

# Deep ocean community food supply and demand impacted by changing climate over 24 years in the abyssal northeast Pacific Ocean

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## SUMMARY

- This study was conducted as part of an ongoing 24-y time series at Station M (Fig. 1, ~4000m) where measurements of deep-sea processes, combined with atmospheric and surface ocean conditions, have been monitored since 1989.
- Particulate organic carbon (POC) supply and carbon demand [sediment community oxygen consumption (SCOC)] were measured year-round by autonomous instruments (Fig. 2).
- From 1989- 2007 carbon demand consistently exceeded local carbon supply.
- Large episodic surpluses of organic carbon reached the seafloor in 2011 and 2012, which might fuel future deficit for months to years (Fig. 3).
- Net primary production in surface waters was significantly higher from 2003-2012 than 1997-2002.

## METHODS

- Sediment traps were moored at 3400 m and 3950 m (50 and 600 m above bottom).
- POC flux was measured from sediment trap samples, with 10 d resolution.
- A camera tripod on the seafloor documented detrital aggregates in hourly photos.
- Observation-based models were used to transform the digitized percent cover of detrital aggregates in photos to estimates of aggregate organic carbon (AOC) flux (Smith et al., 1998; 2013). Separate models used for phytodetritus and salp detritus.
- **Carbon supply** is combined organic carbon (COC) flux (COC flux = the higher of POC flux or AOC flux for any time period).
- **Carbon demand** of sediment communities was measured as SCOC by the FVGR seasonally until 2011, and then by the Benthic Rover, which transits the sea floor taking measurements with daily resolution.

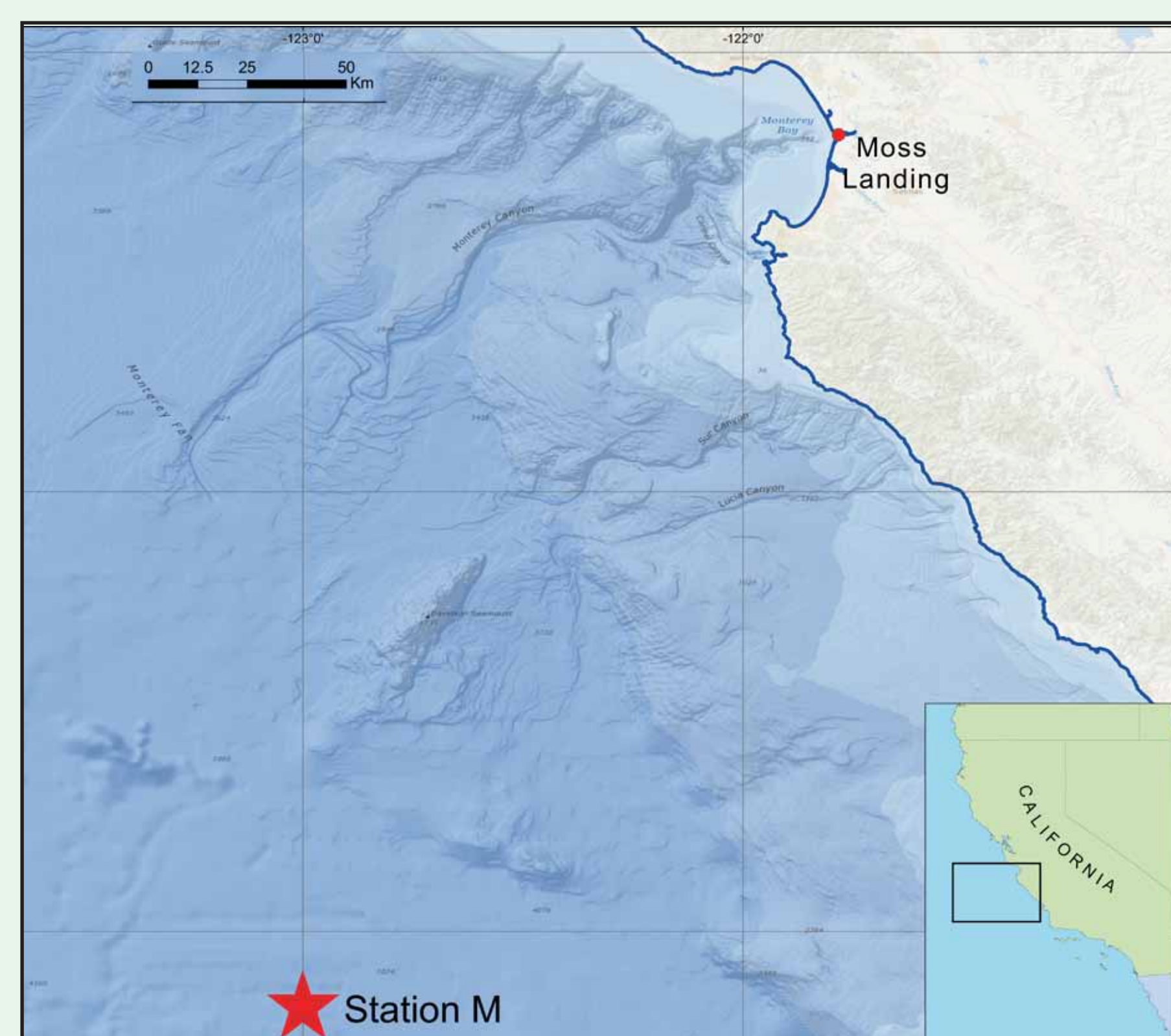


Fig.1. Map of Station M offshore of California; 34° 50'N, 123° 00'W

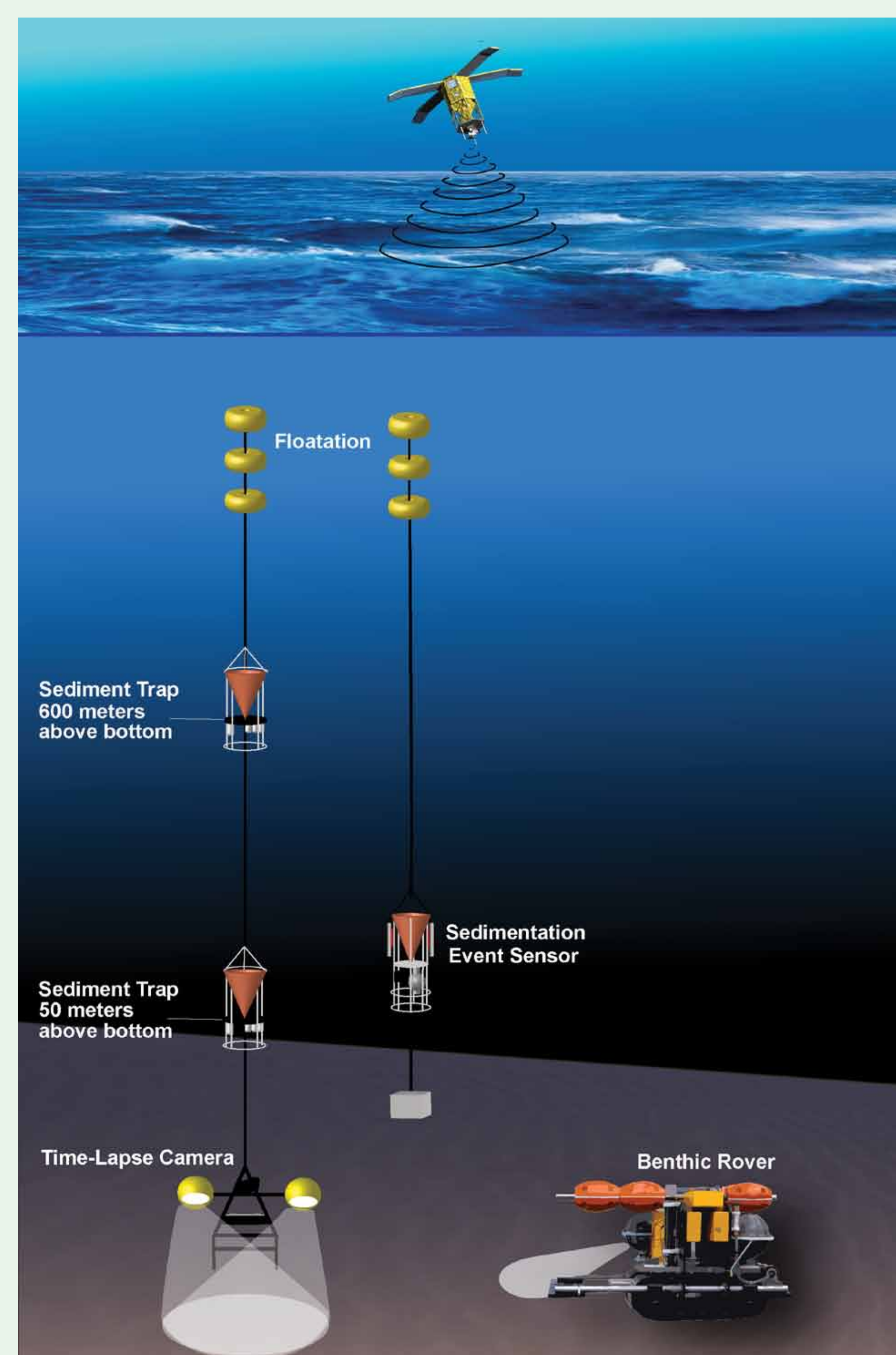


Fig. 2. Instrumentation at Sta. M

## REFERENCES

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## RESULTS

- Following a 22 y food deficit at abyssal depths we documented massive episodic influxes of organic carbon reaching the sea floor in 2011-2012 (Fig 3 A-D).
- Net primary production in surface waters was significantly higher from 2003-2012 than from 1997-2002.
- Sediment community oxygen consumption during these periods with high carbon influx was the highest documented over the 24 y time series (Fig. 3 A).
- Detrital aggregates photodocumented on the sea floor were estimated to represent a significant portion of carbon reaching the sea floor (Fig. 3 C, D).
- Detrital aggregates clogged the sediment traps, leading to low or no traditional measures of particulate organic carbon (POC) flux during high AOC flux periods.
- In 2011 and 2012, carbon supply exceeded demand at magnitudes not previously documented at Station M (Fig 3 E, F).

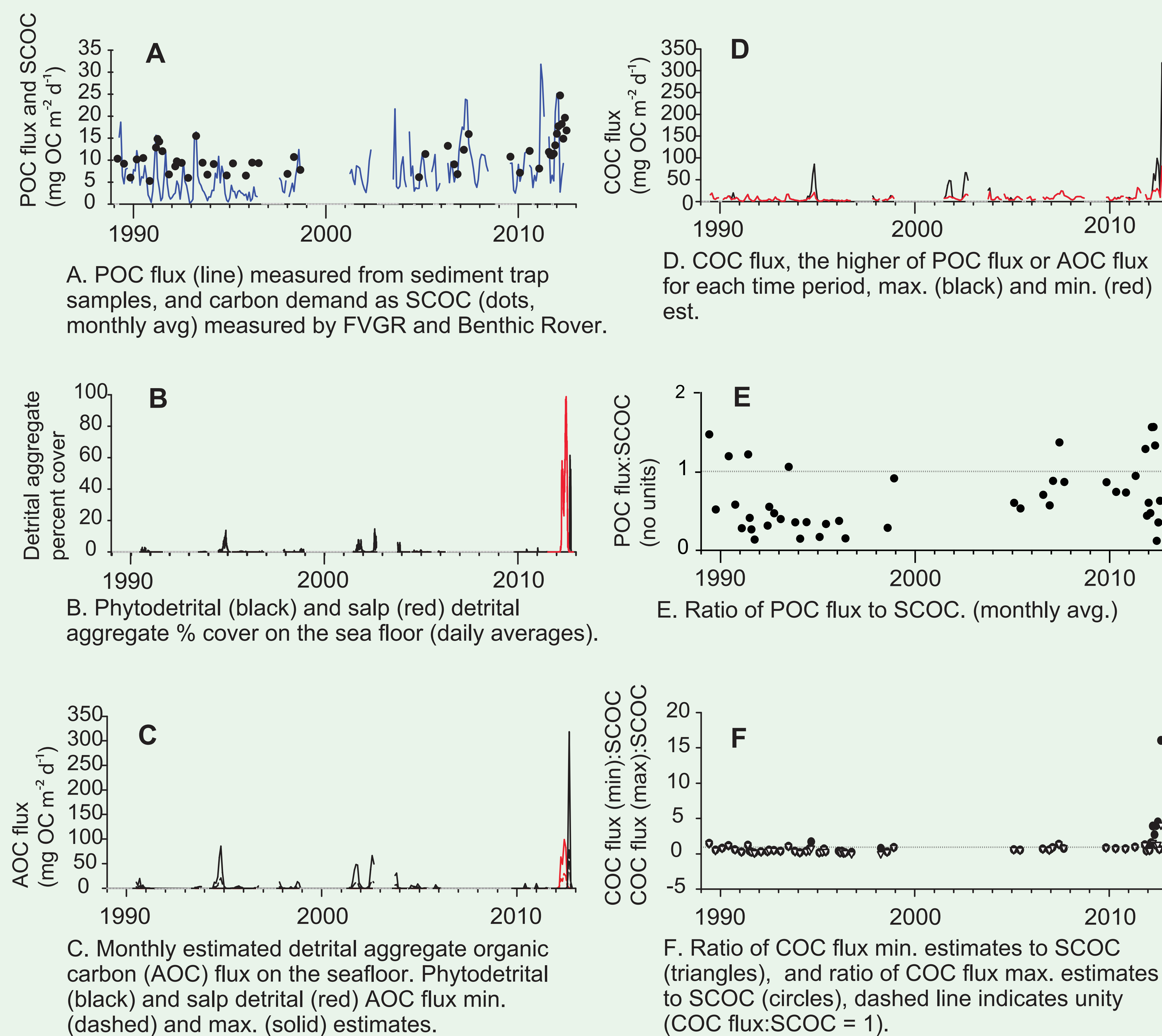


Fig. 3. Organic carbon supply and demand measures and estimates at Station M 1989-2013

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