

Supplemental Information for

An autonomous, *in situ* light-dark bottle device for determining community respiration and net community production

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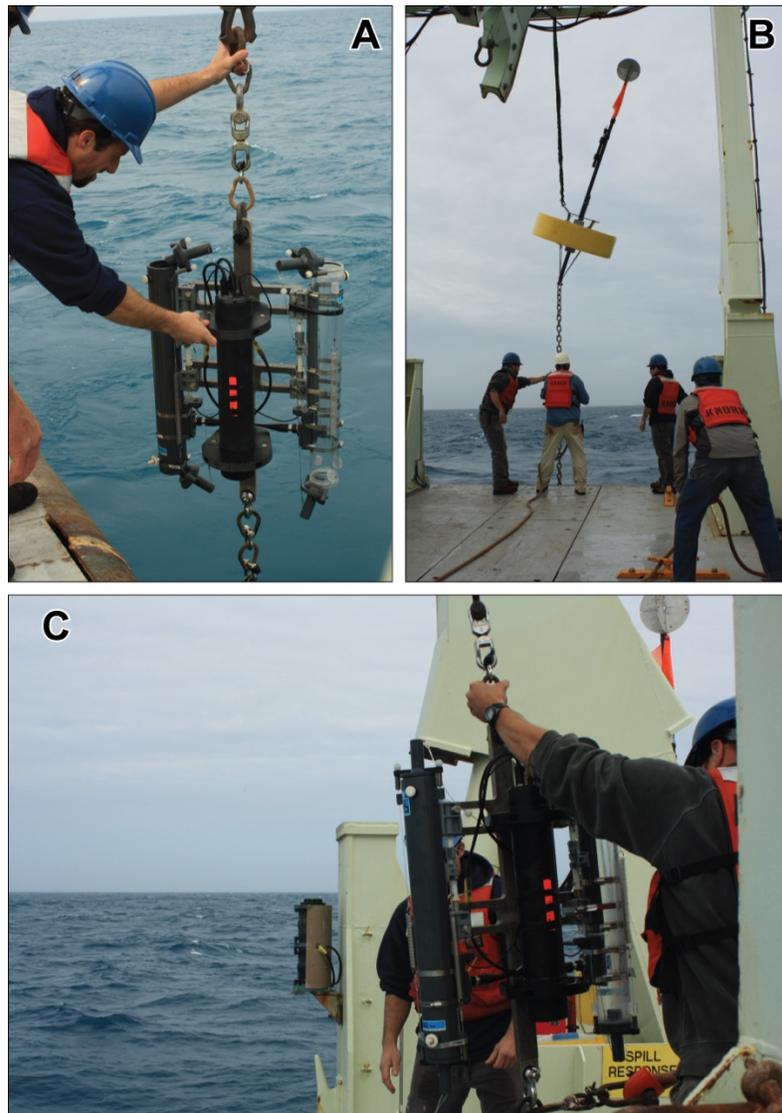
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Supplemental Fig. 1. Deployment and recovery of the PHORCYS prototype from a drifting surface mooring during June 2012. Prior to each deployment, a text interface was used to set mission parameters via a serial cable and personal computer. Using the plain-language interface, one can calibrate the optodes, specify the “burn time” at which the chambers should close, and adjust the sampling interval. **(a)** Both PHORCYS chambers are cocked open using a burn wire assembly immediately prior to initial deployment. **(b)** The surface mooring is recovered. **(c)** The PHORCYS is recovered with both chambers sealed.

Supplemental Table 1. Mixed-layer metabolic rates from deployments of the Photosynthesis and Respiration Comparison-Yielding System (PHORCYS) in three ecosystem types.

| Cruise/ station number and dates | Location ^a | Ecosystem type | Model | Deploy- ment depth (m) | PAR at deploy- ment depth (% of surface) | Equival- ent deploy- ment depth (<i>Z_{equiv}</i>) (m) ^b | Eu- photic zone depth ^c (<i>Z_{eu}</i>) (m) | <i>In situ</i> temp. (°C) | Incubation segment | Incu- dura- tion (h) | Rate estimates from PHORCYS data ($\mu\text{mol O}_2$ $\text{L}^{-1} \text{d}^{-1} \pm \text{SE}$) | | | Notes |
|--|------------------------------------|---|----------------|---------------------------------|---|---|---|---------------------------------|---------------------------|-------------------------------|--|-------------------|------------------|--|
| | | | | | | | | | | | GR ^d | NCP ^e | GPP ^f | |
| KN207-1, QL-1 | Western North Atlantic Ocean | Continental shelf | Pro- totype | 29 | 2.8% | 30.8 | 37.7 | 11.0- 12.5 | Duration of deployment | 71.6 | 1.8 \pm 0.2 | — | — | Deployment too deep to capture any photo- synthetic signal in transparent bottle |
| 24-27 Apr 2012 | 38° 52' 47.4" N 69° 6' 19.2" W | | | | | | | | | | | | | |
| KN207-1, QL-2 | Northern Sargasso Sea | Oligotro- phic open- ocean | Pro- totype | 13.5 | — | — | — | 20.4- 20.5 | Duration of deployment | 65.4 | 4.2 \pm 0.3 | — | — | System malfunction prevented closure of transparent bottle; shipboard PAR sensor was inoperative |
| 30 Apr - 3 May 2012 | 32° 57' 2.4" N 65° 44' 58.8" W | | | | | | | | | | | | | |
| KN207-3, PS-1 | North Atlantic Ocean | Mid-latitude open-ocean | Pro- totype | 20 | 19% | 23.1 | 57.5 | 15.0- 15.6 | Duration of deployment | 41.2 | 2.4 \pm 0.3 | -2.0 \pm 0.4 | 0.5 \pm 0.5 | System malfunction prevented closure of transparent bottle; shipboard PAR sensor was inoperative |
| 17-19 June 2012 | 43° 1' 58.6" N 27° 15' 31.8" W | | | | | | | | | | | | | |
| KN207-3, PS-2 | North Atlantic Ocean | Open-ocean sub-Arctic during summer bloom | Pro- totype | 7 | 27% | 8.4 | 25.8 | 12.4- 13.0 | Duration of deployment | 77.4 | 7.8 \pm 0.4 | -4.2 \pm 0.2 | 3.6 \pm 0.5 | Strike by marine mammal caused significant damage to instrument on final day of deployment |
| 23-27 June 2012 | 53° 29' 43.0" N 30° 45' 2.6" W | | | | | | | | | | | | | |
| KN207-3, PS-4 | North Atlantic Ocean | Open-ocean sub-Arctic during summer bloom | Pro- totype | 20 | 13% | 22.6 | 40.6 | 5.4-5.8 | Duration of deployment | 94.0 | 6.0 \pm 0.5 | — | — | System malfunction prevented closure of transparent bottle |
| 7-11 July 2012 | 61° 41' 40.4" N 33° 46' 21.7" W | | | | | | | | | | | | | |

Supplemental Table 1. Continued

| Cruise/ station number and dates | Location ^a | Ecosystem type | Model | Deploy- ment depth (m) | PAR at deploy- ment depth (% of surface) | Equival- ent deploy- ment depth (<i>Z_{equiv}</i>) (m) ^b | Eu- photic zone depth ^c (<i>Z_{eu}</i>) (m) | <i>In situ</i> temp. (°C) | Incubation segment | Incu- dura- tion (h) | Rate estimates from PHORCYS data ($\mu\text{mol O}_2$ $\text{L}^{-1} \text{d}^{-1} \pm \text{SE}$) | | | Notes |
|---|-----------------------|--------------------------------------|------------------|---------------------------------|---|---|---|-------------------------------------|-----------------------|-------------------------------|--|------------------|------------------|---|
| | | | | | | | | | | | GR ^d | NCP ^e | GPP ^f | |
| Pierside deploy- ment at Iselin Pier 7-10 Nov 2016 | Woods Hole, MA | Temperate estuary (near-shore) | Present model | 1.5 | ~ 20% | 2.9 | 7.5 | 11.9- | 7 Nov 17:15 – | 12.7 | 18.9 ± 1.9 | — | — | System malfunction prevented closure of transparent bottle |
| | | | | | | | | 12.3- | 8 Nov 06:00 | 10.5 | 2.2 ± 1.6 | — | — | |
| | 12.1- | | | | | | | 8 Nov 06:15 - | | | | | | |
| | 12.4 | | | | | | | 8 Nov 16:45 | | | | | | |
| | 12.2- | | | | | | | 8 Nov 17:20 - | 12.7 | 8.0 ± 1.9 | — | — | | |
| | 12.4 | | | | | | | 9 Nov 06:00 | | | | | | |
| 12.2- | 9 Nov 17:30 - | 12.5 | 10.5 ± | — | — | | | | | | | | | |
| | | | 7.5 | | | | | | | | | | | |

^a See Fig. 2

^b Calculated according to Eq. 1 in the text

^c Provided for open-ocean stations only (from shipboard hydrocasts); defined as the depth at which PAR = 1 % of surface intensity

^d GR: gross community respiration, from opaque (dark) bottle; respiration rates are reported as positive values by convention

^e NCP: net community production, from transparent (clear) bottle

^f GPP: gross primary production, calculated as sum of GR and NCP based on Eq. 4 in the text