

Supplemental Information for

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

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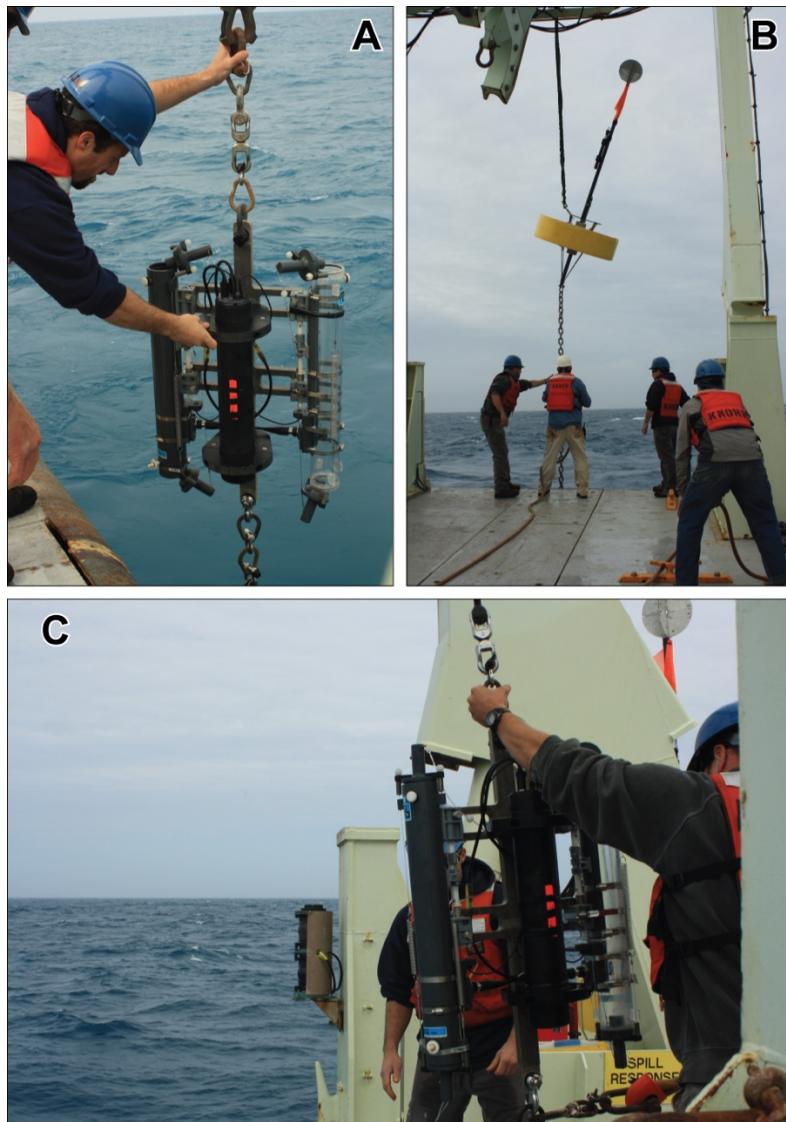
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Supplemental Fig. 1. Deployment and recovery of the PHORCYS prototype from a drifting surface mooring during June 2012. Prior to each deployment, a text interface was used to set mission parameters via a serial cable and personal computer. Using the 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 (z_{equiv}) (m) ^b	Eu- photic zone depth ^c (z_{eu}) (m)	In situ 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	Proto- type	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	Proto- type	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	Proto- type	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	Proto- type	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	Proto- type	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 (z_{equiv}) (m) ^b	Eu- photic zone depth ^c (z_{eu}) (m)	In situ 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 41° 32' 9.6" N 70° 39' 7.2" W	Temperate estuary (near-shore)	Present model	1.5	~ 20%	2.9	7.5	11.9- 12.3 12.1- 12.4 12.2- 12.4 12.2- 12.5	7 Nov 17:15 – 8 Nov 06:00 8 Nov 06:15 - 8 Nov 16:45 8 Nov 17:20 - 9 Nov 06:00 9 Nov 17:30 - 10 Nov 06:00	12.7	18.9 ± 1.9 2.2 ± 1.6 8.0 ± 1.9 10.5 ± 7.5	— — — — —	— — — — —	System malfunction prevented closure of transparent bottle

^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