Question: does the carbon in extractive fisheries resources constitute a significant perturbation to the coastal carbon cycle ?

My goal is to seek guidance on whether the following numbers and assumptions pass the laugh test

Joe Salisbury, University of New Hampshire

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Hypothesis: Removal of carbon from the shelves during wild and cultured fishing activities, macrophyte production and avian consumption affects δpCO_2 and total air sea flux of DIC.

Spoiler alert: If my numbers are correct it's only about 13%.

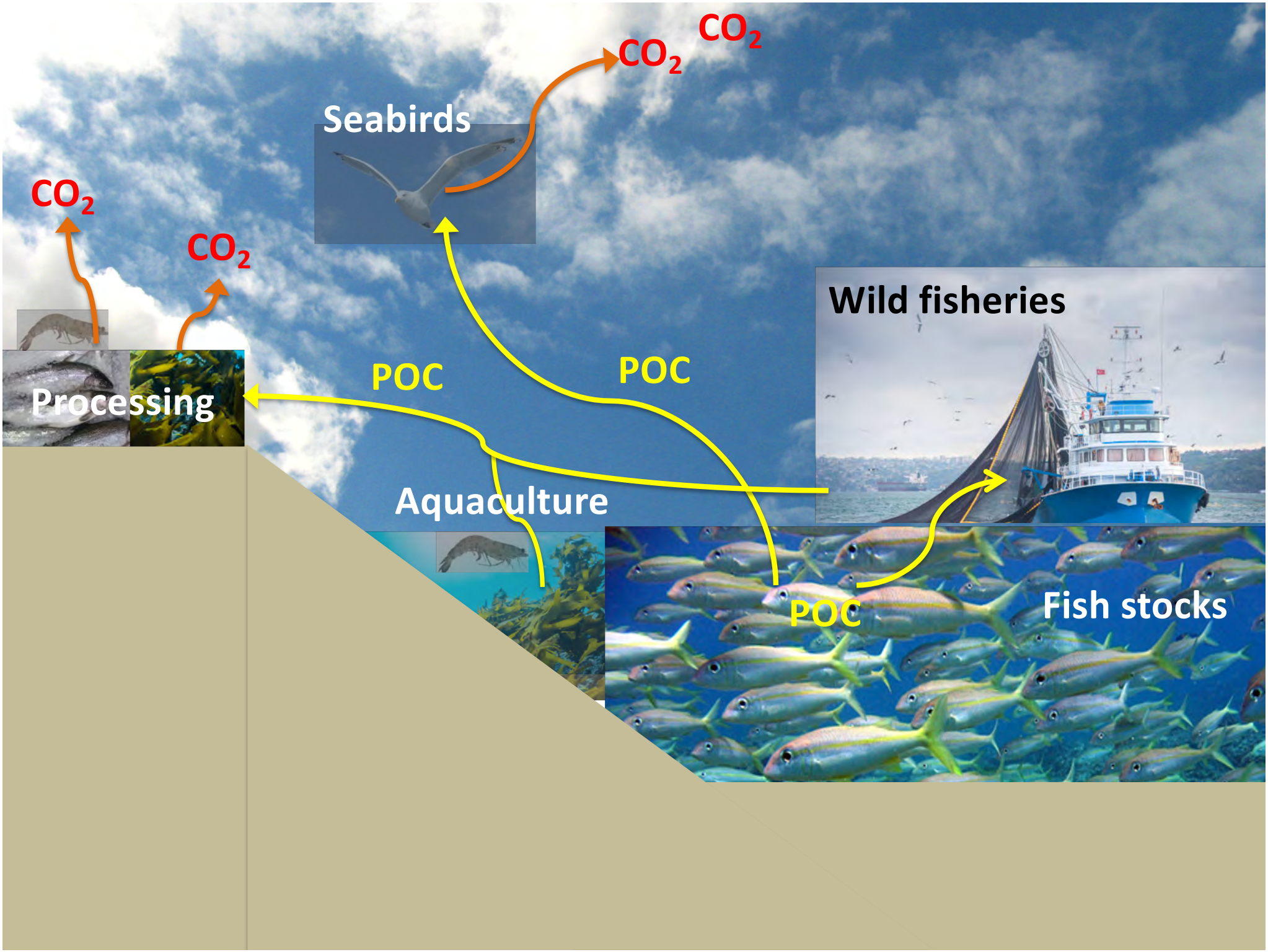
Joe Salisbury, University of New Hampshire

How does that work?

The POC in ocean fish, cultured animals and macrophytes is brought onto land where it oxidizes relatively quickly (monthly time scale). This carbon would normally respire in the ocean raising pCO_2 and DIC.

Consumption of fish stocks by birds is on the same order of magnitude as global fishing effort. They respire this POC directly into the atmosphere, where its shunted from a dissolution phase.

If birds poop some of this consumption back into the shelf waters, its low C:N ratio will promote lowering of surface pCO_2.


CO_2
CO_2
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Seabirds
CO_2
CO_2
Wild fisheries
Processing
POC
POC
Aquaculture
POC
Fish stocks

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My goal is to check assumptions and to seek guidance.

Assumptions:

1. Most present fishing effort is on the shelves. It's ~0.08 Pg y^{-1}
   -Does anyone know the percentage (in mass) of shelf versus open ocean?

2. The carbon: wet mass ratio is 0.18, (so global catch = ~0.02 Pg y^{-1} fish POC)
   - Is there a better estimate?

3. Flux from seabird consumption is 0.07 Pg y^{-1} (converts to ~0.01 Pg y^{-1} fish POC)*

4. Aquaculture flux 0.06 Pg y^{-1} (converts to ~0.01 Pg y^{-1} fish POC)**

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More Assumptions:

1. Other ocean-land fluxes?
   - e.g. Macrophyte stranding is regionally important. How does it scale globally?

1. Cf. Global coastal ocean flux 0.2–0.4 PgC yr^{-1} (Borges et al. 2005; Cai et al., 2006; Chen and Borges, 2009; Laruelle et al., 2010; Cai, 2011; Chen et al., 2013; Laruelle et al., 2014)

1. So, it looks like ocean-land fluxes of wild fish and aquacultured products is comparable to about ~10-15% of the coastal air-sea flux. 0.2–0.4 PgC yr^{-1} versus ~0.3–0.4 PgC yr^{-1}

* Fish poop has low C:N and would tend to further lower DIC

** Much finfish and some shellfish aquaculture are fed with wild fish products (this represents some double counting)

Does the carbon in extractive fisheries resources constitute a significant perturbation to the coastal carbon cycle ?

Discussion

- What have I missed?
- Has anyone done this work before (modeling or observations)?
- Is does ~15% of a target that's constantly moving (global coastal air sea flux) matter scientifically?
- Will the flux numbers change from a) overfishing or b) exploitation of new stocks?