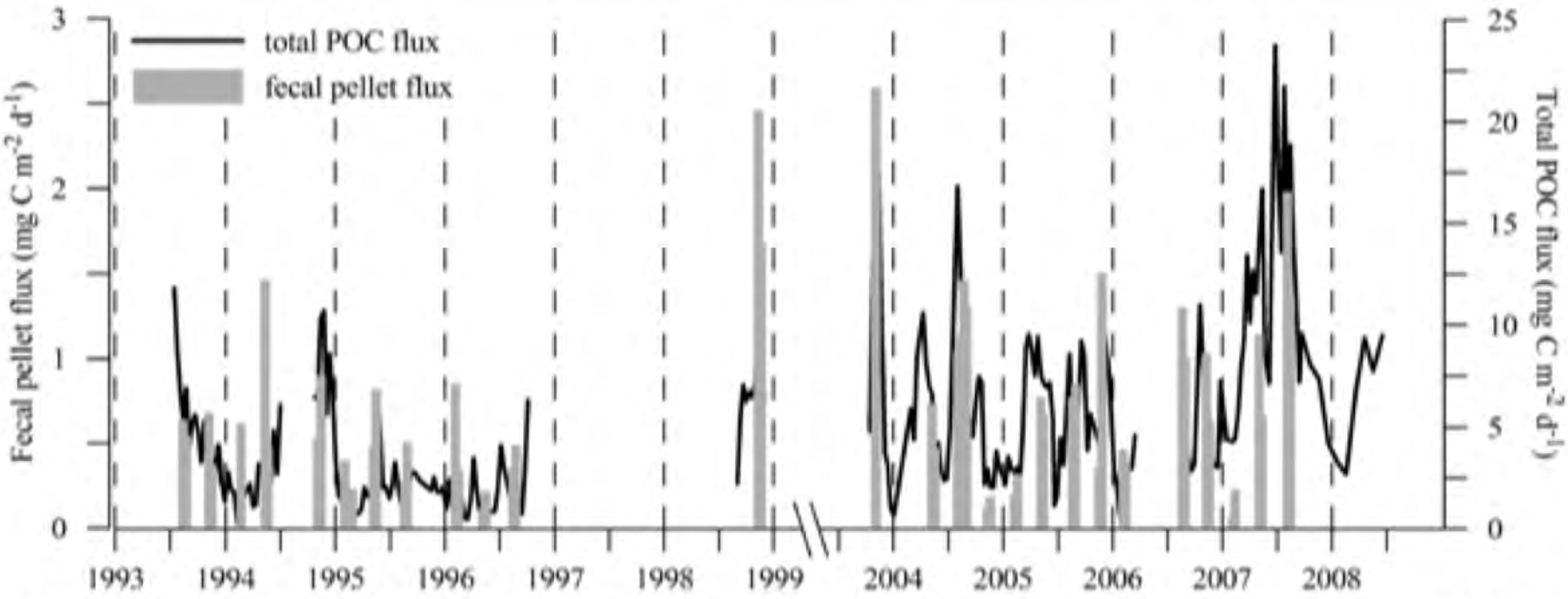
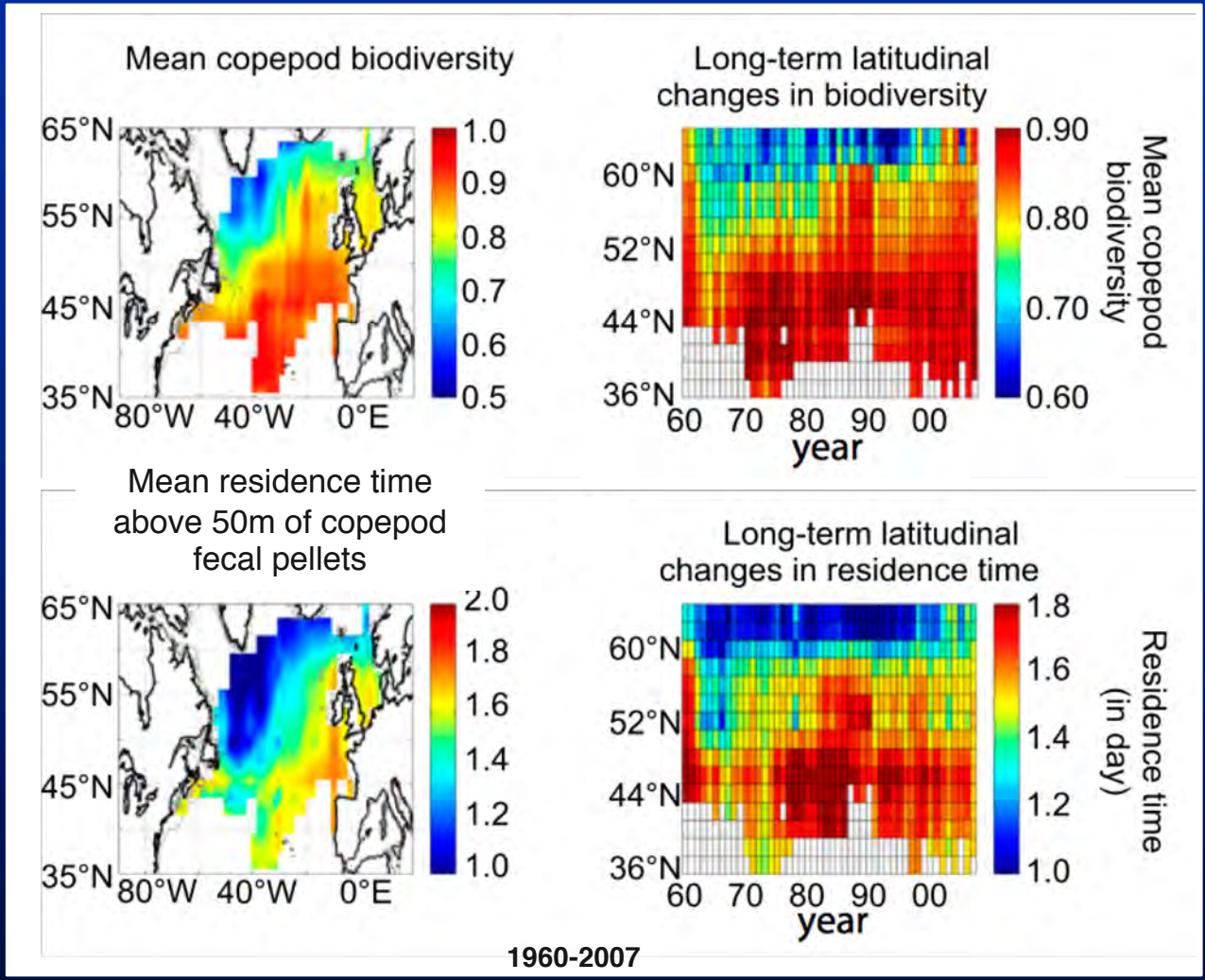


Fig. 1. Total intact fecal pellet flux from 1993 to 2008 within the February, May, August, and November Sta. M 600 mab sediment trap samples (left axis, gray bars) and POC flux (right axis, black line). Blank spaces between lines and bars indicate where samples were unavailable or missing.

% of total POC export = 12-20%

Wilson et al. (2013)

Long-term latitudinal changes in copepod biodiversity & residence time of sinking copepod fecal pellets in N. Atlantic



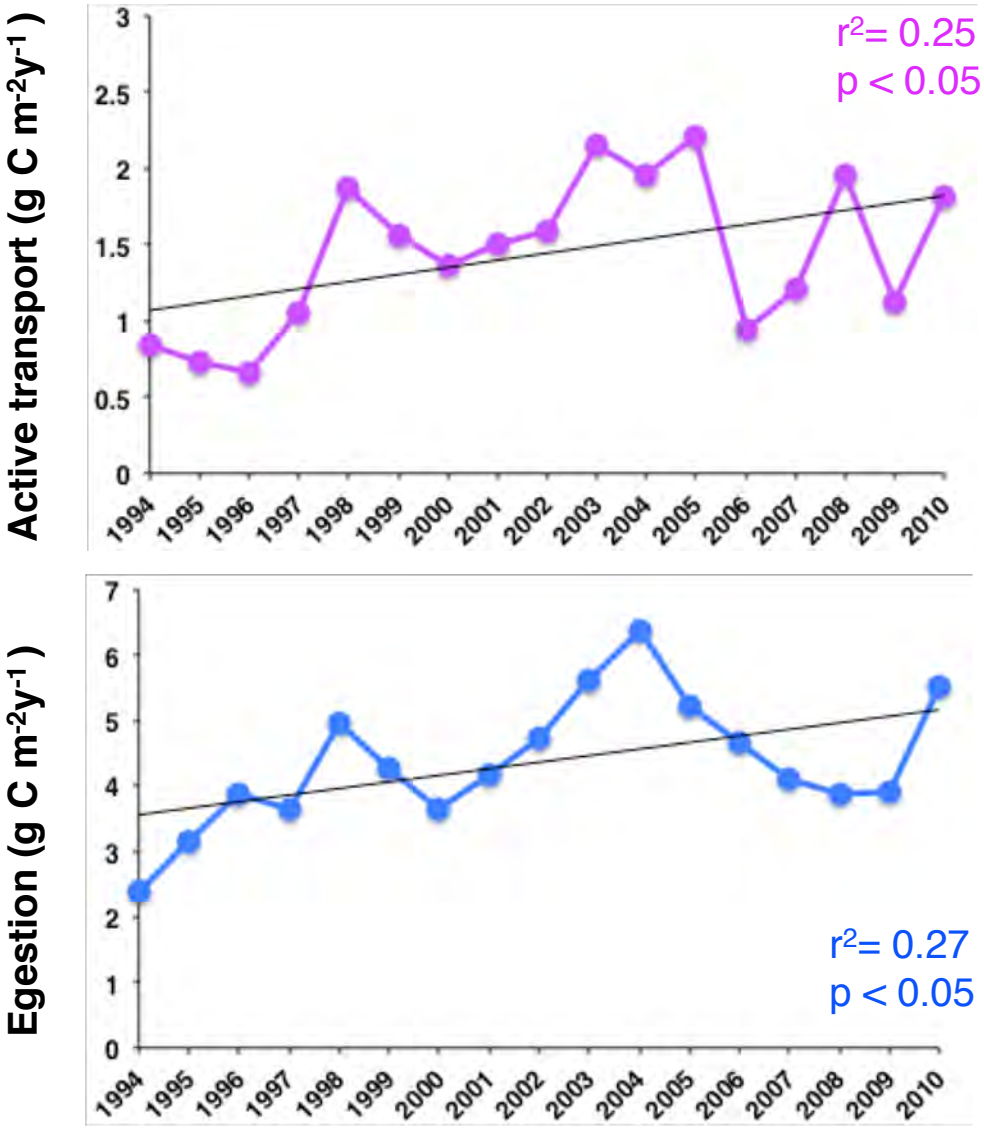
Increase in recent decades in the N

modeled from size-derived relationships w/ copepod body size (which is negatively correlated with diversity)

Beaugrand et al. (2010)

Increase in active transport & fecal pellet production at BATS

Annual migratory CO_2 + DOC + POC flux across 150 m



= 5-33% of POC flux

Annual fecal pellet production (egestion) in top 150 m

= 28-89% of POC flux

Steinberg, Lomas & Cope (2012)

EXPORTS

EXport Processes in the Ocean from RemoTe Sensing