Seasonal and spatial variability of productivity and export in the N. Pacific

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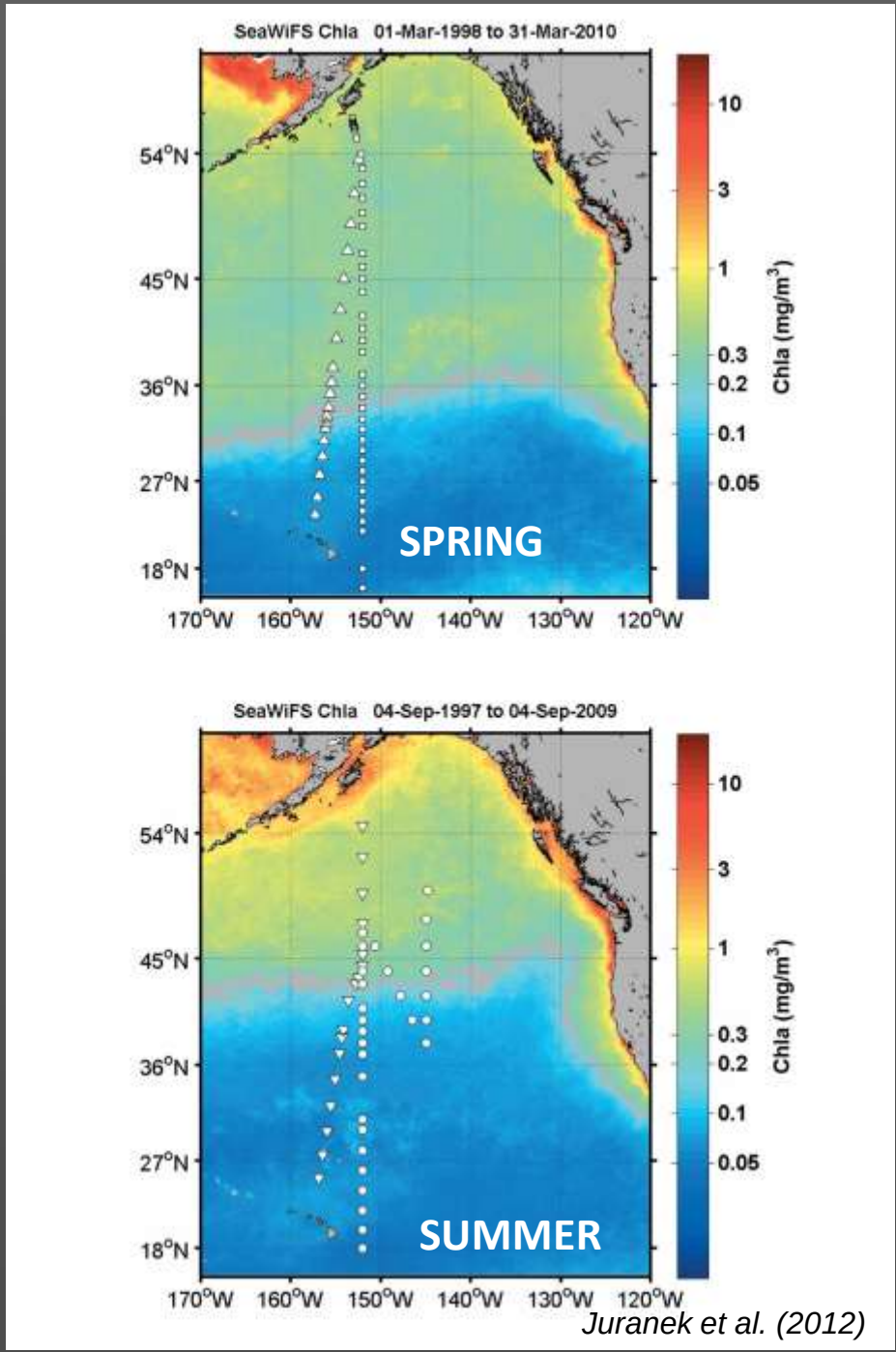
- Several opportunistic surveys across the subtropical/subpolar transition
  - *Upper ocean nutrients, community structure, productivity*
- Transition zone chl front (TZCF) appears to be a major feature with respect to bio carbon cycling
  - *What controls the seasonal dynamics of the TZCF*
  - *How do these dynamics influence productivity rates at the transition?*



Juranek et al. (2012)

The transition zone chlorophyll front: an intro

Pergamon

Progress in Oceanography 49 (2001) 469–483

Progress in Oceanography

www.elsevier.com/locate/pocean

The transition zone chlorophyll front, a dynamic global feature defining migration and forage habitat for marine resources

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JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 115, C05001, doi:10.1029/2009JC005596, 2010

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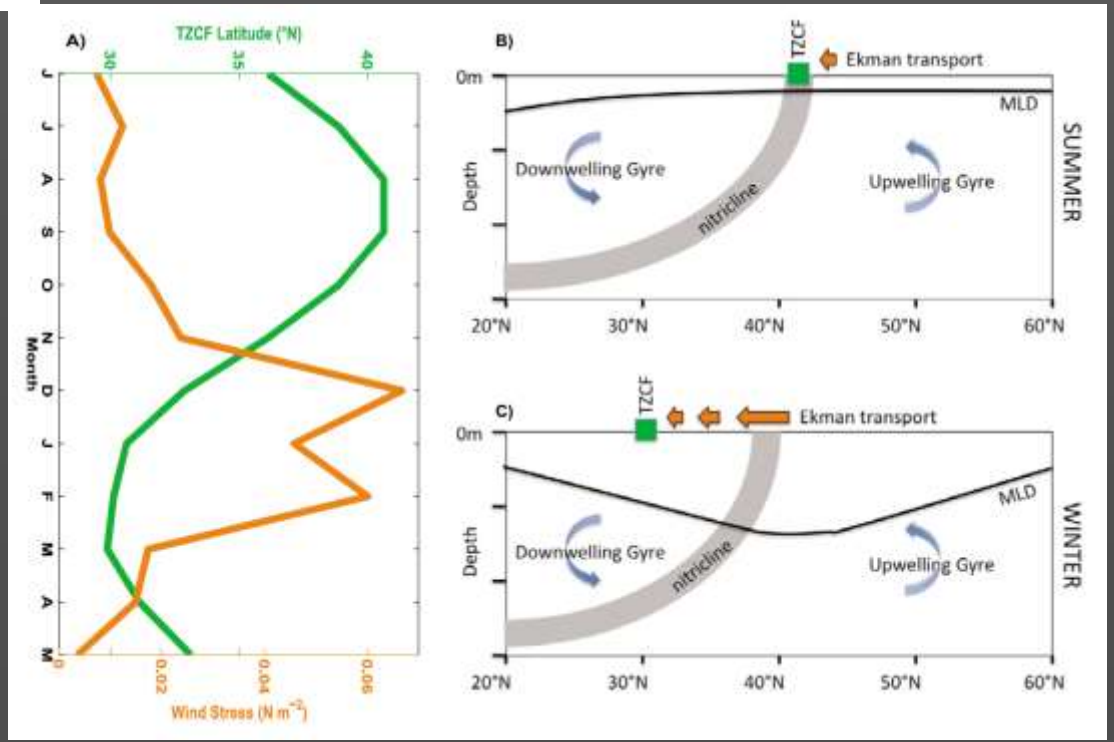
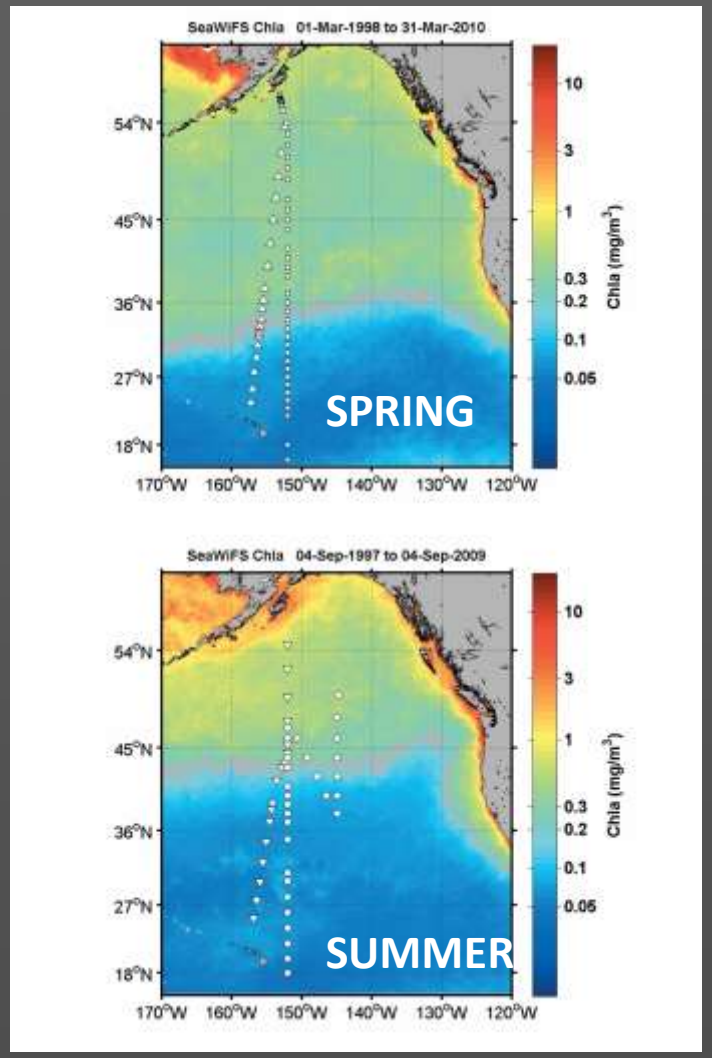
Physical controls on the seasonal migration of the North Pacific transition zone chlorophyll front

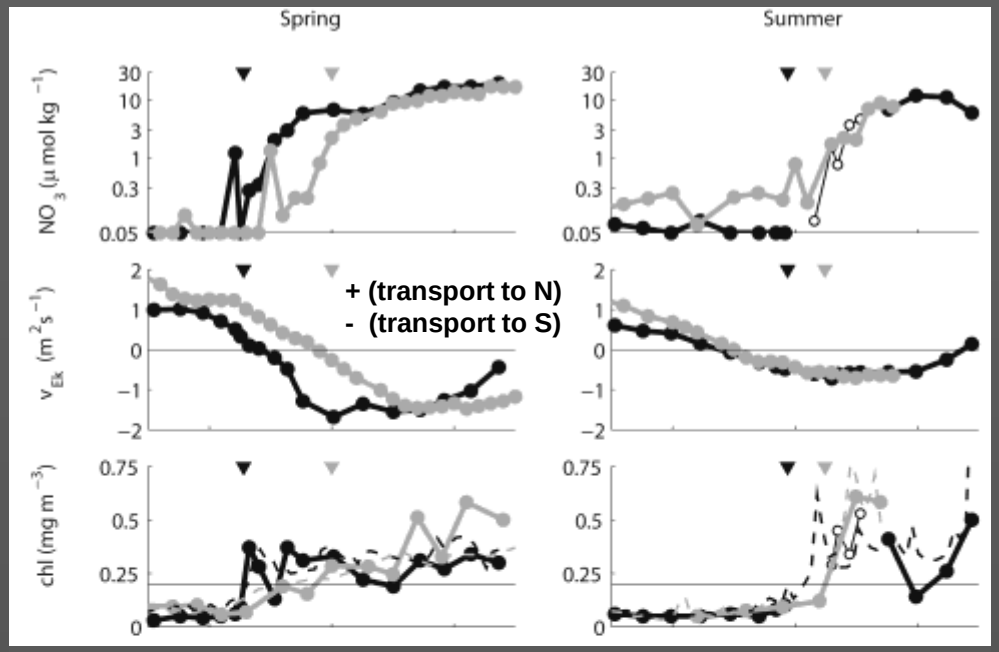
Jennifer M. Ayers[1] and M. Susan Lozier[1]



Transition seems to be controlled by nutrient availability
- winter: coincides with southward extent of Ekman transport
- summer: coincides with surface nitricline outcrop

Results of four cruises across the transition





Location of TZCF generally consistent with Ayers and Lozier hypothesis

Productivity (GOP= gross O_2 production, NCP = net community production) seemed to be significantly enhanced at the transition (nominally defined as 0.2 mg m^{-3} chl horizon)

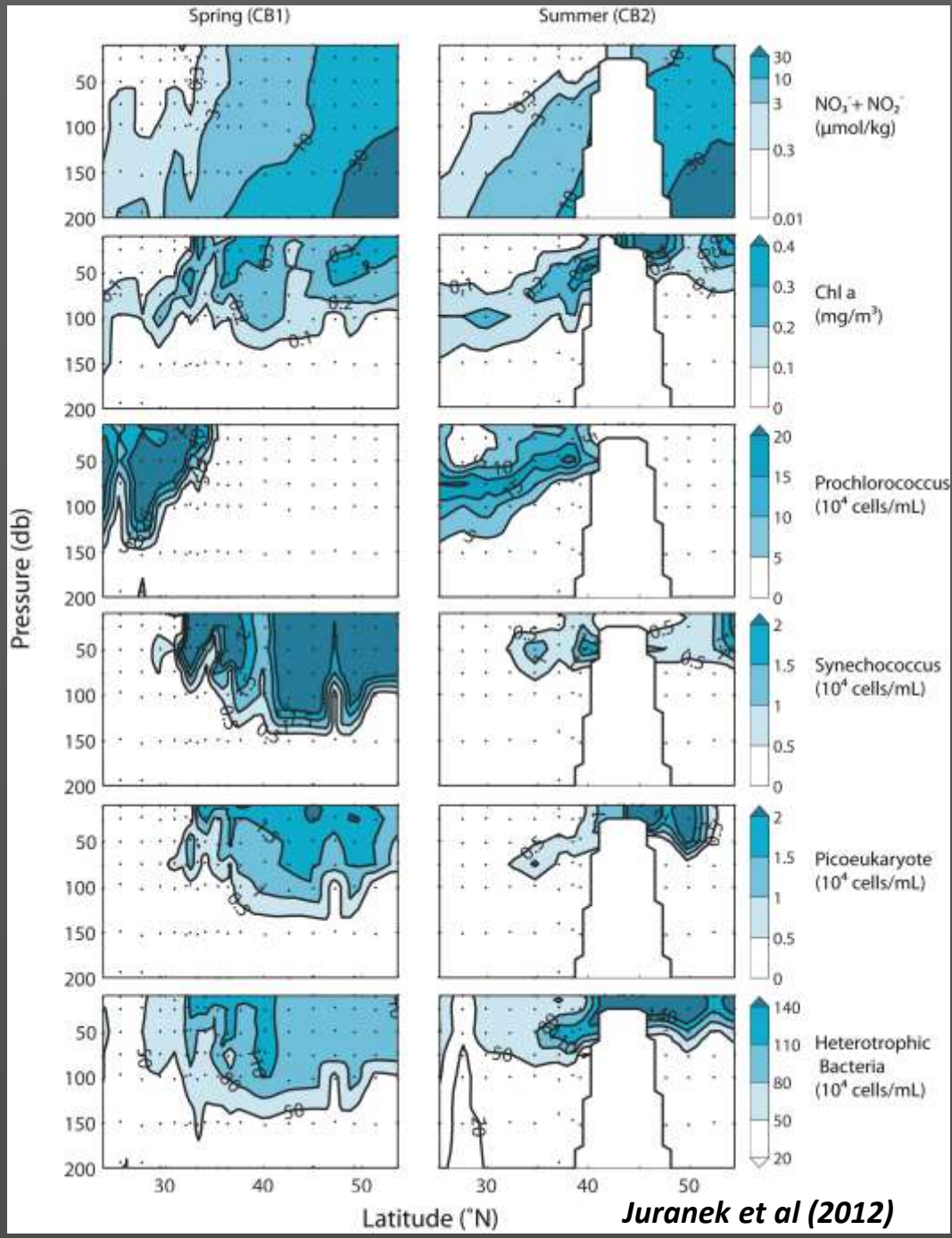
Juranek et al (2012)

Biological gradients at the Transition…

Chl and nitrate front also associated with dramatic shifts in pigments and community composition

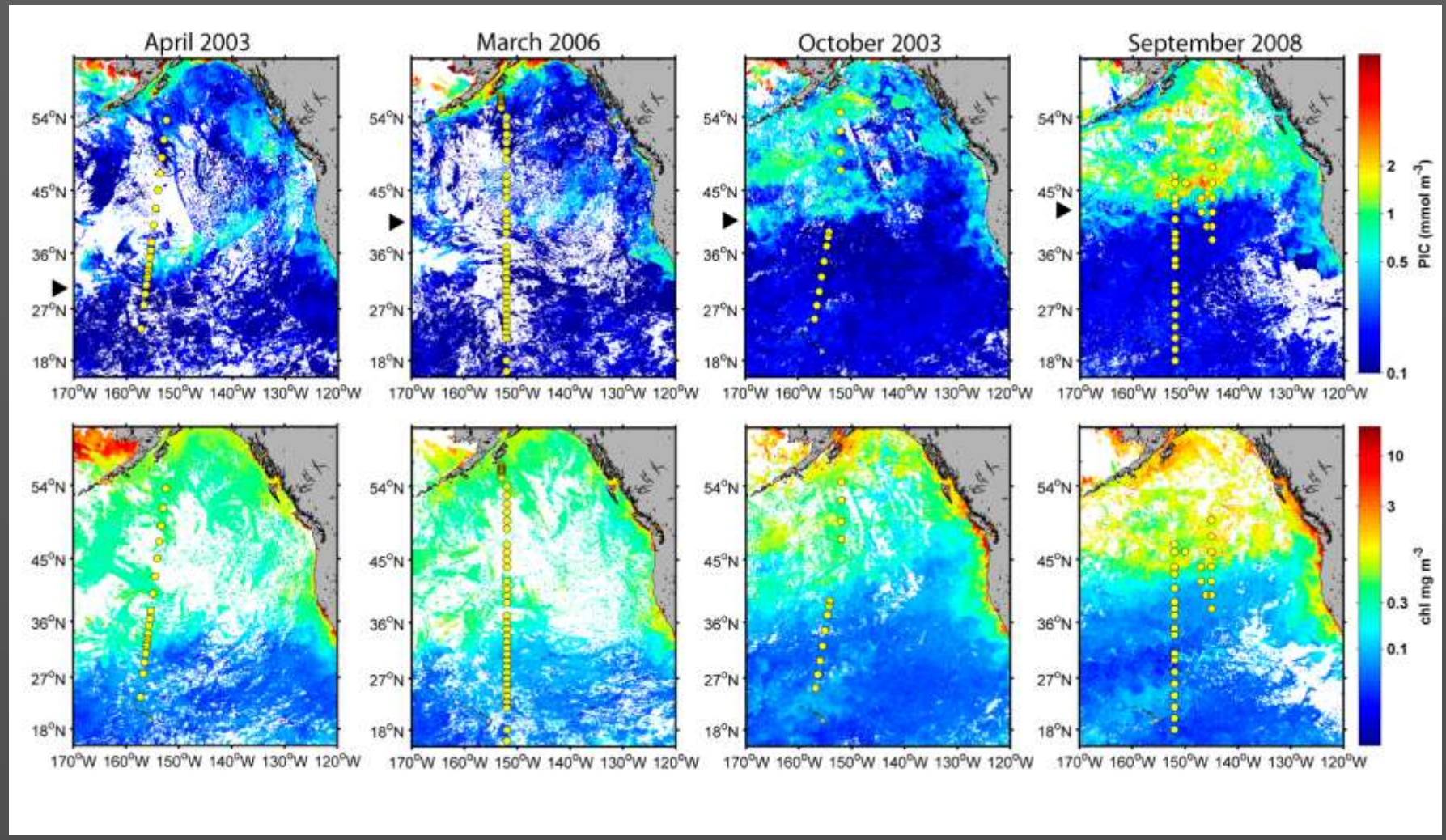
The TZCF seems to mark the shift between planktonic ecotypes associated with the subtropical and subarctic regions

But what causes net and gross productivity to be enhanced at the front?



Juranek et al (2012)

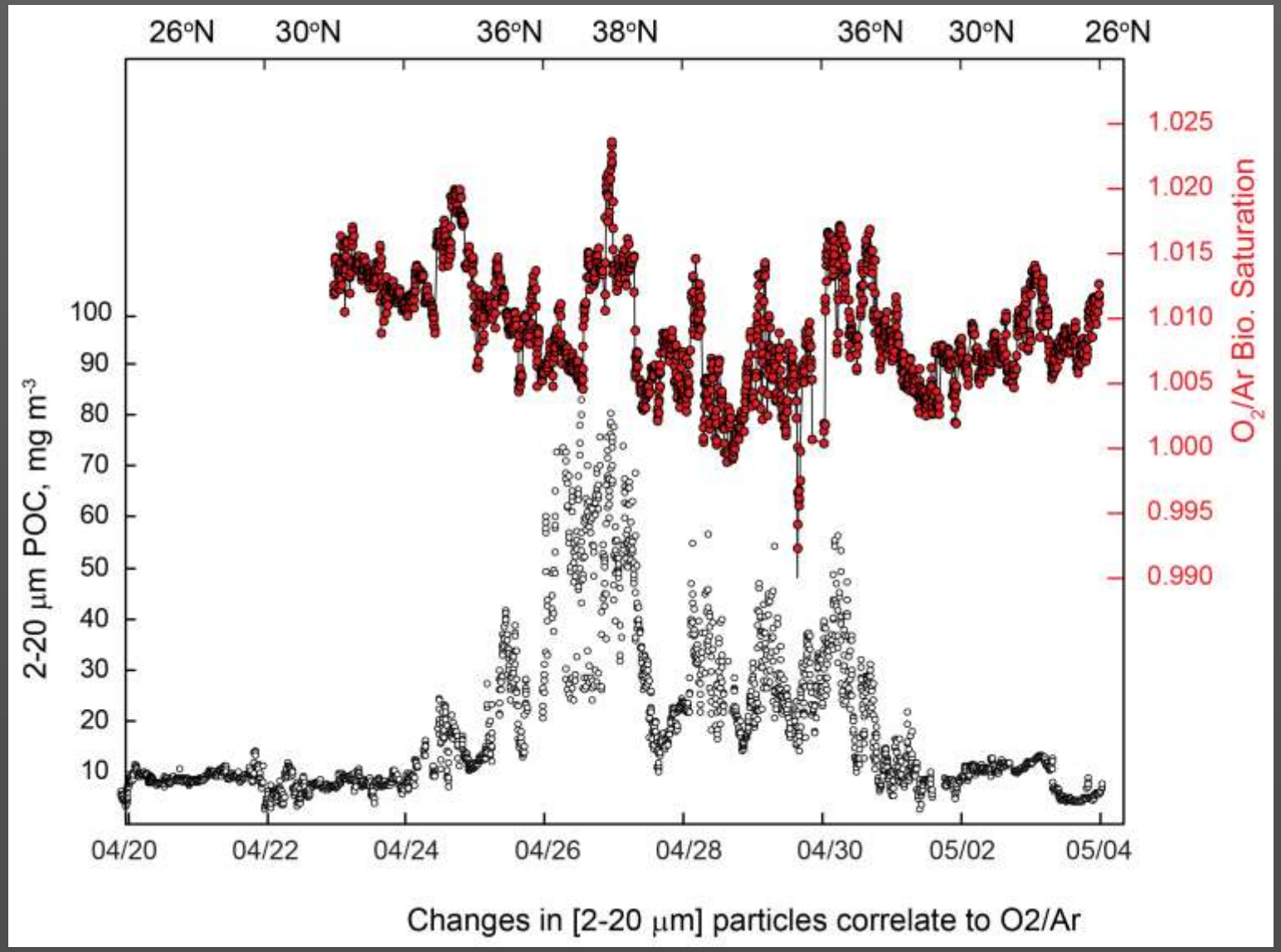
Biological gradients at the TZCF: observations from space

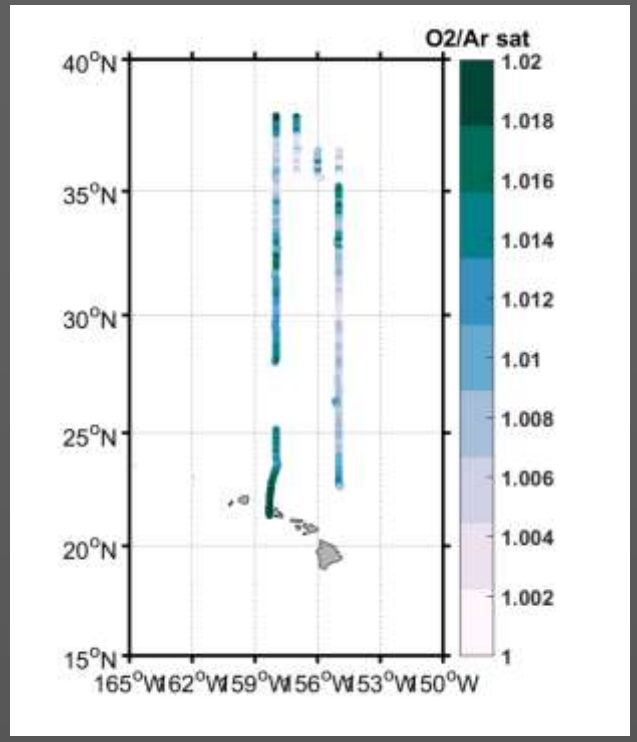


Top: MODIS Aqua Particulate Inorganic Carbon
Bottom: SeaWiFS Chl a

Juranek et al (2012)

New results from 2016 indicate close association of picoeuks and NCP





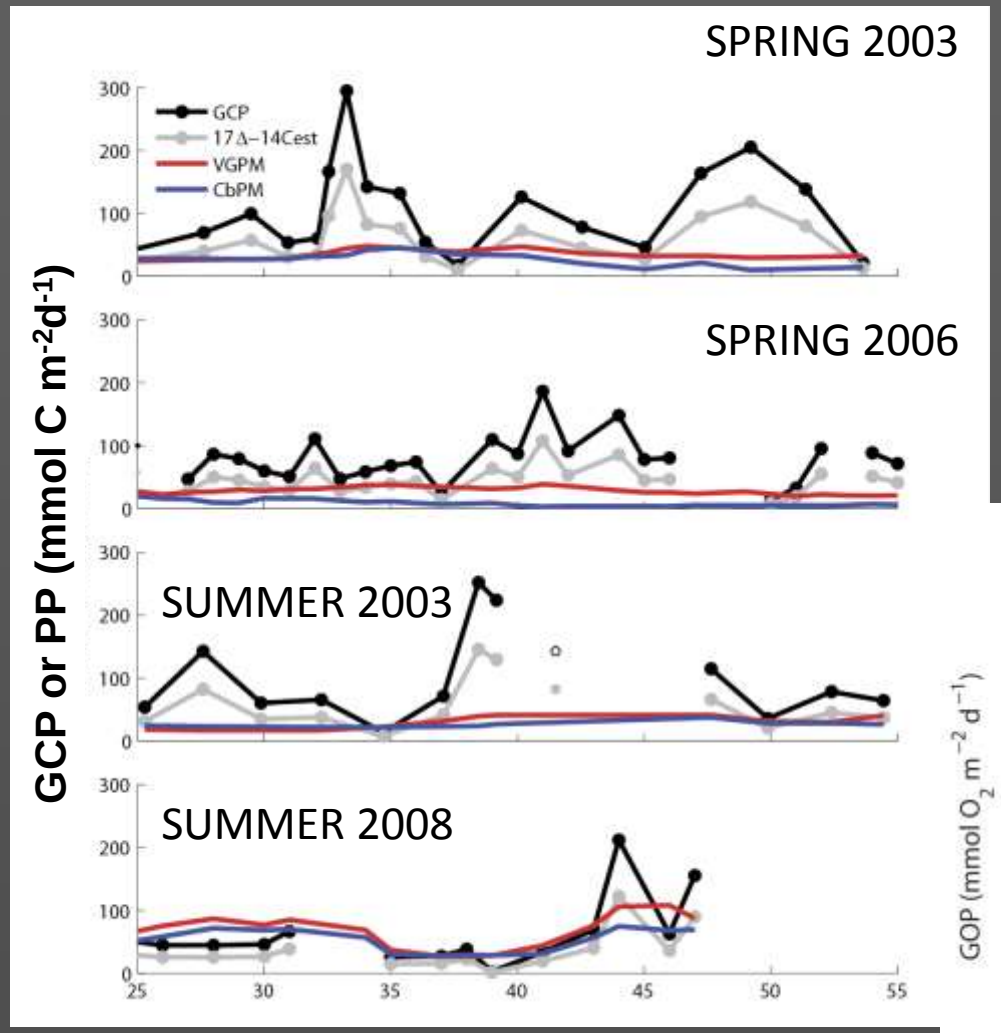
Preliminary results from “Gradients” Cruise across the transition in May 2016

Continuous O_2/Ar (proxy for NCP) and LISST laser-based particle determination (proxy for POC) indicate strong coherence for ‘medium size’ cell carbon

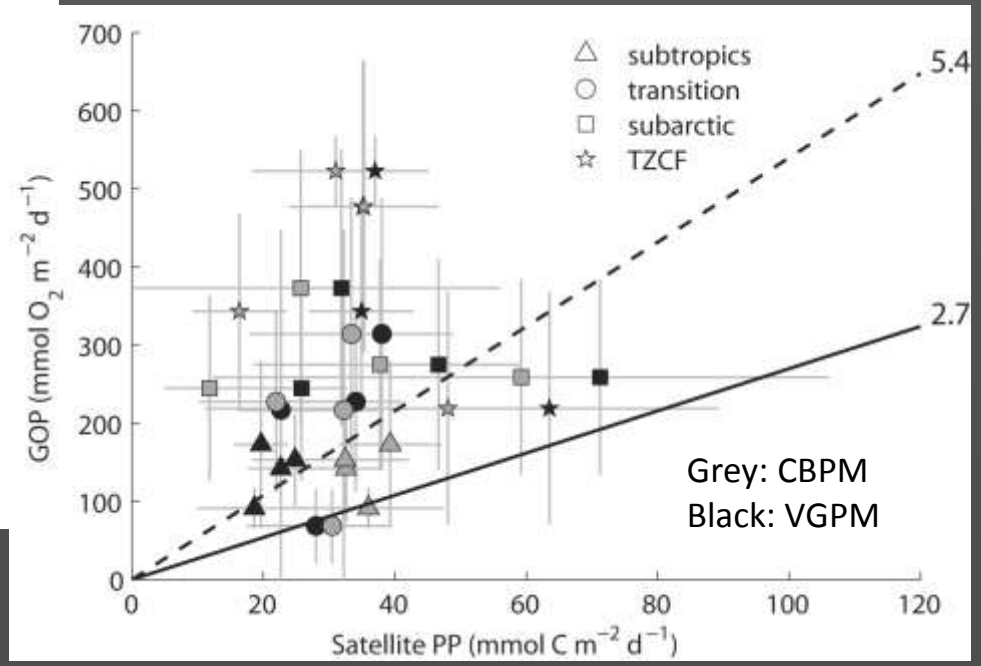
Seaflow flow cytometer data indicate ‘peaks’ occur coincident with shifts to picoeukaryotes

A. White, L. Juranek unpublished data

How do satellite-based productivity estimates perform in this region?



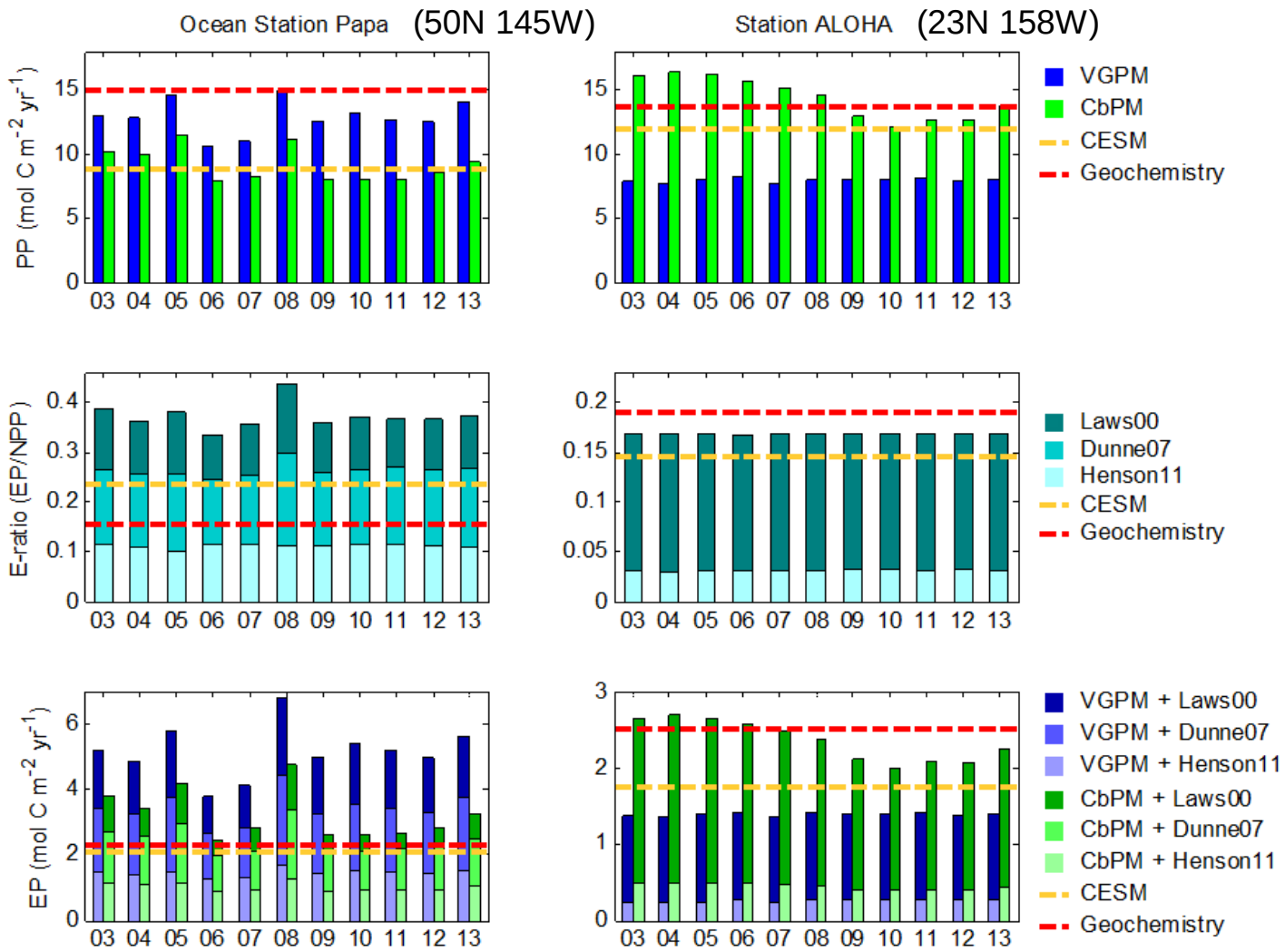
Satellite estimates seem to be underestimating both the mean AND the variability in regional productivity



VGPM: *Behrenfeld and Falkowski*, 1997
CBPM: *Westberry et al., 2008*
Downloaded from OSU PP webpage:
http://web.science.oregonstate.edu/ocean.productivity/

Juranek et al (2012)

Satellite, Model and Geochemical Estimates of PP and NCP



Satellite = VGPM, CbPM

Community Earth System Model = CESM

Geochemistry = ^{14}C-PP, O_2/Ar-NCP,

Pavlesky, Quay et al. (in press)

Brief Recap:

N. Pacific Subtropical/subpolar Transition is biologically dynamic

Enhanced surface NCP seems to be associated with picoeukaryote/ coccolithophore abundance

Features of productivity/export across the transition are essentially invisible in satellite PP records

More generally, no single combination of model , PP, or export algorithm can match long term records at ALOHA and Station P

Remaining Questions:

What are the implications of these community structure and productivity gradients for export efficiency to mesopelagic?

What are the implications for TEI cycling?