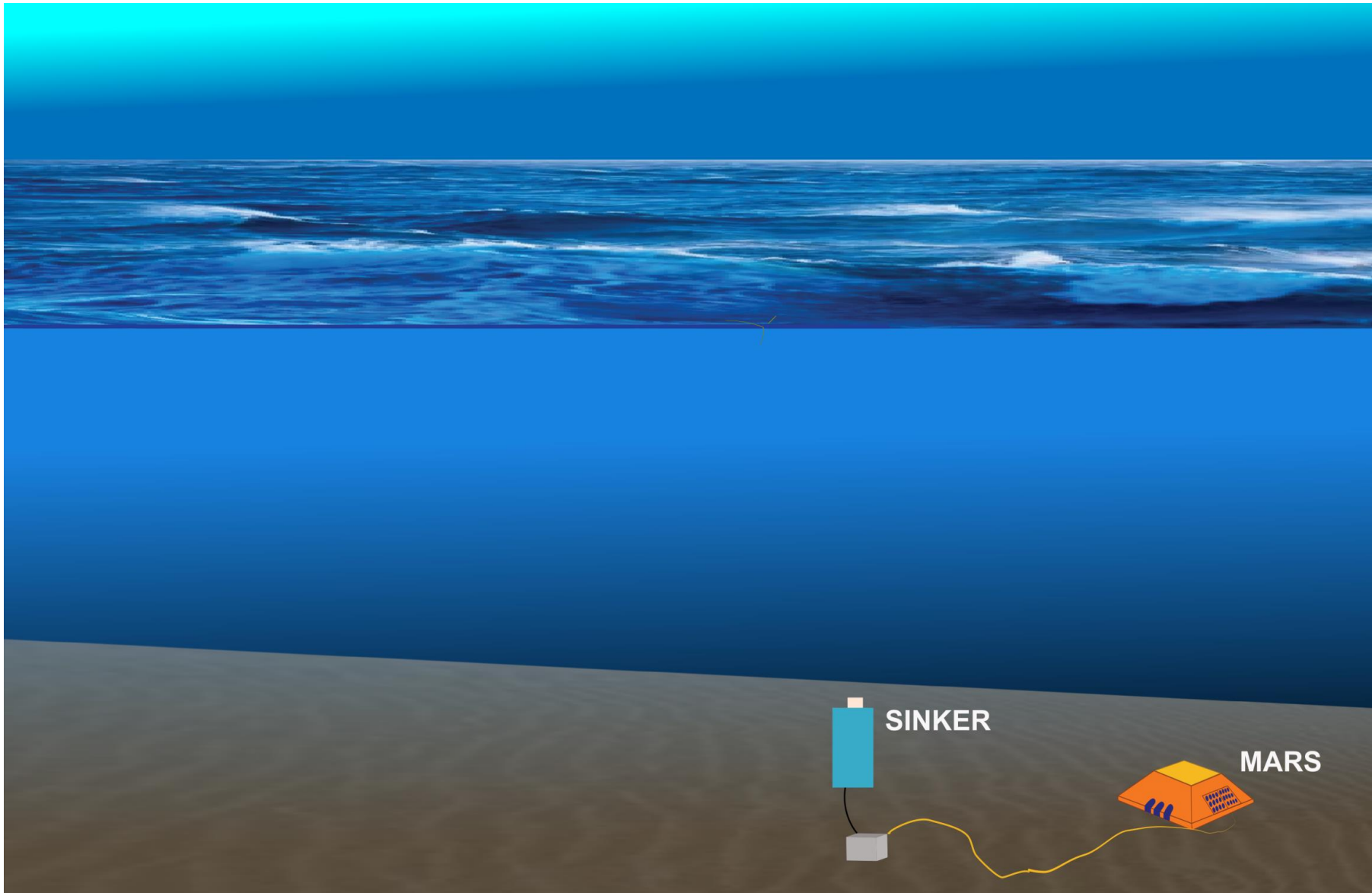
SINKER: a moored instrument for measuring sinking particles

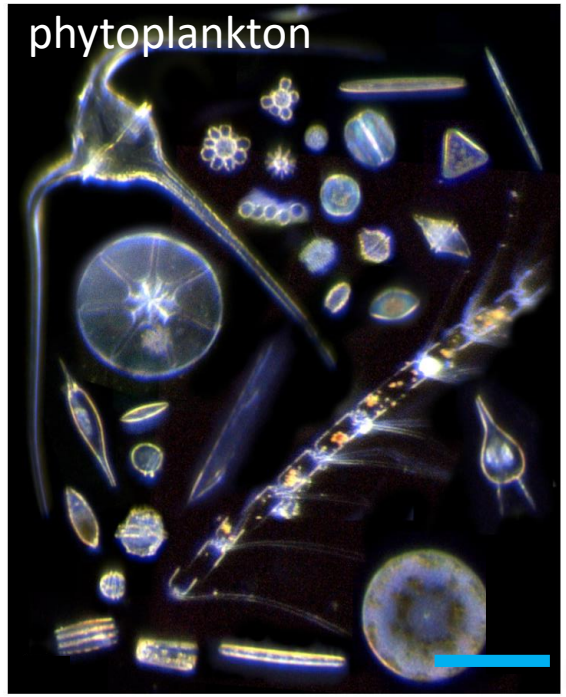
Mission:
Remotely observe the ecological mechanism of carbon export, sustained over hours and across seasons

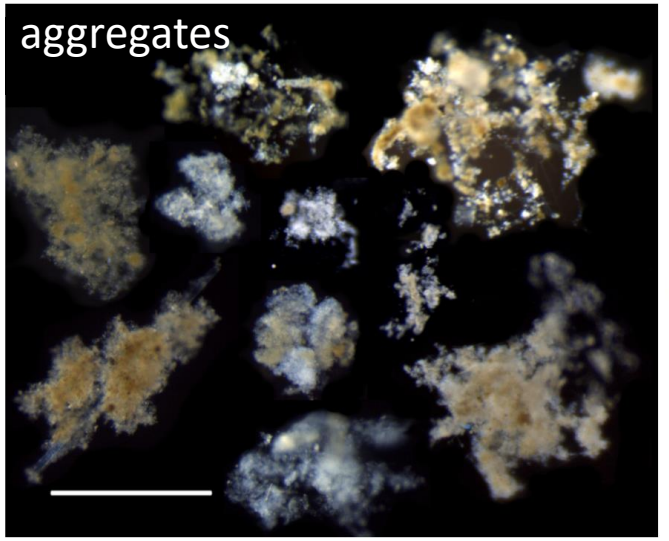
<u>Team:</u>
Colleen Durkin
Paul Roberts
François Cazanave
Alana Sherman
Paul McGill
Francisco Chavez

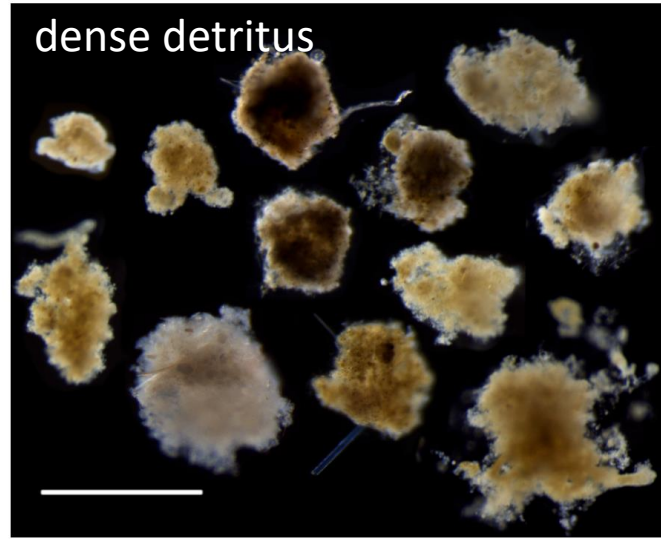


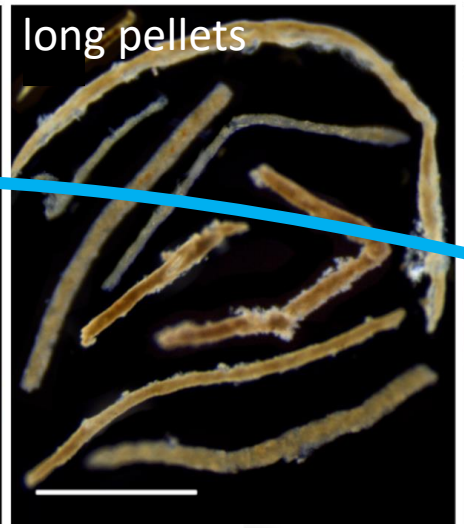
Why do we need to collect ecologically relevant observations of carbon export?

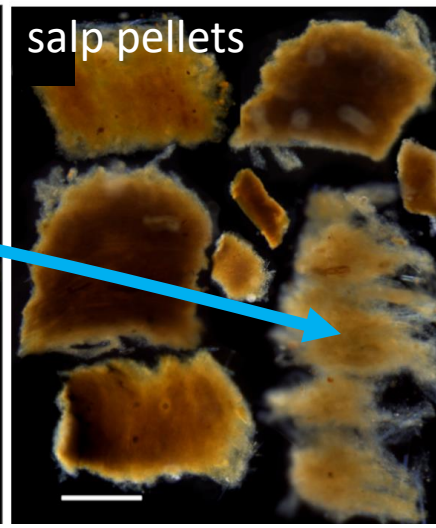
Particle type explains ***why*** carbon was exported and ***how much***.

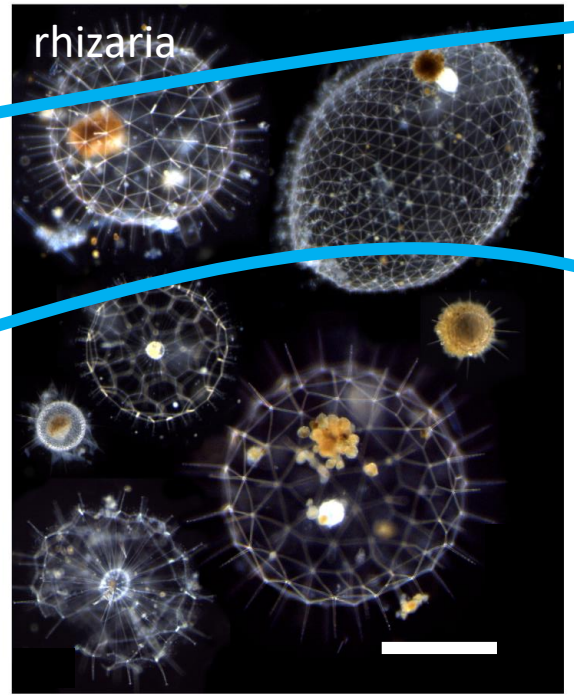






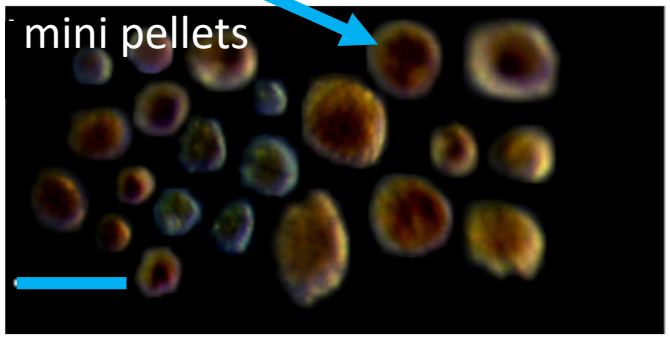


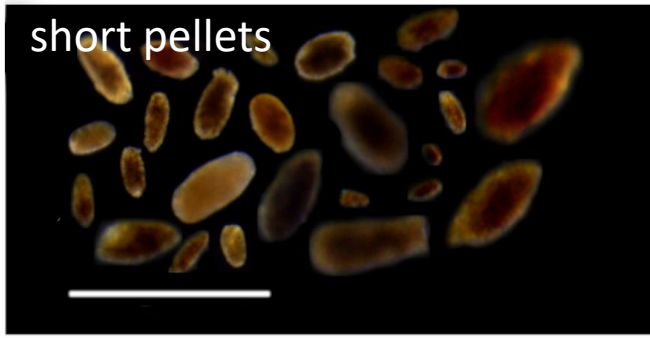




5000 µm

50 µm





Scale bars:
White = 1 mm
Blue = 100 µm

Current Challenges

- Persistence : currently one-off snapshots
- Automation : imaging and analysis require extensive human resources
- Scalability: currently too resource intensive (personell time, ships, $$$)

Available in situ particle imaging tools are not designed to address these challenges

(e.g. UVP, ISIIS, EyeRIS, Planktivore, VPR, IFCB)

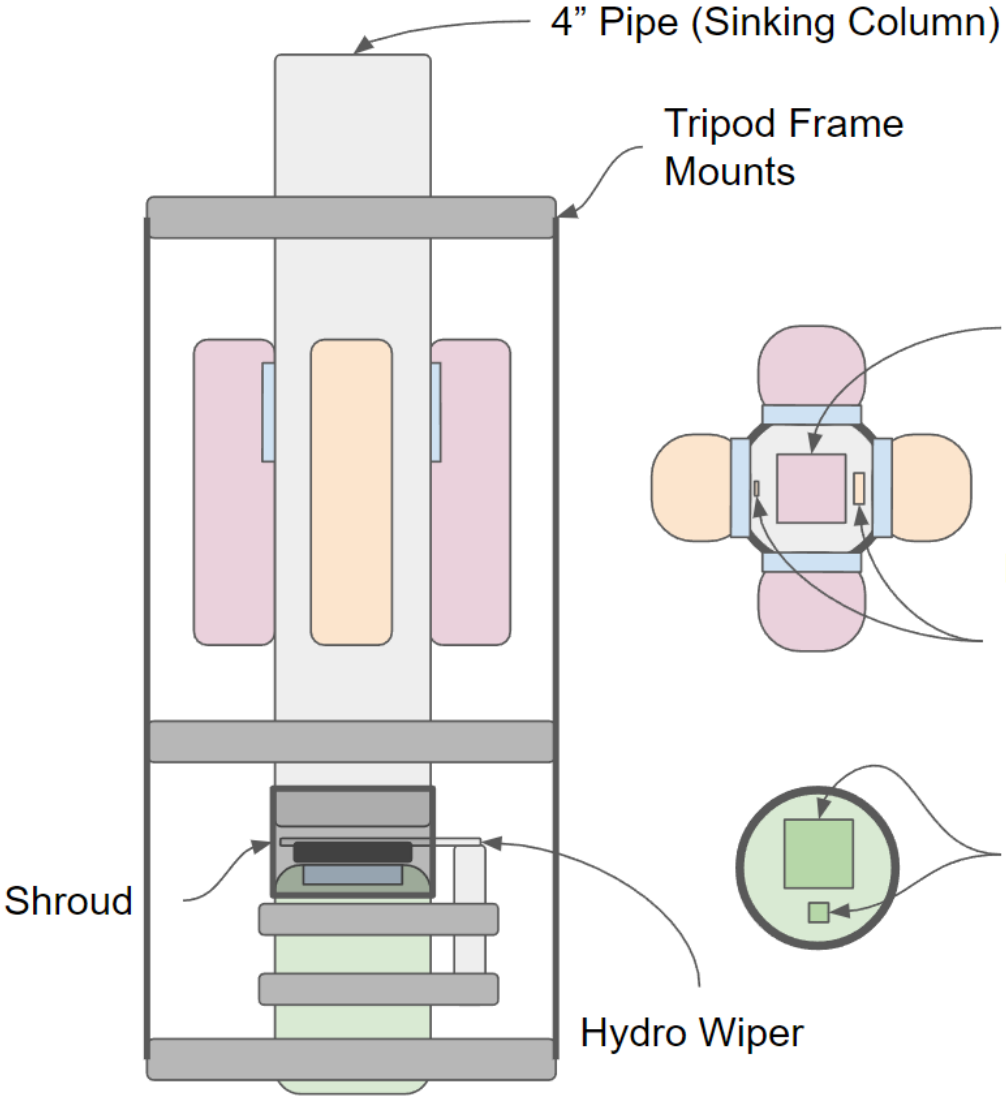
- Don’t measuring ***sinking*** particles (i.e. fluxes)
- Don’t measure sinking speeds
- Don’t span the relevant size range
- Don’t have a persistent presence

We want to build an instrument that will:

- Identify sinking particles across a large size range
- Measure their sinking speeds
- Measure their fluxes
- Sustain observations over ecologically relevant time periods
- Make measurements scalable through automated approaches

Proposed Concept

SINKER: the SINKing Ecology Robot



ISIIS DPI (1x 5MP PoE, Mono, red light)

- 0.143x (24 um pixel, 5 cm x 5cm x 5 cm)

Planktivore (2x 5MP PoE, color white light)

- Low: 0.5x (7 um pixel, 1.6 cm x 1.6 cm x 0.3 cm)
- High: 4.0x (0.7 um pixel, 0.2 cm x 0.2 cm x 0.01 cm)

Sediment Cameras (2x 24 MP PoE, color white light)

- Low: 0.25x (11 um pixel, 6 cm x 5 cm x 0.6 cm)
- High: 1.0x (2.7 um pixel, 1.5 cm x 1.13 x 0.02 cm)

Measuring flux and sinking speed of particles spanning 3 orders of magnitude requires multiple cameras

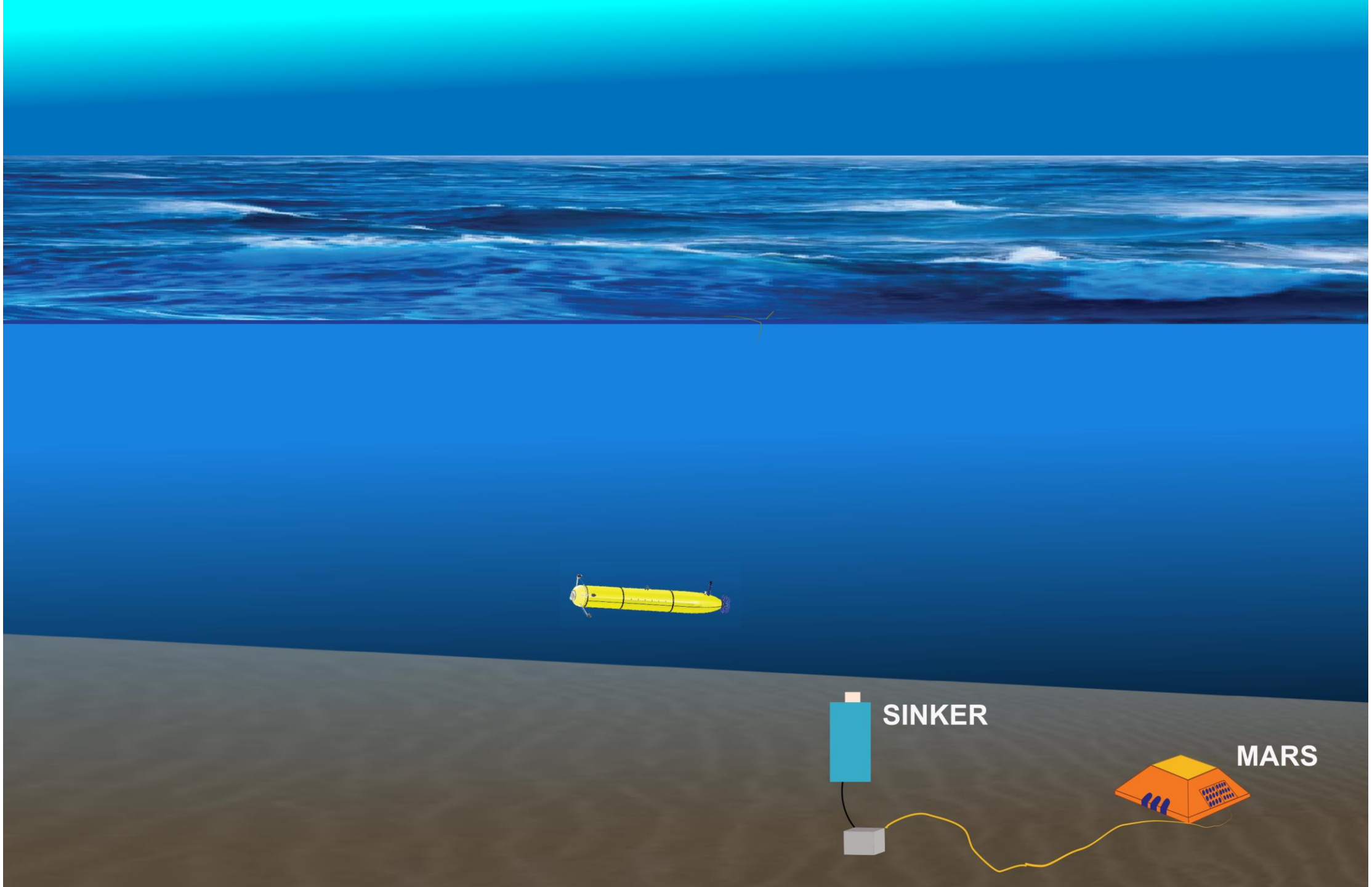
	Sinking Speeds (m d^{-1})			**Fluxes (# m^{-2} d^{-1})**	
Size range:	30–300 µm	200–1000 µm	800–5000 µm	30–500 µm	300–5000 µm
ISIIS DPI					
Planktivore low mag					
Planktivore high mag					
Sediment camera low mag					
Sediment camera high mag					

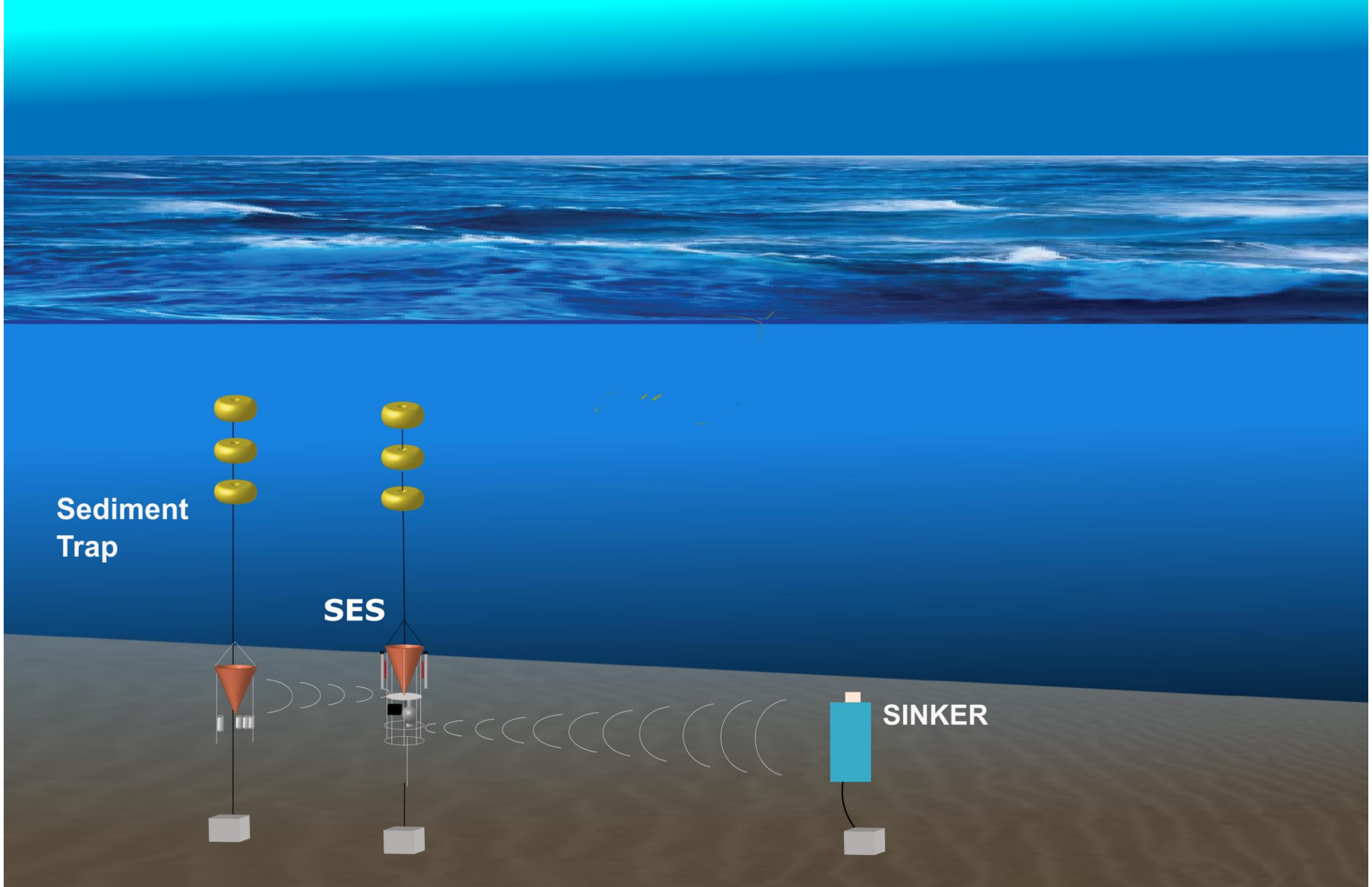
Year 1 Timeline and Resources

SINKER: the SINKing Ecology Robot

- EyeRIS
- Planktivore
- BioInspir Lab Multicam
- Timelapse Cameras

Year 1		Year 2	Year 3	
Development		Refinement / MARS integration	Science Operations	
Colleen Durkin	Requirements		Tank Data Analysis	Field deployments and data analysis
Paul Roberts (300 hrs)	System design, camera interfaces, software	System integration	Image processing and visualization	
François Cazanave (300 hrs)	Pressure housings, internal mech, support frame	Test tank support		Rigging and deployment support
Alana Sherman (150 hrs)	Battery power and low-power control			
Paul McGill (150 hrs)	MARS compatibility / interface			
M-Tech / E-Tech		System Integration		
Machine Shop		Housing Fabrication		

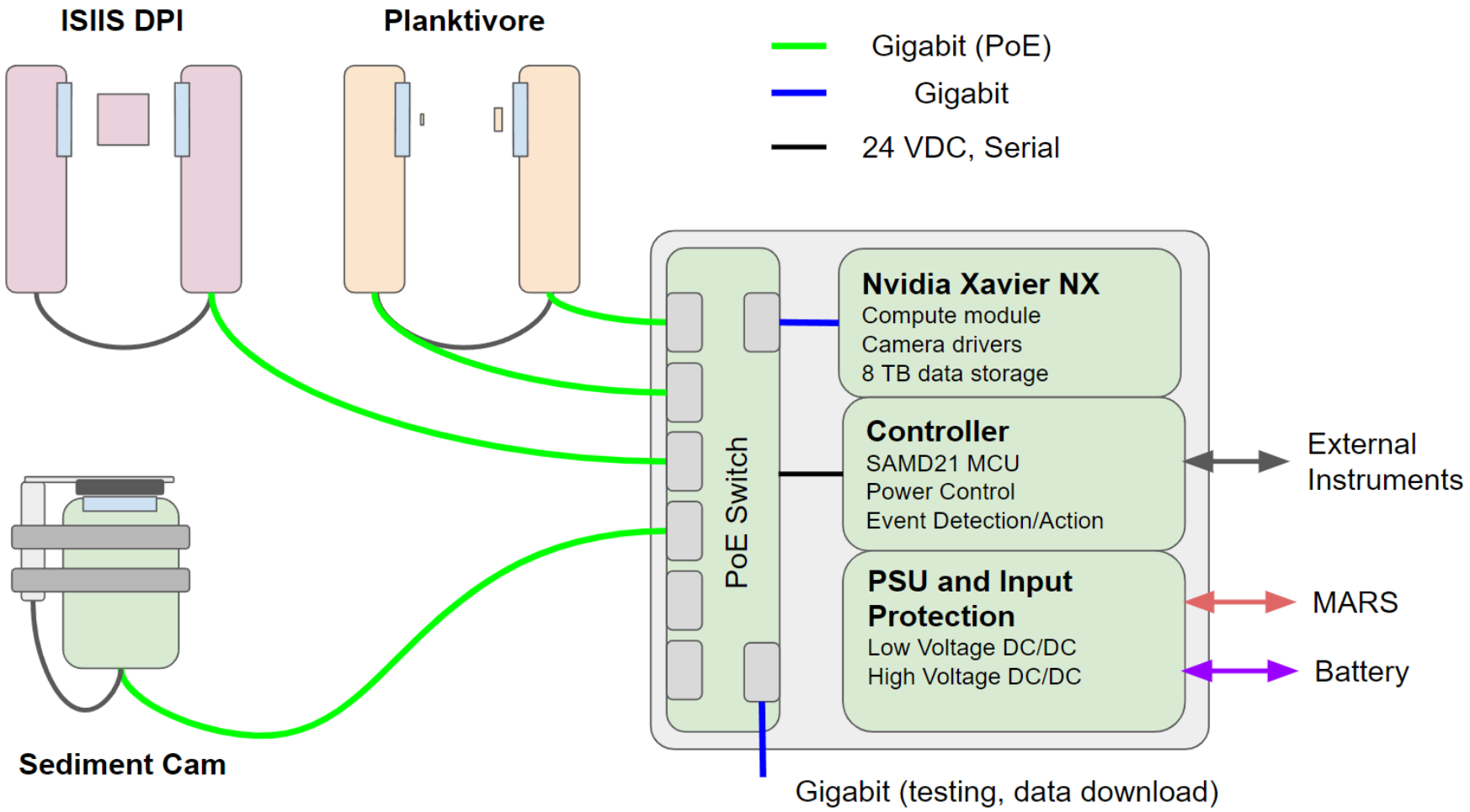

SINKER
MARS


Sediment
Trap
SES
SINKER


SINKER

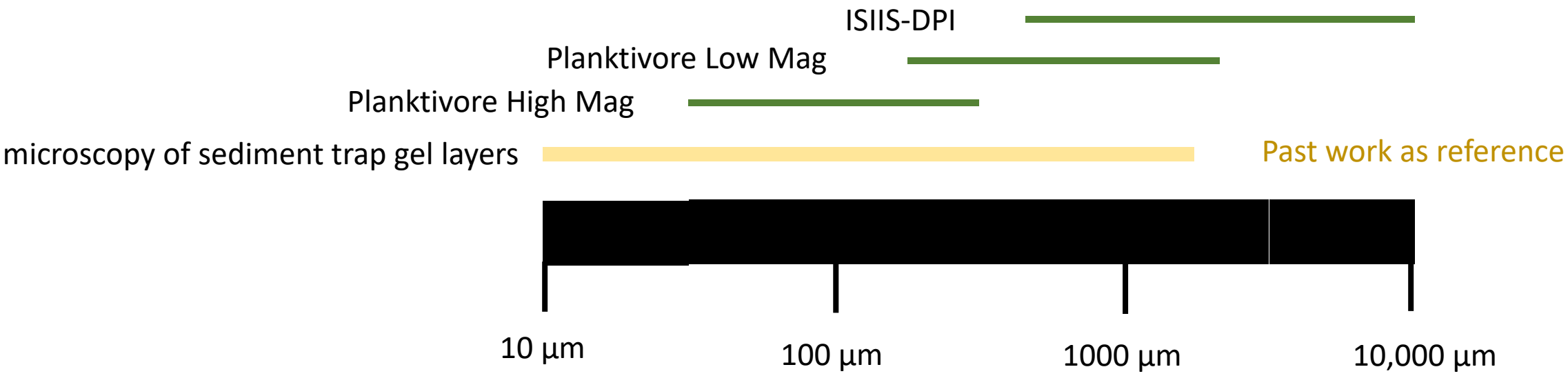
Proposed Concept

SINKER: the SINKing Ecology Robot

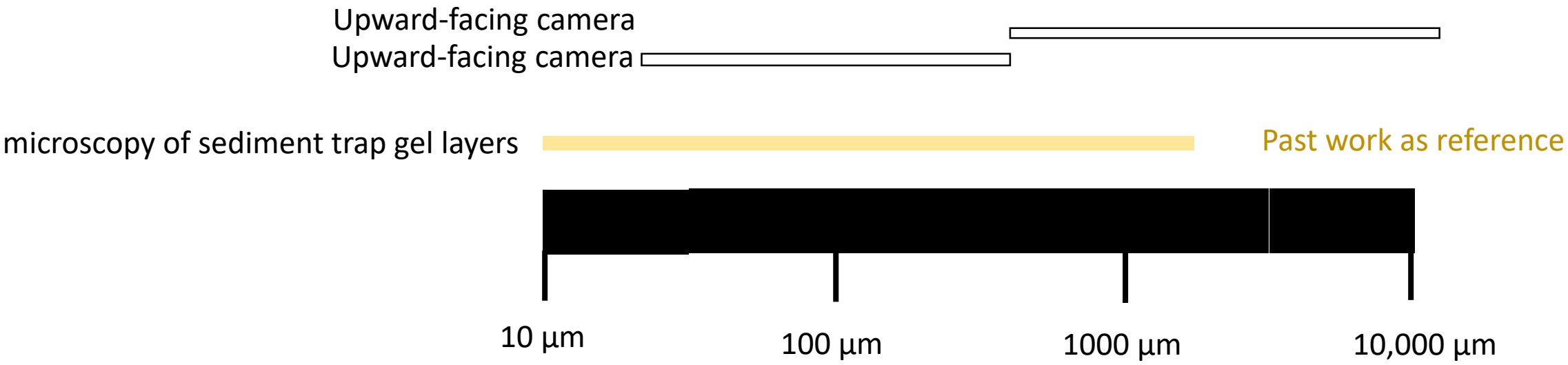


SINKER imaging system will identify a wide size range

Cameras for sinking speed



SINKER imaging system will identify a wide size range



SINKER imaging system will resolve flux and sinking speed of a large size range