

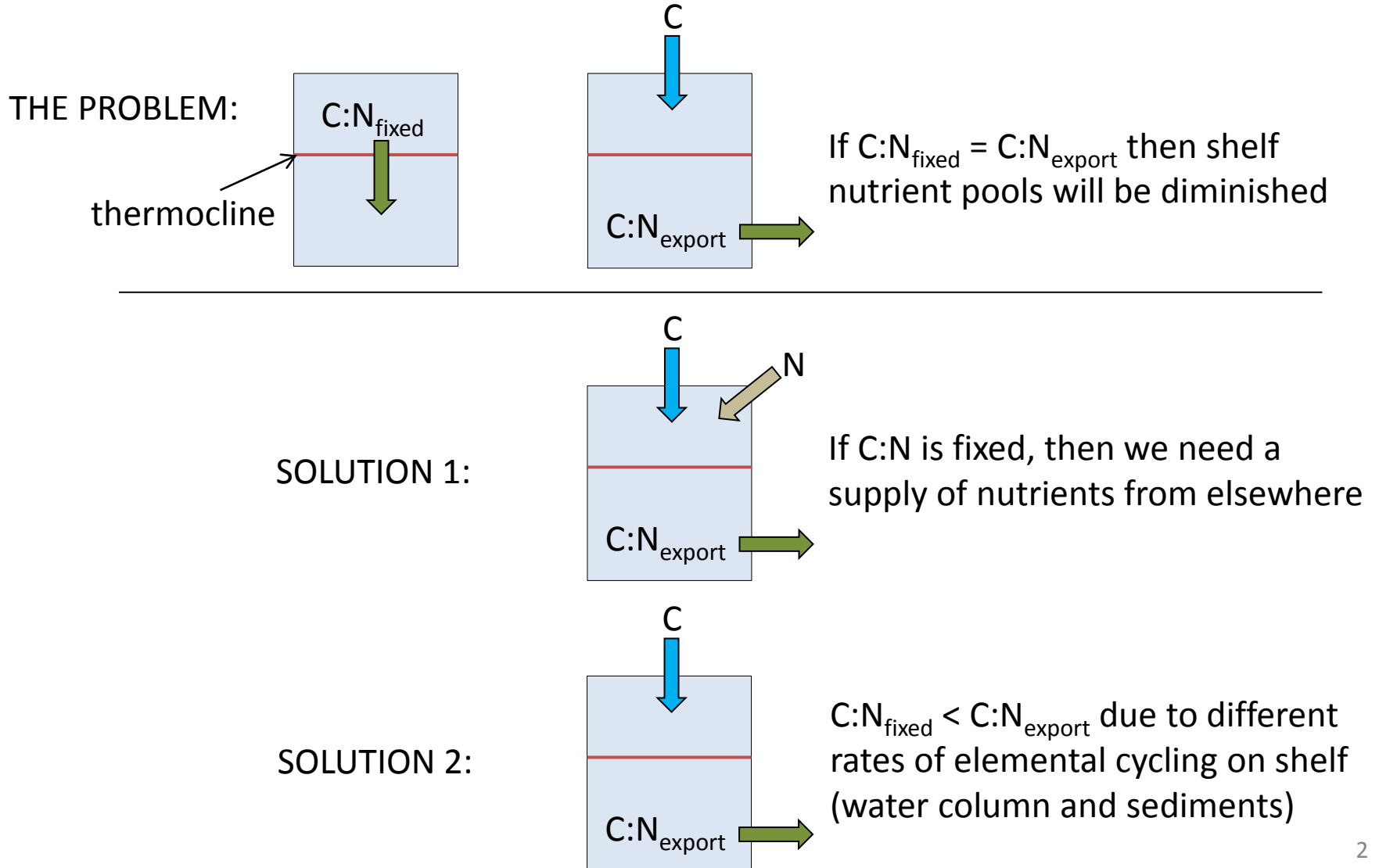
SSB WP1

How does a shelf export C but keep N, P?

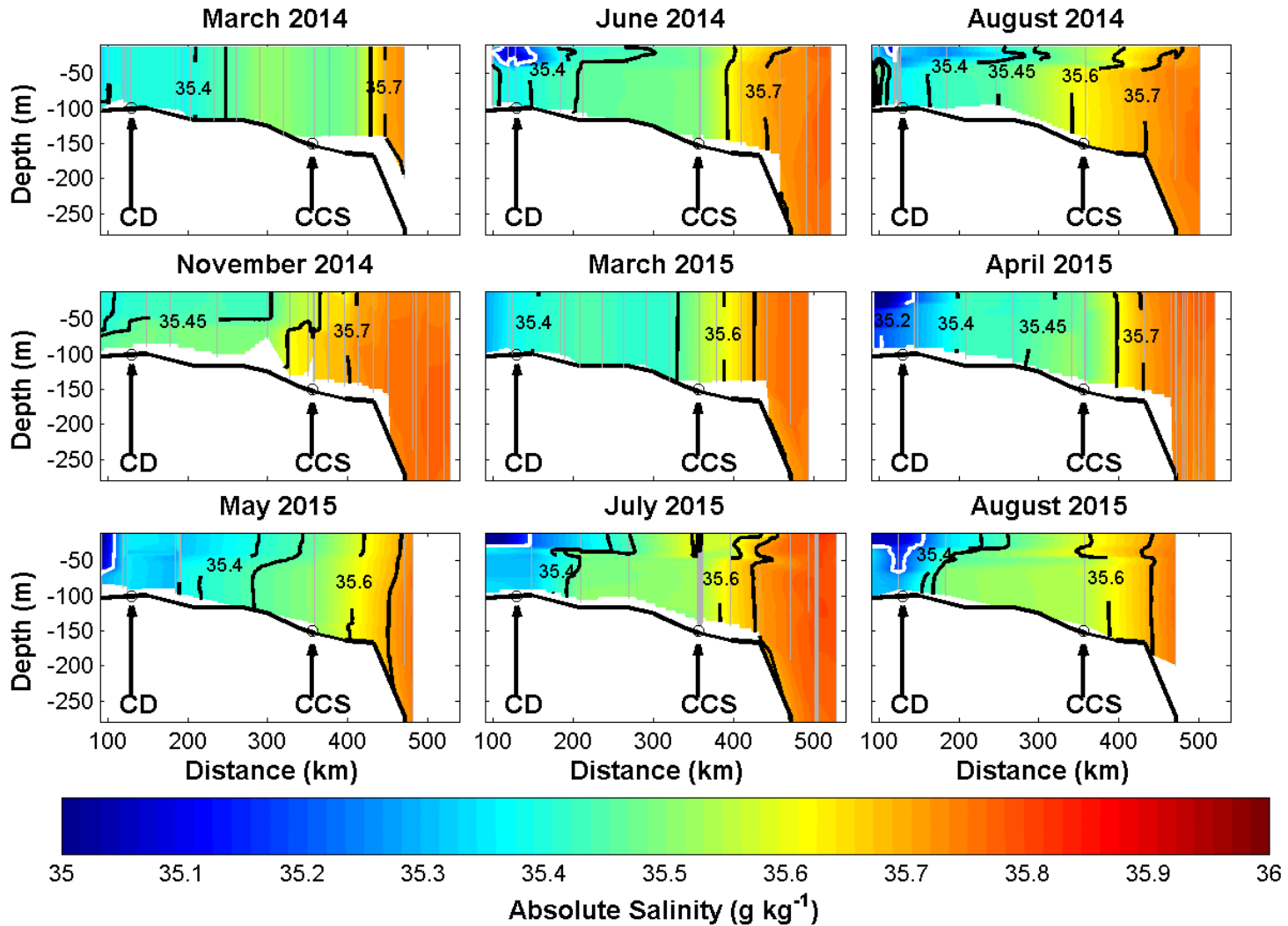
Jonathan Sharples
University of Liverpool

Objective 2

Determine how the carbon export is sustained.



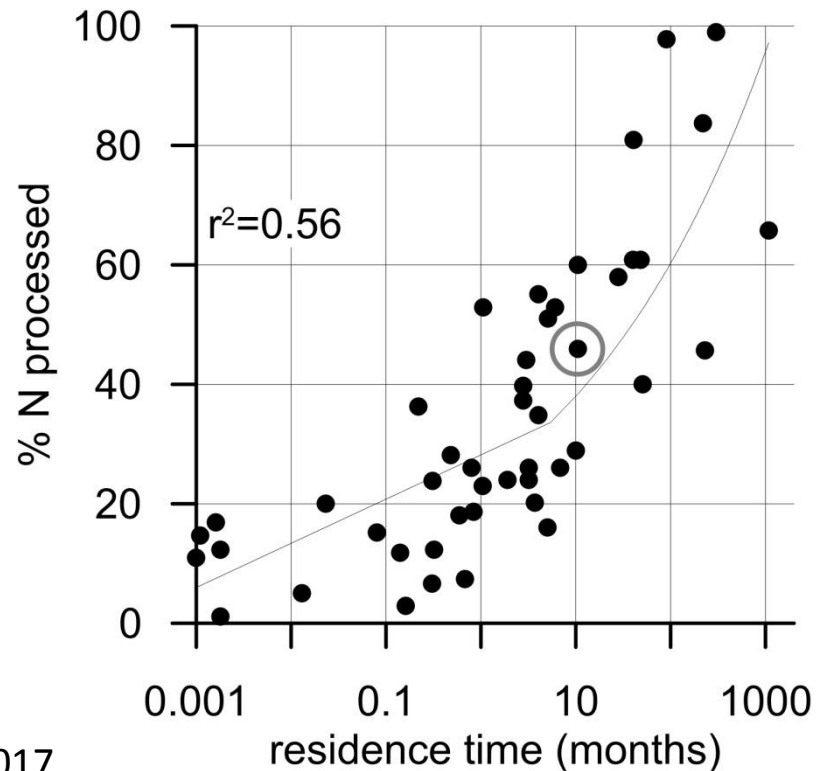
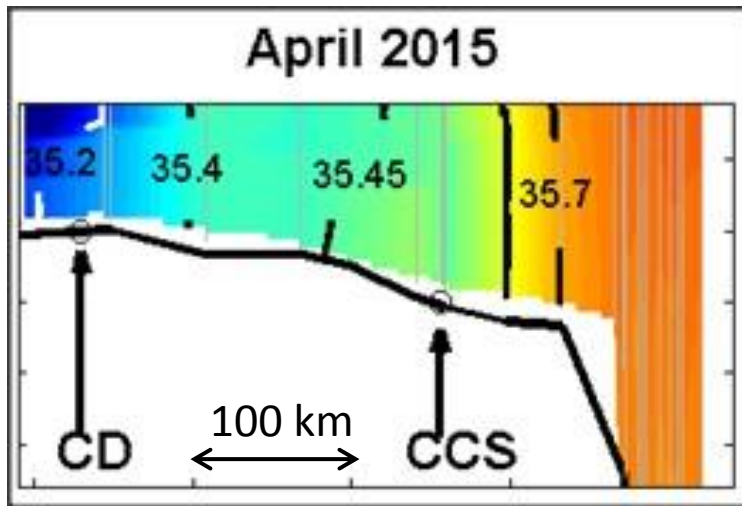
Salinity transects are REALLY useful



Water Transports and Nutrients

What have we learnt?

1. Cross-shelf salinity gradient tells us how much freshwater influence there is.



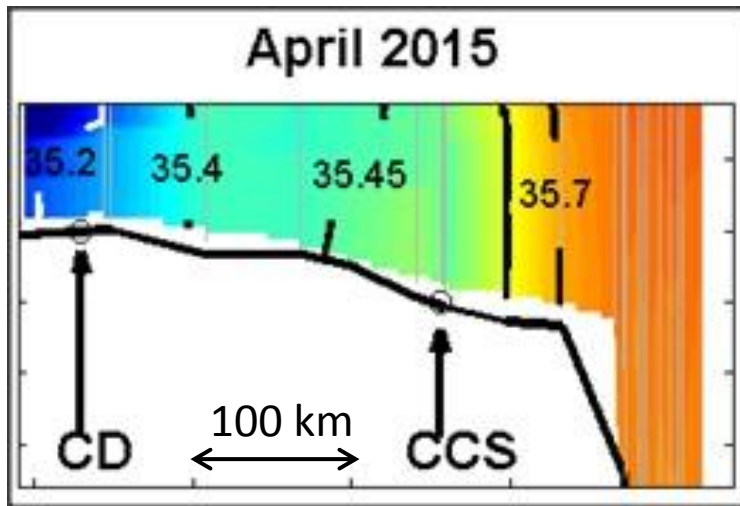
Seitzinger et al., *Ecol. Appl.* 2006

Sharples et al., *Global Biogeochem. Cycles*, 2017

Water Transports and Nutrients

What have we learnt?

1. Cross-shelf salinity gradient tells us how much freshwater influence there is.



(work by Eugenio Ruiz, Liverpool Uni)

Pre-spring bloom nitrate:

At CD

0.8% freshwater fraction

2.8 mmol m^{-3} out of 7 mmol m^{-3}
is riverine (40%).

At CCS

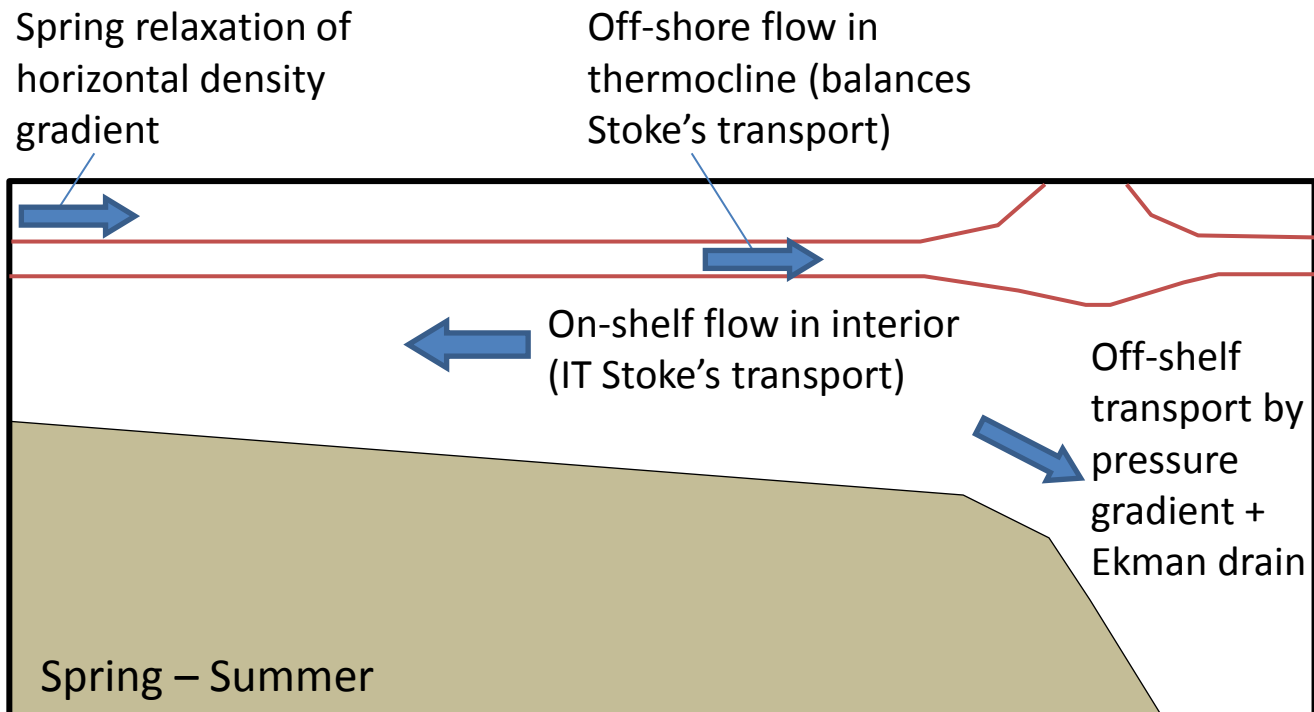
0.4% freshwater fraction

1.2 mmol m^{-3} out of 9 mmol m^{-3}
is riverine (13%).

Water Transports and Nutrients

What have we learnt?

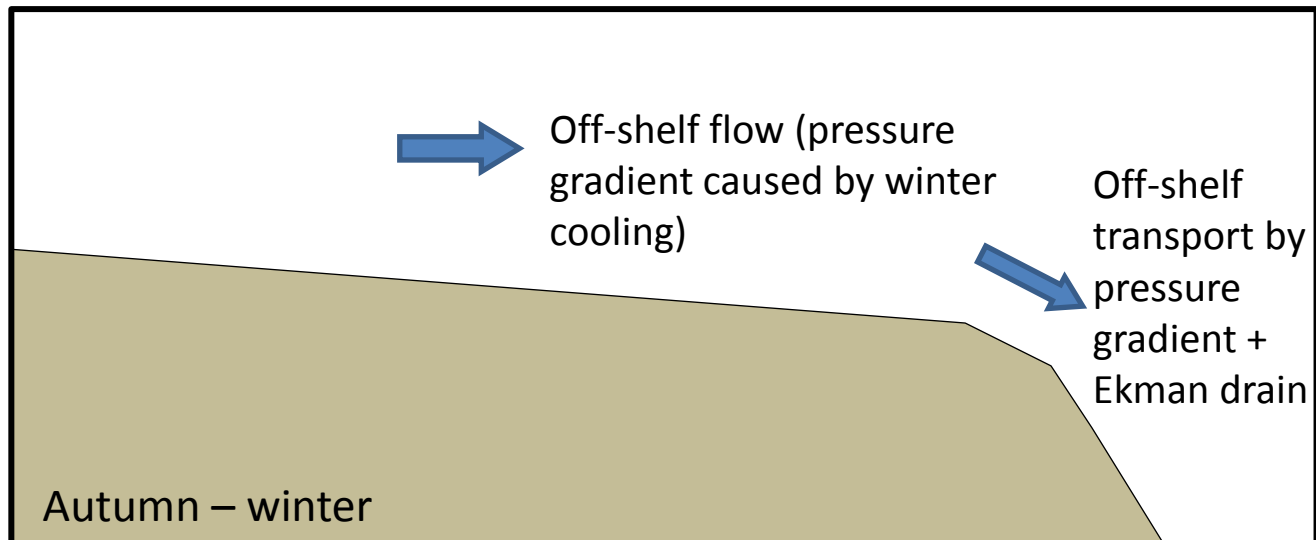
2. Salinity changes tell us where the water moves.



Water Transports and Nutrients

What have we learnt?

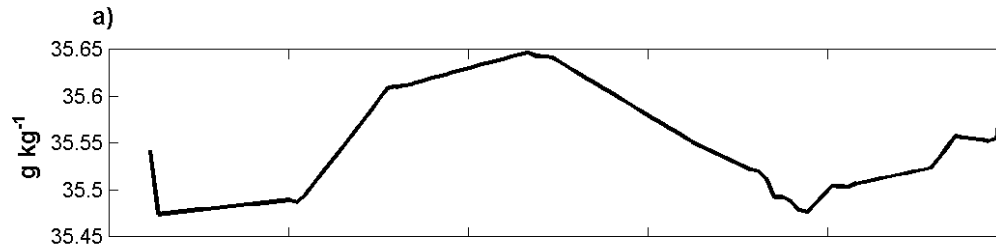
2. Salinity changes tell us where the water moves.



Water Transports and Nutrients

What have we learnt?

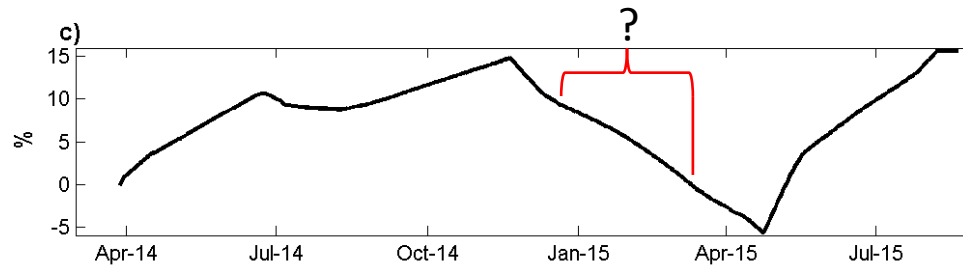
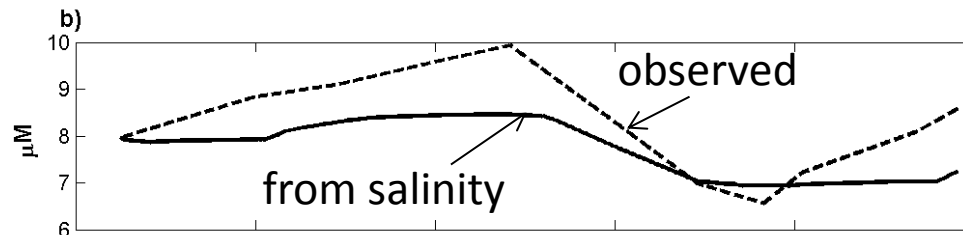
3. Salinity changes tell us the physical component of nutrient supply.



2 μM excess in
bottom 100 metres

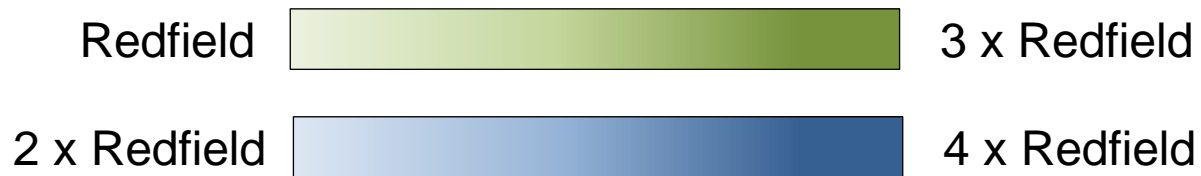
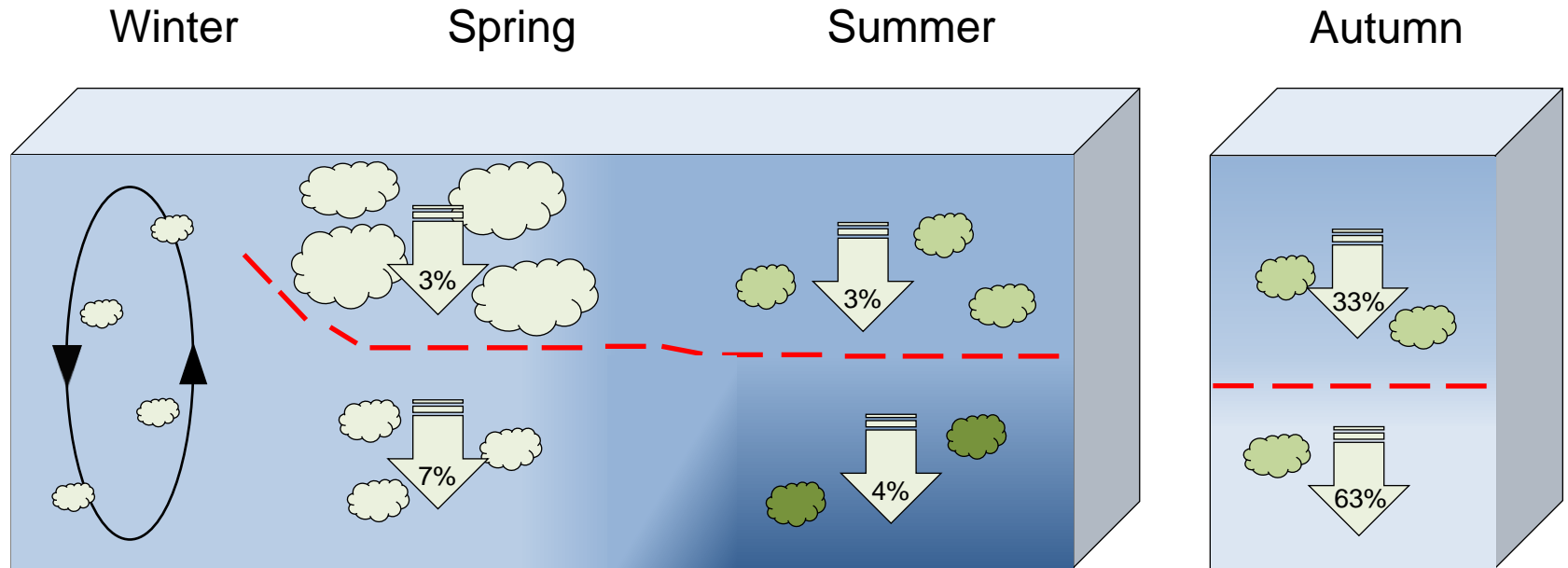
⇒

4 μM (50%) of
original surface
layer N was recycled
in the bottom layer



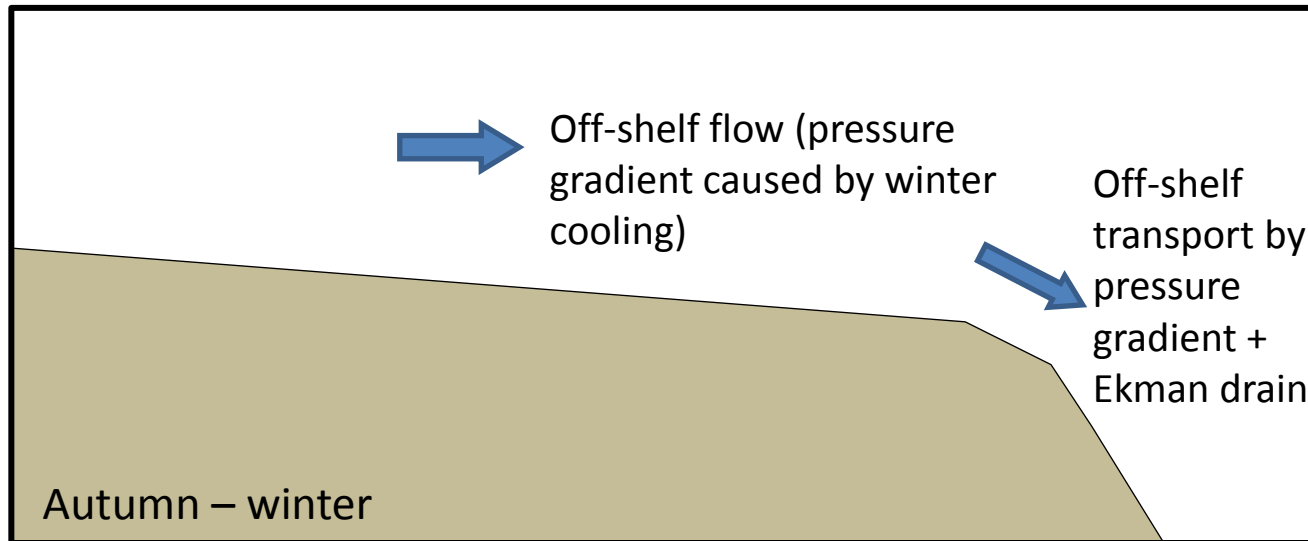
Particle and DOM Stoichiometry?

Results from module 5



DOC:DON about 2 – 3 x Redfield:
Hypothesis: non-Redfield C export is driven as DOC

Water Transports and DOC Export?

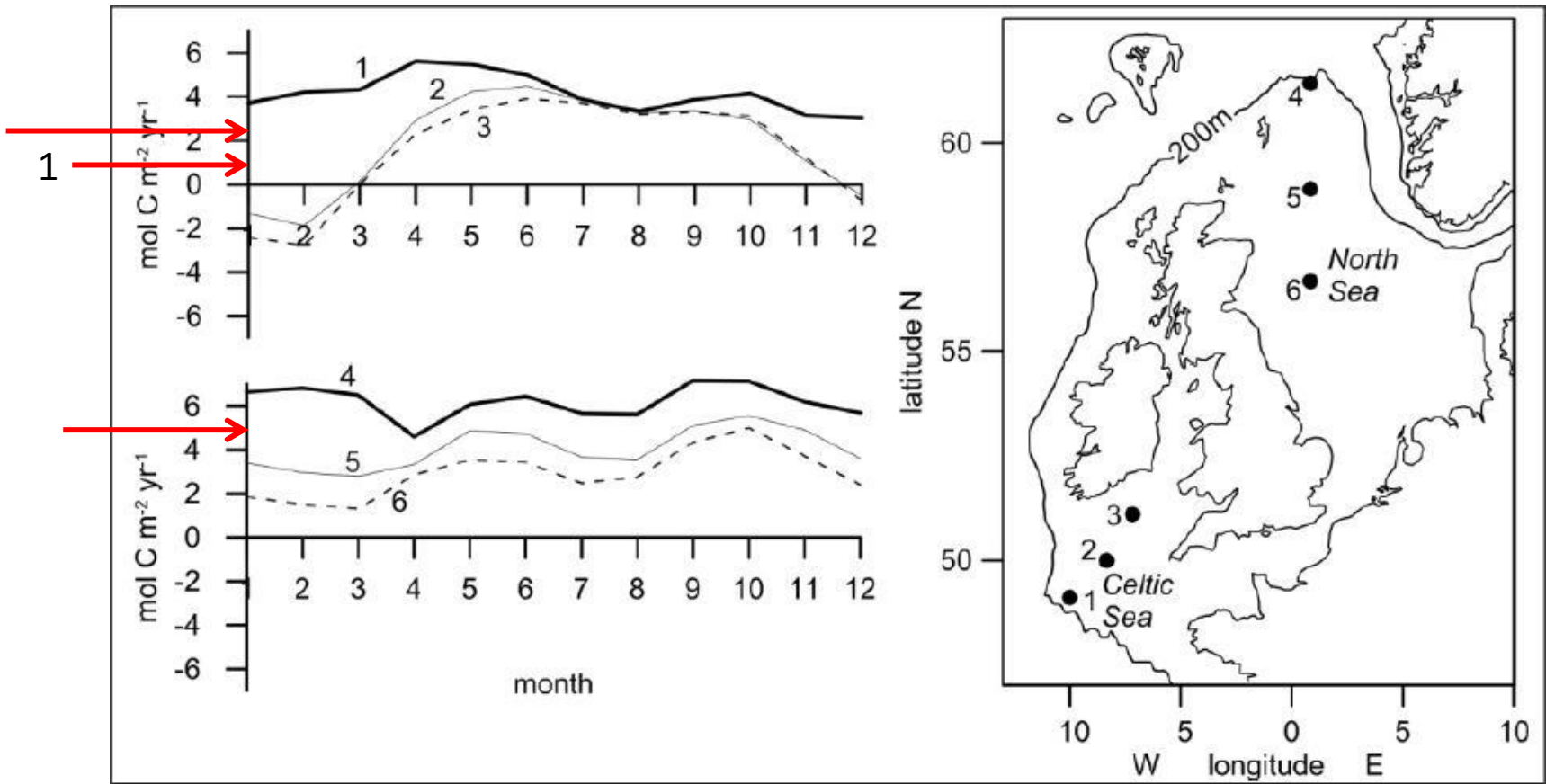


Winter off-shelf water transport from Celtic Sea was about $2 \text{ m}^2 \text{ s}^{-1}$

CCS DOC in winter $\sim 60 \text{ mmol m}^{-3}$

Over $\sim 400 \text{ km}$ of shelf $\Rightarrow 2.3 \text{ mol C m}^{-2}$ exported as DOC over winter (probably an upper bound).

C export



Next Steps?

The nitrate story:

- At CCS, 13% is riverine, 50% is recycled between years, so 37% needs to be topped-up from the ocean each year. How and when does it get there?
- Spring nitrate is a measure of capacity for C drawdown. Interannual variability?

The phosphorus story:

- Similar analysis possible....

The carbon story:

- Can DOC export balance the air-sea flux of C, or do we need particles as well?
- What happens at the shelf edge over winter?
- Relative roles of autotrophs and heterotrophs in DOC production?
- How refractory is the DOC, and what is its fate in the open ocean?
- Interannual variability in DOC and air-sea C exchange?

