# Autonomous Investigation of Export Pathways from Hours to Seasons

## SCIENCE GOALS

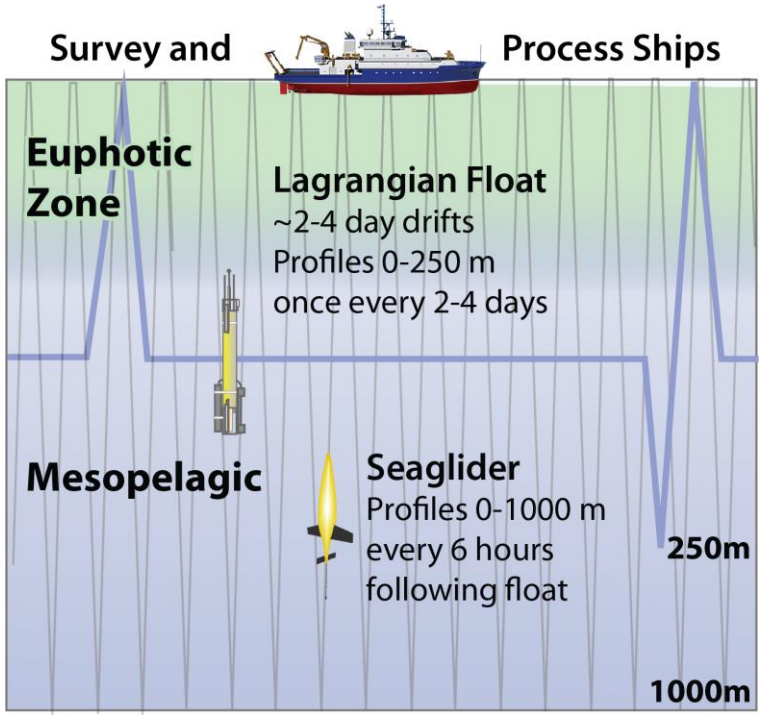
- Identify dominant export pathways from euphotic to twilight zone.
- Quantify carbon fluxes and relate to productivity, ecosystem state and physical forcing.
- Sample broad spatial and temporal span to capture diverse states.

## TECHNICAL GOALS

- Using multi-month, *in situ* autonomous measurements, satellite remote sensing and models:
  - Qualitatively identify export pathways
  - Quantitatively assess export fluxes

## TEAM MEMBERS

Craig Lee (APL-UW) – physics, gliders, overall management
Eric D'Asaro (APL-UW) – physics, Lagrangian float, zooplankton
Mary Jane Perry (self) – biology, optics, proxy development
David Nicholson (WHOI) – biogeochemical budgets
Melissa Omand (URI) – particles, optical sediment trap, SnoCam
Andrew Thompson (CalTech) – physics, submesoscale analyses




EXPORTS
EXport Processes in the Ocean from RemoTe Sensing

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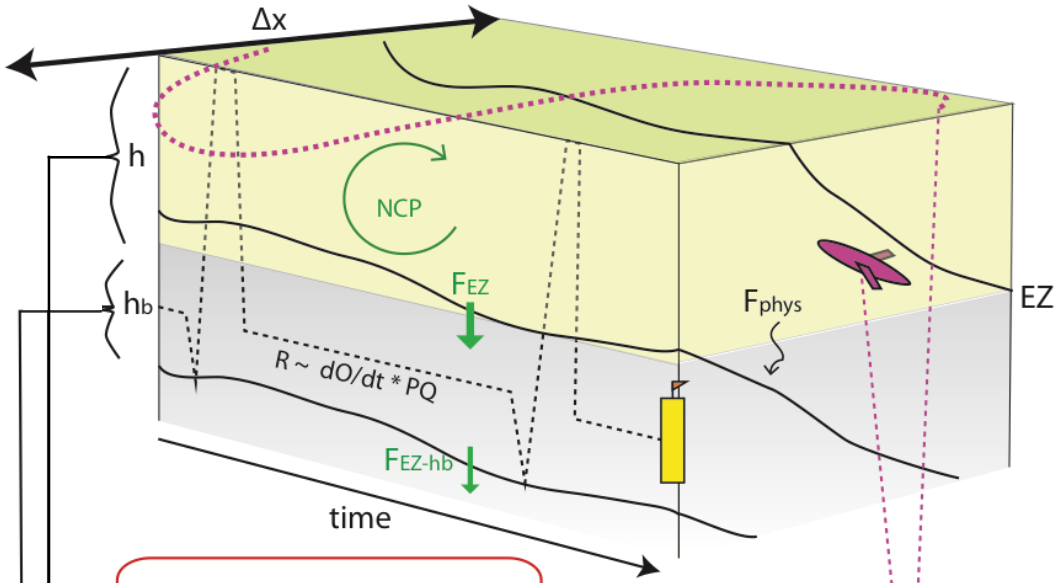
- One Lagrangian Float
  - T, S, $O_2$ ,$NO_3$, Chl, bbp
    Optical sediment trap
- One Seaglider follows float
  - T, S, $O_2$, PAR, Chl, $b_{bp}$
    Acoustic backscatter (zooplankton)
- 4-6 months, spanning EXPORTS cruises.
- Deploy from Canadian Line-P or OOI cruise.
- Provide:
  - Temporal context
  - Targeting for ship-based efforts
  - Lagrangian reference frame
  - Sensor-based proxies
  - Additional states
- Possibility of additional gliders and/or BioArgo floats (EXPORTS, OOI)




What we will measure/model

What we will solve (NCP, R, FEZ)

$$(NCP)^N = h\frac{d(N)}{dt} - F^N_{phys}$$

$$(NCP)^{O2} = h\frac{d(O_2)}{dt} + F^{O2}_{as} - F^{O2}_{phys}$$

$$h_b\frac{d(C_{org})}{dt} = \int_{EZ-h_b}^{EZ}(-R^C)dz + F^C_{EZ} - F^C_{EZ+h_b} + F^C_{phys}$$

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# Proxy Development for Autonomous Sensors

**Ship measurements ➔**

**map to CTD/flow-through/hull sensors ➔**

**map to autonomous sensors**

| 'Parameter' | Ship Measurement | Simple Sensor | Autonomous Sensor |
|---|---|---|---|
| Phytoplankton stock | Chl, HPLC, a(676) | Chl F | Chl F |
| Plankton community composition | FCM, imaging taxa (1º), HPLC (2º) | Chl F/$b_{bp}$ | Chl F/$b_{bp}$ |
| POC | Chemical POC | $C_p$, $b_{bp}$ | $C_p$, $b_{bp}$ |
| Aggregates | LISST, UVP | Optical spikes | Optical spikes |
| Zooplankton stock | Net tows | Hull-based acoustics | ADCP backscatter |