Active transport by vertical migration:

- gas exchange
- grazing
- respiration: $\text{CO}_2$, DOC
- excretion: $\text{NH}_4$, DON, $\text{PO}_4$, DOP
- defecation: POC, PON, POP

Base of euphotic zone

- microbial loop
- respiration: $\text{CO}_2$, DOC
- excretion: $\text{NH}_4$, DON, $\text{PO}_4$, DOP
- defecation: POC, PON, POP
- molts, mucus, death
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

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)

- Summer mean: 67% (mostly krill pellets)
- Winter mean: 26%

Gleiber, Steinberg, & Ducklow (2012)
Zooplankton fecal pellets as vs. total POC flux-3500m trap off CA

% 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 CO₂ + DOC + POC flux across 150 m

Annual fecal pellet production (egestion) in top 150 m

Steinberg, Lomas & Cope (2012)