OCB WORKSHOP 2018

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海洋环境生态学研究组
COASTAL ECOLOGY GROUP

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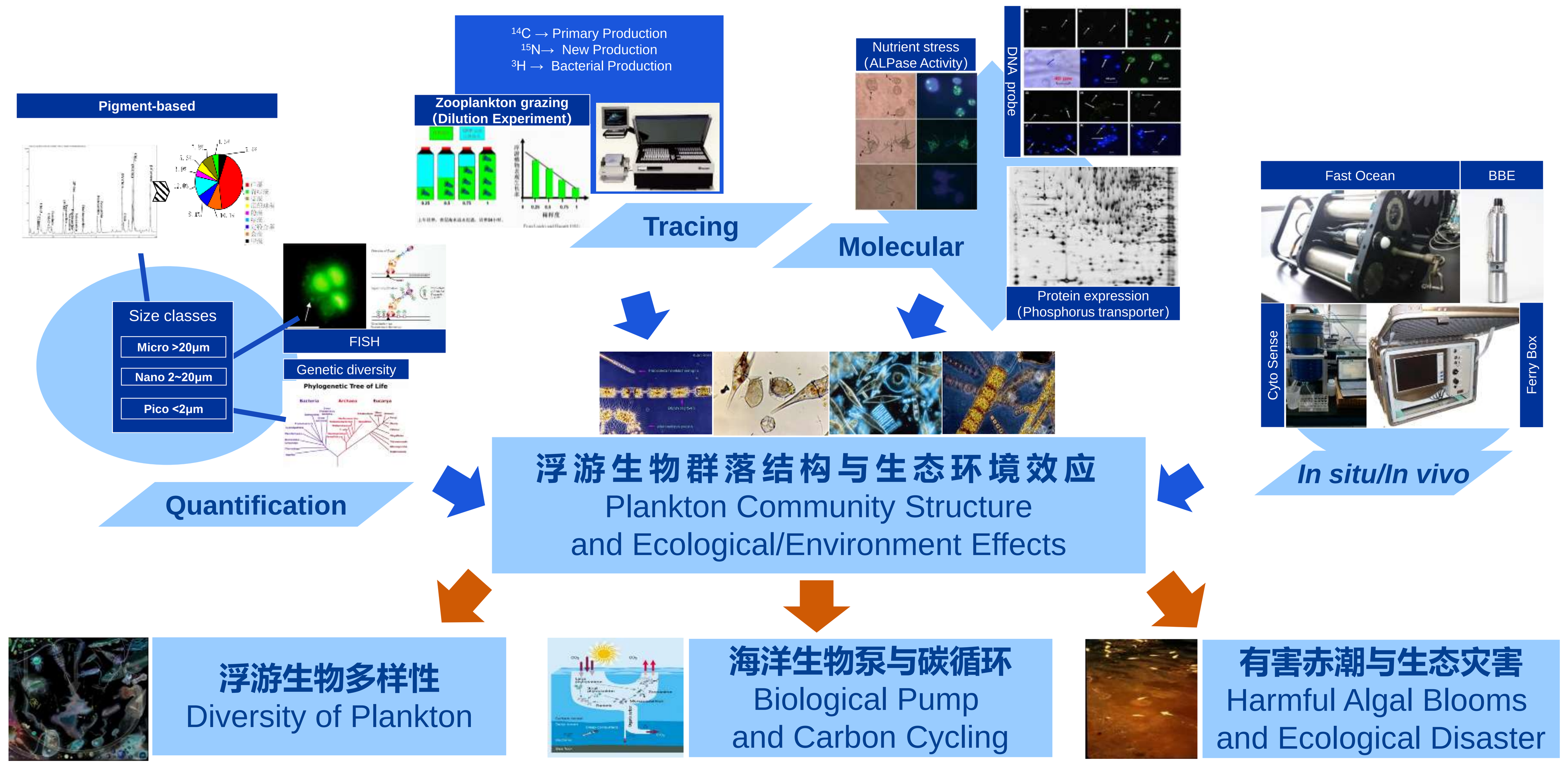
Coastal Ecology Group (CEG) is a part of the College of the Environment and Ecology, the State Key Lab of Marine Environmental Science (MEL), the Key Laboratory of Coastal and Wetland Ecosystems, the Ministry of Education, and the Fujian Provincial Key Laboratory for Coastal Ecology and Environmental Studies of Xiamen University. The group, led by Dr. Bangqin Huang, focuses on "Plankton community and its Ecological/Environmental Effects". Our research includes marine primary production processes, phytoplankton functional groups, biological pump and POC export, microzooplankton (ciliates and flagellates) diversity, ecology, harmful algal blooms and ecological disaster, eco-physiology and molecular ecology of the key phytoplankton species.



Recent work on biological pump

Fecal pellets sinking in a marginal sea and the prey effect

Yong Qiu *et al.* being prepared

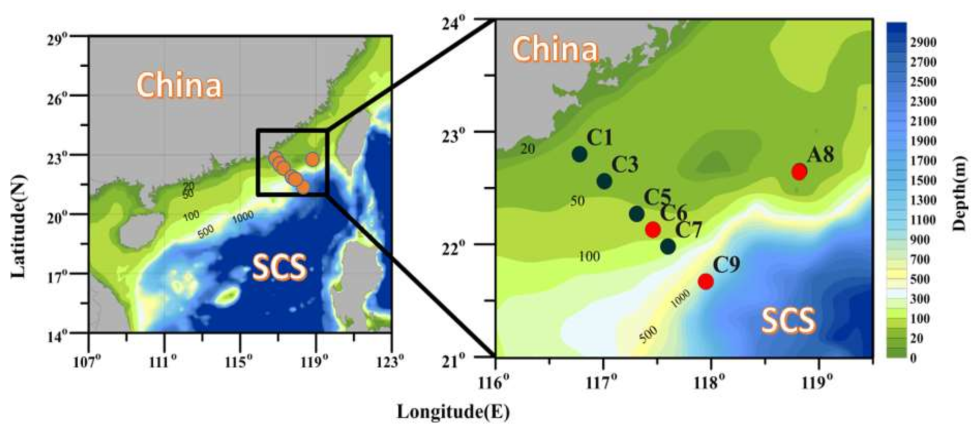


Fig. 1 Sampling station. Red: floating sediment trap

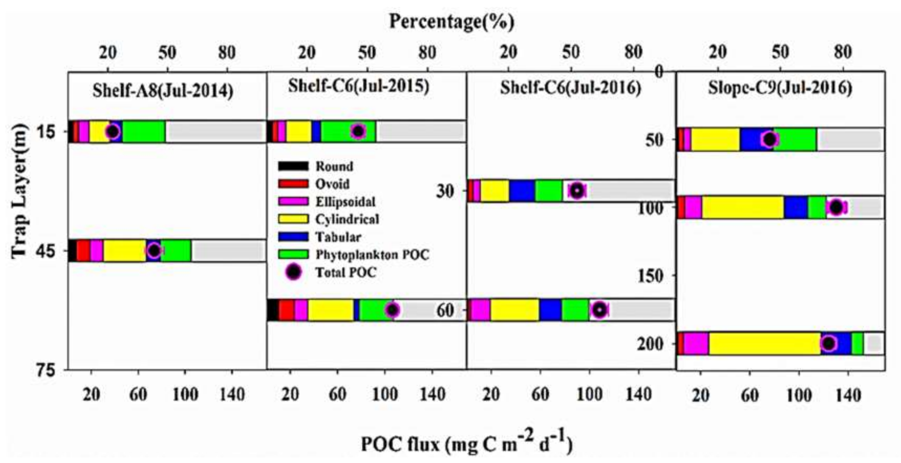


Fig. 2 Trap-based POC flux and the fecal pellets content

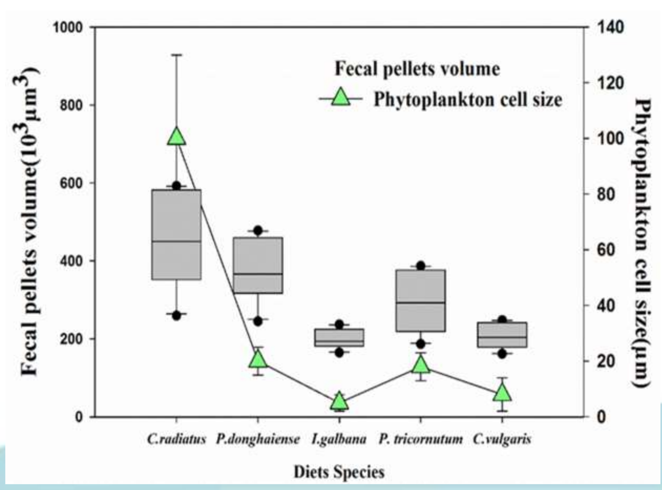


Fig. 3 Volume of copepod fecal pellets using different phytoplankton prey.

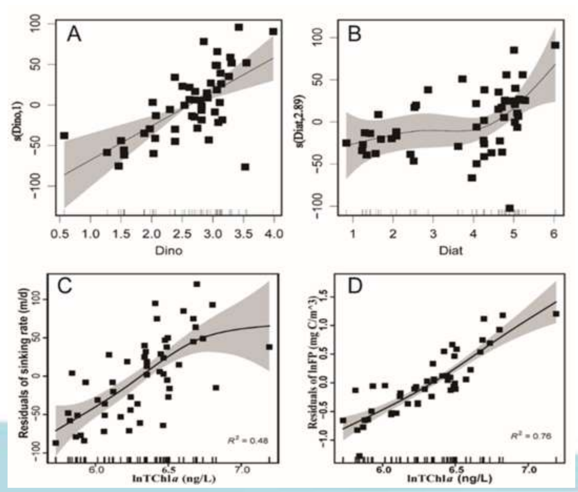


Fig. 4 GAM model : Sinking rate = α+s(Dino)+s(Diatom)+ε , R2=0.6 (A, B); Fecal pellet = α+s(TChla)+ε, R2=0.76 (C); Sinking rate = α+s(TChla)+ε, R2=0.48(D).

Diel patterns of variable fluorescence and carbon fixation of picocyanobacterial Prochlorococcus-dominated phytoplankton in the South China Sea basin

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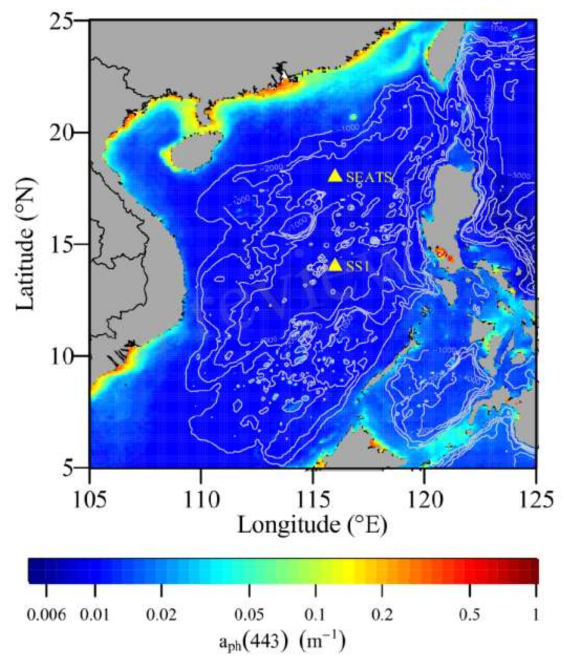
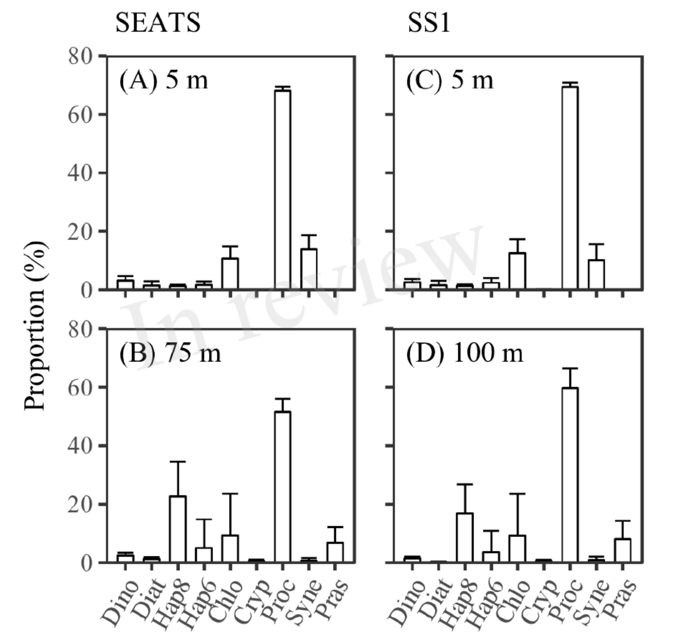
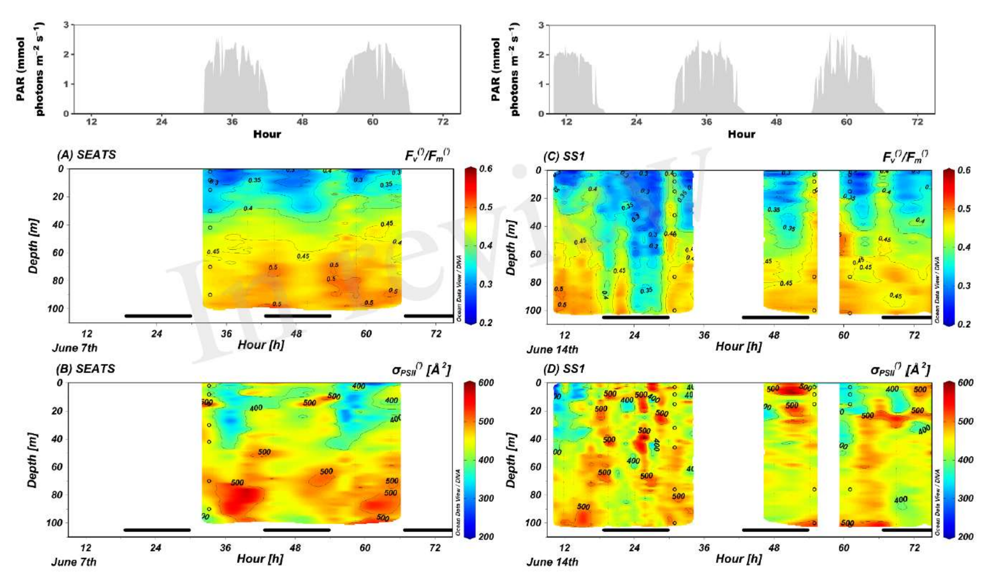
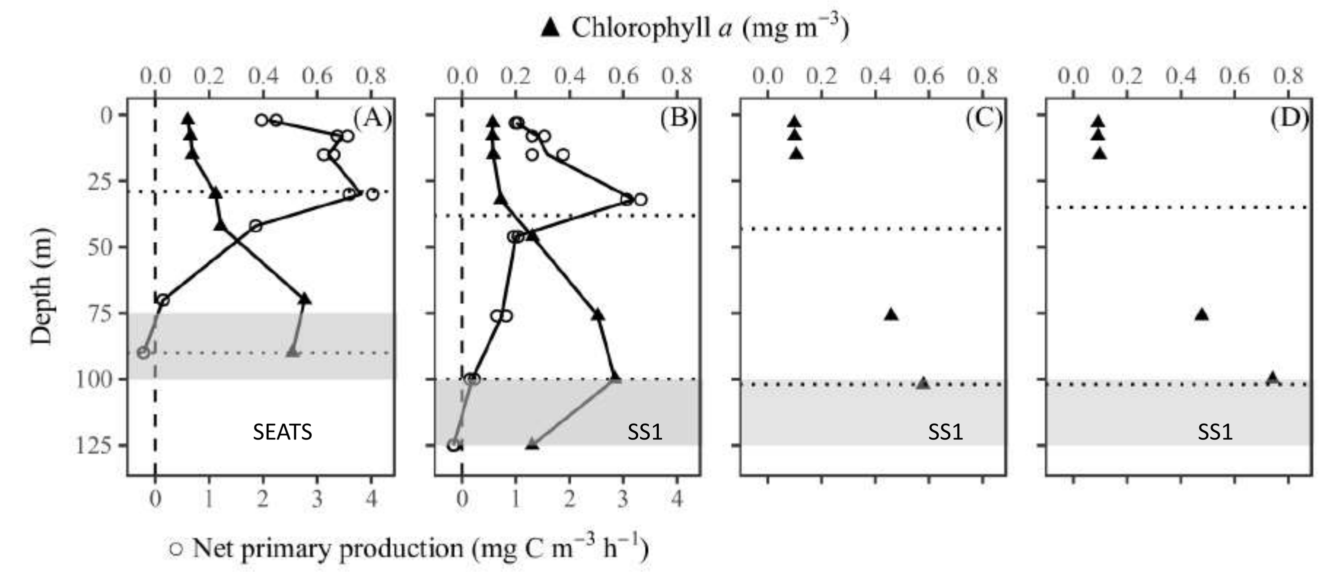


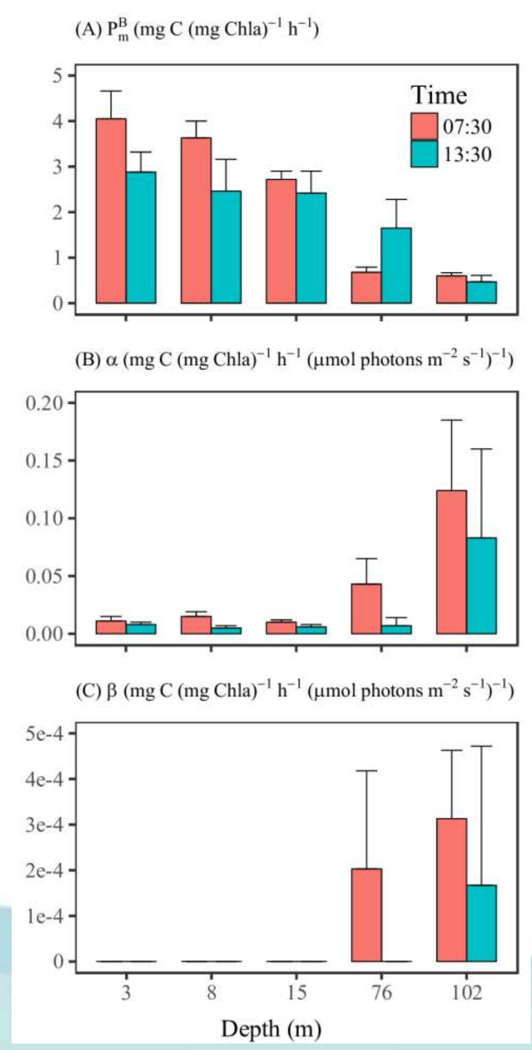


Item	parameters	depths	frequency	period
CTD	**temperature** **salinity**	0–300 m.	at an interval of 1.5 h or 3 h at station SEATS; at an interval of 1.5 h at station SS1.	June 7th, 9:20–June 10th, 10:10 at station SEATS; June 14th, 8:30–June 17th, 10:00 at station SS1.
Nutrients	**nitrate+nitrite** **phosphate** **silicate**	5, 15, 25, 30, 40, 50, 75, 100, 125, 150, 175, 200, 250, 300 m.	at an interval of 3 h.	
FRRf	$F_v^{(\prime)}/F_m^{(\prime)}$ $\sigma_{PSII}^{(\prime)}$	0–100 m.	at varied intervals at station SEATS; at an interval of 1.5 h or 3 h at station SS1.	
NPP	NPP	at the surface and the depths with 70, 50, 23, 12, 3, 1, 0.3% of surface PAR.		June 8th, 9:30, at station SEATS, 24 h incubation. June 15th, 7:30, at station SS1, 24 h incubation.
P-I curve	P_m^B α β	3, 8, 15, 76, 102 m.		June 16th, 7:30, at station SS1, 1 h incubation; June 16th, 13:30, at station SS1, 1 h incubation.
Chl*a*	Chl*a*	along with NPP and P-I curve.		along with NPP and P-I curve.
Pigments	**pigments** **classes**	5, 25, 50, 75, 100, 150 m.	at an interval of 3 h.	June 7th, 7:00–June 8th, 7:50 at station SEATS; June 14th, 8:30–June 17th, 10:00 at station SS1.

- Active chlorophyll fluorescence like Fast Repeat Rate fluorometry (FRRf) is a powerful technique for assessing the photosynthetic performance and photo-physiological state of phytoplankton.
- The diel pattern at surface in the South China Sea basin is: a nocturnal decrease, dawn maximum, and midday decrease of the maximum quantum yield of PSII (F_v/F_m or F_v'/F_m'), indicating macro- or micro- nutrients limitation (Behrenfeld & Kolber, 1999)
- *Prochlorococcus* thrives in oligotrophic oceans, *Prochlorococcus* cannot maintain photosynthesis at a stable rate under high-light stress conditions, because it invests substantially less energy in repairing damaged photosystems, it's a trade-offs for the high tolerance of to low nutrient concentrations.
- Through careful analysis of the dynamics of active chlorophyll *a* fluorescence and carbon fixation of phytoplankton, it is possible to determine the photosynthetic efficiency between light absorption and carbon fixation and to relate that efficiency to the light utilization strategy of the phytoplankton.







- In order to examine the energy allocation during photosynthesis. We roughly estimated the "Photosynthetic currencies":

  - Daily integrated ETR (mmol e- m-2 d-1)
    (1) Constant nPSII
    (2) More nPSII of Pro than Euk

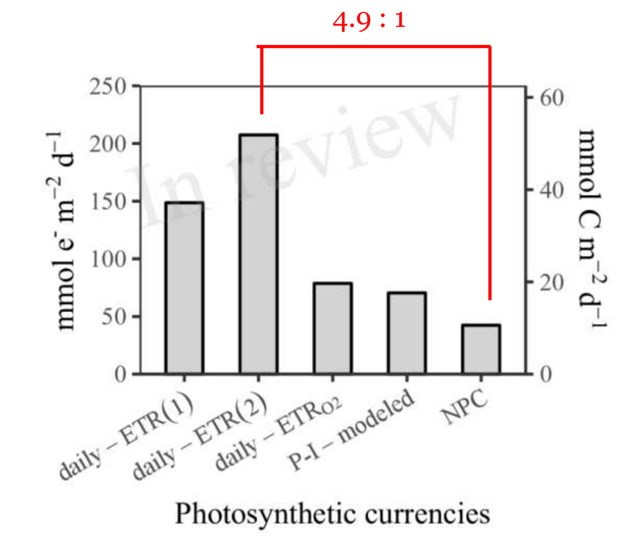
$$daily\text{-}ETR = \sum_{t=6}^{18}\sum_{z=0}^{100} E(z,t) \times \text{corrected-}\sigma'_{PSII}(z,t) \times \text{Chl}a(z,t) \times n_{PSII} \times \frac{F_q'}{F_v'}(z,t) \times \phi_e \times \left(\frac{\frac{F_v'}{F_m'}(z,t)}{0.65}\right) \times 24.3$$

  - Daily integrated ETR for oxygen flash yield (mmol e- m-2 d-1)

$$daily\text{-}ETR_{O2} = \sum_{t=6}^{18}\sum_{z=0}^{100} E(z,t) \times \left(\frac{K_R \times F_0'(z,t)}{E_{LED} \times \sigma'_{PSII}(z,t)}\right) \times \text{corrected-}\sigma'_{PSII}(z,t) \times \frac{F_q'}{F_v'}(z,t) \times 3600$$

  - P-I modeled carbon production (mmol C m-2 d-1)
  - Net carbon production (mmol C m-2 d-1)

✓ A common strategy (Halsey & Jones 2015)



- In order to examine the energetic stoichiometry beginning from total light absorption, we estimated different absorption coefficients:

  - Electron flow $a_{PSII\_eflow}(447) = \text{corrected-}\sigma'_{PSII} \times \text{Chl}a \times n_{PSII} \times (\frac{F_v'}{F_m'}/0.65) \times 0.00674$

  - Oxygen flash yield $a_{PSII\_O2}(447) = \frac{K_R \times F_0'(z,t)}{E_{LED}}$

✓ Substantially low maximum quantum yield of carbon fixation in the basin (Babin *et al.* 1996; Xie *et al.* 2015)