Towards a better understanding of fish contribution to carbon flux

Ocean, Carbon, & Biogeochemistry Workshop March 4-5, 2019
Motivation

Ducklow, Steinberg, Buesseler 2001
Motivation

Herndl & Reinthaler 2013
Motivation

FISH!

Turner 2015
Motivation

Carbonates, too

\[
\text{Global New Production} = 0.7 - 1.4 \text{ Pg CaCO}_3 \text{ C year}^{-1}
\]

\[
\text{Fish Carbonates} = 0.04 - 0.11 \text{ Pg CaCO}_3 \text{ C year}^{-1}
\]

(High Magnesium calcites soluble at shallow depths)

>1 km Depth:
Total dissolution \(~0.41 - 0.5\) \text{ Pg CaCO}_3 \text{ C year}^{-1}

\[
\text{Sinking Flux} \sim 0.4 \text{ Pg CaCO}_3 \text{ C year}^{-1}
\]

\[
\text{Dissolution of lower solubility carbonates (calcites & aragonites)}
\]

Wilson et al. 2009
Motivation

Greatly limited number of studies on fish carbon flux

< 10 studies have estimated active transport in DVM fish

< 5 studies have focused on direct measurements of fish passive flux
Why Fish Carbon Needs to be Resolved

• Essential to determine its potential for a food source for benthic organisms

• Improve parameterization of key processes affecting the biological pump

• Develop more accurate regional and global carbon models

• Understand interannual and seasonal/spatial variability and long-term changes of fish fecal flux

• Evaluate the potential role of environmental factors and climate change on fish carbon flux
Project Goals

- Synthesize the existing research on fish carbon flux
  - Active and Passive flux
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  – Identify species, major taxon groups, and habitats most frequently studied
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    • Combining fisheries stock assessment data with existing fish flux data
    • Incorporating a fish component into biogeochemical models
  – Compare fish flux measurements to those reported for zooplankton
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= Paper #2
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• Synthesize the existing research on fish carbon flux

• Recognize challenges in measuring fish carbon flux and discuss approaches to resolve them
  – Sampling approaches
  – Required fish information (species, abundance, biomass, spatial/vertical distributions, etc.)
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- Recognize challenges in measuring fish carbon flux and discuss approaches to resolve them

- Develop research priorities to fill the large gaps in understanding fish carbon flux
  - Define key laboratory and/or field studies
  - Upscaling measurements to regional & global estimates through modeling
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• Recognize challenges in measuring fish carbon flux and discuss approaches to resolve them

• Develop research priorities to fill the large gaps in understanding fish carbon flux

• Identify opportunities to obtain resources needed to move this research forward
Workshop Goals

• Finalize Paper 1: Synthesis, Challenges, Gaps, Research Priorities, Assign specific tasks with deadlines for completion

• Make as much progress as possible on Paper 2:
  – Finalize Approaches for Fish Biomass Estimates, Passive and Active Fish Carbon Fluxes, Comparisons to Total Carbon Flux and Zooplankton Flux
  – Assign specific tasks with deadlines to complete Paper 2

• Discuss Potential Proposals for Filling Gaps