Primary Production, 12 and 24 hour experiments from R/V Thomas G. Thompson TT043, TT045, TT049, TT050, TT053, TT054 cruises in the Arabian Sea in 1995 (U.S. JGOFS Arabian Sea project)

Website: https://www.bco-dmo.org/dataset/2520
Version: July 29, 1996
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Project
» U.S. JGOFS Arabian Sea (Arabian Sea)

Program
» U.S. Joint Global Ocean Flux Study (U.S. JGOFS)

Contributors	Affiliation	Role
Barber, Richard	Duke University	Principal Investigator
Marra, John F.	Lamont-Doherty Earth Observatory (LDEO)	Co-Principal Investigator
Chandler, Cynthia L.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Dataset Description

Primary Production, 12 and 24 hour experiments

Methods & Sampling

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Data Processing Description

In Situ Primary Productivity Protocol

A Description of Actual Procedures Used on the 1992 EqPac Survey and Time Series Cruises

Richard T. Barber

The conceptual basis for the anti-contamination procedures are, of course, the classic paper by Fitzwater,

Knauer and Martin (1982), but other important comments on inhibition of phytoplankton are given in Chavez and Barber (1987), Price *et al.* (1986), Williams and Robertson (1989) and Marra and Heinemann (1987).

I. ^{14}C Solution

A. Anhydrous crystalline sodium carbonate is added to stock carbonate solution of 0.3 g carbonate in 1.0 liter of Nanopure water. The lot number of the NEN (New England Nuclear) $Na_2{}^{14}CO_3$ was 2653-074; the specific activity was 55.0 mCi/mmol. The designation number is NEC-088H.

B. The solution is made up and stored in Teflon containers that are cleaned as described below.

C. The ^{14}C solution is refrigerated, but allowed to come to room temperature before addition to the seawater.

D. The intended activity of the ^{14}C solution is 100 ï¿½Ci/ml; however, in our procedure the activity added is measured for each profile, so variations in the initial activity are not a problem.

II. Cleaning

A. New bottles and labware are cleaned as follows: soak in a 2 % Micro solution for three days. Rinse three times with DI water, then soak overnight in DI water. Rinse again, then soak for two days in 0.5*N* HCl (Fisher trace metal grade). Rinse three times with Nanopure water.

B. After each use, the incubation bottles are soaked in a 10 % acid wash for 12 to 24 hours and then rinsed well (3 times) with Nanopure water.

C. Teflon stock bottles are cleaned by performing Micro and DI soaks as above. Then sequential three-day soakings are performed, filling first with 6 *N* HCl for three days, then with 2 *N* HNO_3 for three days, and then with the cleanest available 0.5 *N* HNO_3 for three days. Each filling should be followed with Nanopure rinses. Oven dry on a plastic tray at 65^{o} C.

D. Polyethylene or vinyl disposable gloves without talc are worn during Rosette handling and all other procedures.

III. Sampling

A. Eight light depths are sampled down to the 0.1 % I_0 light depth with custom made Go-Flo bottles on a ``trace metal clean'' General Oceanics rosette. The rosette was made by General Oceanics according to Moss Landing Marine Laboratory's specification; it is called the EqPac ``clean rosette.'' The rosette was lowered on a Kevlar conducting hydroline with non-metal sheaves and a dedicated winch.

B. Samples were taken before dawn, usually at 3:00 to 4:00 am.

C. The 280 ml polycarbonate bottles are rinsed three times with sample water and filled. The water ``fell'' from the Go-Flo spout into the bottle without the use of a ``filling tube''. (McCarthy *et al* and Landry *et al.* always use a ``filling tube'' to reduce shear and turbulence that hurts microflagellates and ciliates. To avoid potential contamination, we do not use a ``filling tube.'')

D. Inoculation of 100 ï¿½l of ^{14}C solution is done in the radioactivity van with an Eppendorf disposable tip dispenser.

E. In addition to two bottles from each light depth a third bottle is taken from surface (``100 % I_0 '') and the 8 % I_0 depth for the determination of time zero particulate ^{14}C counts. The 100 % and 8 % samples are inoculated and immediately filtered and treated identically to the incubated filters.

IV. Incubation

A. The two replicate bottles from each depth are placed in a nylon mesh bag and closed with polyethylene cable ties.

B. Each bag is attached to the polypropylene array line by ``tuna'' snaps that clip into rings that are spliced in the line at one-meter intervals.

C. The array line has a 50-lb lead weight at the bottom and two floats at the top.

D. A 20 m tag line connects the array line to the array spar buoy which has an aluminum radar reflector, 3M light reflector sheets, a reflective International Orange flag, a Novatech VHF transmitter and a Novatech xenon flasher. Batteries on the VHF and flasher are changed at each deployment.

E. The array is picked up after about 24 hours or about 4 am. The nylon bags are taken off and placed in a box as the array is recovered. The recovery takes about 20 to 30 minutes after the spar buoy is caught with grapnel hooks.

V. Filtration

A. Following retrieval of the nylon bags from the array line the bags and bottles are taken to the radioactivity van. One ml is taken from the 100 % and 8 % I_0 depth bottles and added to scintillation vials containing 1 ml of beta phenethylamine then 10 ml of Ecolume is added. The purpose of this procedure is to determine an added ^{14}C activity.

B. The samples are then filtered through Whatman GFF filters.

C. The filters are placed in scintillation vials and 0.5 ml of 0.5 *N* HCl added. The acidified filters are left for 24 hours in the hood.

D. 10 ml of Ecolume is then added and the vials capped and left for 24 hours.

VI. Counting and Calculations

A. The time zero, total activity and incubated samples are counted on the liquid scintillation counter with a wide window.

B. Carbon uptake for each light level is calculated as follows:

Carbon = ([DPM_{24} - DPM_0] • 1.05 • 24000)/DPM_{tot} • time)
DPM_{24} = CPM_{24}/efficiency of filters
DPM_0 = CPM_0/efficiency of filters
DPM_{tot} = (CPM_{tot}/efficiency tot) • bottle volume
1.05 = factor for preferential uptake of ^{12}C over ^{14}C
24000 = weight in mg/m^3 of the inorganic carbon in seawater

C. Carbon uptake for the water column down to the 1.0 % and 0.1 % light level is calculated using a trapezoidal integration. We note that each P.I. in JGOFS uses a different integration scheme. This is an area where some discussion might be useful.

Literature Cited

Chavez, F.P. and R.T. Barber (1987).

An estimate of new production in the equatorial Pacific. *Deep-Sea Research*, **34**: 1229--1243.

Fitzwater, S.E., G.A. Knauer and J.H. Martin (1982).

Metal contamination and its effects on primary production measurements. *Limnology and Oceanography*, **27**: 544--551.

Marra, J. and K. R. Heinemann (1987).

Primary production in the north Pacific central gyre. *Deep-Sea Research*, **43**: 1821--1829.

Price, N. M., P. J. Harrison, M. R. Landry, F. Azam and K. J. F. Hall (1986).

Toxic effect of latex and Tygon tubing on phytoplankton, zooplankton and bacteria. *Marine Ecology: Progress Series*, **34**: 41.

Williams, P. J. LeB. and N. I. Robertson (1989).

A serious inhibition problem from a Niskin sampler during plankton productivity studies. *Limnology and Oceanography*, **34**: 1300--1304.

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Parameters

Parameter	Description	Units
sta	station number, from event log	
sta_std	Arabian Sea standard station identifier	
lat_n	nominal latitude (minus = South)	decimal degrees
lon_n	nominal longitude (minus = West)	decimal degrees
event	event number, from event log	
depth_n	nominal depth at which Go-Flo or Niskin bottle was closed	meters
depth_in	depth where samples were incubated in situ	meters
chl_a	chlorophyll-a as measured by fluorometric method	milligrams/m^3
pp12	primary production, carbon assimilation from dawn to dusk (12 hr.)	milligrams C/m^3
pb12	carbon assimilation per unit chl-a from dawn to dusk	milligrams C/m^3
pp24	primary production, carbon assimilation from dawn to dawn (24 hr.)	milligrams C/m^3
pb24	carbon assimilation per unit chl-a from dawn to dawn	milligrams C/m^3

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Instruments

Dataset-specific Instrument Name	Go-flo Bottle
Generic Instrument Name	GO-FLO Bottle
Dataset-specific Description	Go-Flo bottles on a "trace metal clean" General Oceanics rosette.
Generic Instrument Description	GO-FLO bottle cast used to collect water samples for pigment, nutrient, plankton, etc. The GO-FLO sampling bottle is specially designed to avoid sample contamination at the surface, internal spring contamination, loss of sample on deck (internal seals), and exchange of water from different depths.

Dataset-specific Instrument Name	Niskin Bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	CTD/Niskin Rosette bottles.
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

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Deployments

TT043

Website	https://www.bco-dmo.org/deployment/57704
Platform	R/V Thomas G. Thompson
Report	http://osprey.bcodmo.org/datasetDeployment.cfm?ddid=2580&did=353&flag=view
Start Date	1995-01-08
End Date	1995-02-05
Description	Purpose: Process Cruise #1 (Late NE Monsoon) **Methods & Sampling** PI: Richard Barber (Duke University) and John Marra (Lamont-Doherty Earth Observatory) dataset: Primary Production, 12 and 24 hour experiments dates: January 11, 1995 to January 30, 1995 location: N: 19.1669 S: 9.9986 W: 57.9939 E: 67.1673 project/cruise: Arabian Sea/TN043 - Process Cruise 1 (Late NE Monsoon) ship: Thomas Thompson Methods reported in: Barber, Richard T. 1993. In Situ Primary Production Protocols. U.S. Joint Global Ocean Flux Study . **Processing Description** In Situ Primary Productivity Protocol A Description of Actual Procedures Used on the 1992 EqPac Survey and Time Series Cruises Richard T. Barber The conceptual basis for the anti-contamination procedures are, of course, the classic paper by Fitzwater, Knauer and Martin (1982), but other important comments on inhibition of phytoplankton are given in Chavez and Barber (1987), Price et al. (1986), Williams and Robertson (1989) and Marra and Heinemann (1987). I. C Solution A. Anhydrous crystalline sodium carbonate is added to stock carbonate solution of 0.3 g carbonate in 1.0 liter of Nanopure water. The lot number of the NEN (New England Nuclear) Na CO was 2653-074; the specific activity was 55.0 mCi/mmol. The designation number is NEC-088H. B. The solution is made up and stored in Teflon containers that are cleaned as described below. C. The C solution is refrigerated, but allowed to come to room temperature before addition to the seawater. D. The intended activity of the C solution is 100 ï¿½Ci/ml; however, in our procedure the activity added is measured for each profile, so variations in the initial activity are not a problem. II. Cleaning A. New bottles and labware are cleaned as follows: soak in a 2 % Micro solution for three days. Rinse three times with DI water, then soak overnight in DI water. Rinse again, then soak for two days in 0.5N HCl (Fisher trace metal grade). Rinse three times with Nanopure water. B. After each use, the incubation bottles are soaked in a 10 % acid wash for 12 to 24 hours and then rinsed well (3 times) with Nanopure water. C. Teflon stock bottles are cleaned by performing Micro and DI soaks as above. Then sequential three-day soakings are performed, filling first with 6 N HCl for three days, then with 2 N HNO for three days, and then with the cleanest available 0.5 N HNO for three days. Each filling should be followed with Nanopure rinses. Oven dry on a plastic tray at 65 C. D. Polyethylene or vinyl disposable gloves without talc are worn during Rosette handling and all other procedures. III. Sampling A. Eight light depths are sampled down to the 0.1 % I light depth with custom made Go-Flo bottles on a ``trace metal clean" General Oceanics rosette. The rosette was made by General Oceanics according to Moss Landing Marine Laboratory's specification; it is called the EqPac ``clean rosette." The rosette was lowered on a Kevlar conducting hydroline with non-metal sheaves and a dedicated winch. B. Samples were taken before dawn, usually at 3:00 to 4:00 am. C. The 280 ml polycarbonate bottles are rinsed three times with sample water and filled. The water ``fell" from the Go-Flo spout into the bottle without the use of a ``filling tube". (McCarthy et al and Landry et al. always use a ``filling tube" to reduce shear and turbulence that hurts microflagellates and ciliates. To avoid potential contamination, we do not use a ``filling tube.") D. Inoculation of 100 ï¿½l of C solution is done in the radioactivity van with an Eppendorf disposable tip dispenser. E. In addition to two bottles from each light depth a third bottle is taken from surface (``100 % I ") and the 8 % I depth for the determination of time zero particulate C counts. The 100 % and 8 % samples are inoculated and immediately filtered and treated identically to the incubated filters. IV.

	Incubation A. The two replicate bottles from each depth are placed in a nylon mesh bag and closed with polyethylene cable ties. B. Each bag is attached to the polypropylene array line by ``tuna" snaps that clip into rings that are spliced in the line at one-meter intervals. C. The array line has a 50-lb lead weight at the bottom and two floats at the top. D. A 20 m tag line connects the array line to the array spar buoy which has an aluminum radar reflector, 3M light reflector sheets, a reflective International Orange flag, a Novatech VHF transmitter and a Novatech xenon flasher. Batteries on the VHF and flasher are changed at each deployment. E. The array is picked up after about 24 hours or about 4 am. The nylon bags are taken off and placed in a box as the array is recovered. The recovery takes about 20 to 30 minutes after the spar buoy is caught with grapnel hooks. V. Filtration A. Following retrieval of the nylon bags from the array line the bags and bottles are taken to the radioactivity van. One ml is taken from the 100 % and 8 % I depth bottles and added to scintillation vials containing 1 ml of beta phenethylamine then 10 ml of Ecolume is added. The purpose of this procedure is to determine an added C activity. B. The samples are then filtered through Whatman GFF filters. C. The filters are placed in scintillation vials and 0.5 ml of 0.5 N HCl added. The acidified filters are left for 24 hours in the hood. D. 10 ml of Ecolume is then added and the vials capped and left for 24 hours. VI. Counting and Calculations A. The time zero, total activity and incubated samples are counted on the liquid scintillation counter with a wide window. B. Carbon uptake for each light level is calculated as follows: Carbon = ([DPM - DPM] 1.05 24000)/DPM time) DPM = CPM/efficiency of filters DPM = CPM/efficiency of filters DPM = (CPM/efficiency tot) bottle volume 1.05 = factor for preferential uptake of C over C 24000 = weight in mg/m of the inorganic carbon in seawater C. Carbon uptake for the water column down to the 1.0 % and 0.1 % light level is calculated using a trapezoidal integration. We note that each P.I. in JGOFS uses a different integration scheme. This is an area where some discussion might be useful. Literature Cited Chavez, F.P. and R.T. Barber (1987). An estimate of new production in the equatorial Pacific. Deep-Sea Research, 34: 1229--1243. Fitzwater, S.E., G.A. Knauer and J.H. Martin (1982). Metal contamination and its effects on primary production measurements. Limnology and Oceanography, 27: 544--551. Marra, J. and K. R. Heinemann (1987). Primary production in the north Pacific central gyre. Deep-Sea Research, 43: 1821--1829. Price, N. M., P. J. Harrison, M. R. Landry, F. Azam and K. J. F. Hall (1986). Toxic effect of latex and Tygon tubing on phytoplankton, zooplankton and bacteria. Marine Ecology: Progress Series, 34: 41. Williams, P. J. LeB. and N. I. Robertson (1989). A serious inhibition problem from a Niskin sampler during plankton productivity studies. Limnology and Oceanography, 34: 1300--1304.

TT045

Website	https://www.bco-dmo.org/deployment/57706
Platform	R/V Thomas G. Thompson
Start Date	1995-03-14
End Date	1995-04-10
	Methods & Sampling PI: Richard Barber (Duke University) and John Marra (Lamont-Doherty Earth Observatory) dataset: Primary Production, 12 and 24 hour experiments dates: March 18, 1995 to April 05, 1995 location: N: 19.1673 S: 10.0057 W: 57.9986 E: 67.1664 project/cruise: Arabian Sea/TN045 - Process Cruise 2 (Spring Intermonsoon) ship: Thomas Thompson Methods reported in: Barber, Richard T. 1993. In Situ Primary Production Protocols. U.S. Joint Global Ocean Flux Study **Processing Description** In Situ Primary Productivity Protocol A Description of Actual Procedures Used on the 1992 EqPac Survey and Time Series Cruises Richard T. Barber The conceptual basis for the anti-contamination procedures are, of course, the classic paper by Fitzwater, Knauer and Martin (1982), but other important comments on inhibition of phytoplankton are given in Chavez and Barber (1987), Price et al. (1986), Williams and Robertson (1989) and Marra and Heinemann (1987). I. C Solution A. Anhydrous crystalline sodium carbonate is added to stock carbonate solution of 0.3 g carbonate in 1.0 liter of Nanopure water. The lot number of the NEN (New England Nuclear) Na CO was 2653-074; the specific activity was 55.0 mCi/mmol. The designation number is NEC-088H. B. The solution is made up and stored in Teflon containers that are cleaned as described below. C. The C solution is refrigerated, but allowed to come to room temperature before addition to the seawater. D. The intended activity of the C solution

Description	is 100 µCi/ml; however, in our procedure the activity added is measured for each profile, so variations in the initial activity are not a problem. II. Cleaning A. New bottles and labware are cleaned as follows: soak in a 2 % Micro solution for three days. Rinse three times with DI water, then soak overnight in DI water. Rinse again, then soak for two days in 0.5N HCl (Fisher trace metal grade). Rinse three times with Nanopure water. B. After each use, the incubation bottles are soaked in a 10 % acid wash for 12 to 24 hours and then rinsed well (3 times) with Nanopure water. C. Teflon stock bottles are cleaned by performing Micro and DI soaks as above. Then sequential three-day soakings are performed, filling first with 6 N HCl for three days, then with 2 N HNO for three days, and then with the cleanest available 0.5 N HNO for three days. Each filling should be followed with Nanopure rinses. Oven dry on a plastic tray at 65 C. D. Polyethylene or vinyl disposable gloves without talc are worn during Rosette handling and all other procedures. III. Sampling A. Eight light depths are sampled down to the 0.1 % I light depth with custom made Go-Flo bottles on a ``trace metal clean' General Oceanics rosette. The rosette was made by General Oceanics according to Moss Landing Marine Laboratory's specification; it is called the EqPac ``clean rosette.' The rosette was lowered on a Kevlar conducting hydroline with non-metal sheaves and a dedicated winch. B. Samples were taken before dawn, usually at 3:00 to 4:00 am. C. The 280 ml polycarbonate bottles are rinsed three times with sample water and filled. The water ``fell' from the Go-Flo spout into the bottle without the use of a ``filling tube'. (McCarthy et al and Landry et al. always use a ``filling tube' to reduce shear and turbulence that hurts microflagellates and ciliates. To avoid potential contamination, we do not use a ``filling tube.') D. Inoculation of 100 µl of C solution is done in the radioactivity van with an Eppendorf disposable tip dispenser. E. In addition to two bottles from each light depth a third bottle is taken from surface (``100 % I ') and the 8 % I depth for the determination of time zero particulate C counts. The 100 % and 8 % samples are inoculated and immediately filtered and treated identically to the incubated filters. IV. Incubation A. The two replicate bottles from each depth are placed in a nylon mesh bag and closed with polyethylene cable ties. B. Each bag is attached to the polypropylene array line by ``tuna' snaps that clip into rings that are spliced in the line at one-meter intervals. C. The array line has a 50-lb lead weight at the bottom and two floats at the top. D. A 20 m tag line connects the array line to the array spar buoy which has an aluminum radar reflector, 3M light reflector sheets, a reflective International Orange flag, a Novatech VHF transmitter and a Novatech xenon flasher. Batteries on the VHF and flasher are changed at each deployment. E. The array is picked up after about 24 hours or about 4 am. The nylon bags are taken off and placed in a box as the array is recovered. The recovery takes about 20 to 30 minutes after the spar buoy is caught with grapnel hooks. V. Filtration A. Following retrieval of the nylon bags from the array line the bags and bottles are taken to the radioactivity van. One ml is taken from the 100 % and 8 % I depth bottles and added to scintillation vials containing 1 ml of beta phenethylamine then 10 ml of Ecolume is added. The purpose of this procedure is to determine an added C activity. B. The samples are then filtered through Whatman GFF filters. C. The filters are placed in scintillation vials and 0.5 ml of 0.5 N HCl added. The acidified filters are left for 24 hours in the hood. D. 10 ml of Ecolume is then added and the vials capped and left for 24 hours. VI. Counting and Calculations A. 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Website	https://www.bco-dmo.org/deployment/57710
Platform	R/V Thomas G. Thompson
Start Date	1995-07-17
End Date	1995-08-15
Description	**Methods & Sampling** PI: Richard Barber (Duke University) and John Marra (Lamont-Doherty Earth Observatory) dataset: Primary Production, 12 and 24 hour experiments dates: July 21, 1995 to August 11, 1995 location: N: 19.1986 S: 9.9964 W: 57.3012 E: 67.1716 project/cruise: Arabian Sea/TN049 - Process Cruise 4 (Middle SW Monsoon) ship: Thomas Thompson Methods reported in: Barber, Richard T. 1993. In Situ Primary Production Protocols. U.S. Joint Global Ocean Flux Study **Processing Description** In Situ Primary Productivity Protocol A Description of Actual Procedures Used on the 1992 EqPac Survey and Time Series Cruises Richard T. Barber The conceptual basis for the anti-contamination procedures are, of course, the classic paper by Fitzwater, Knauer and Martin (1982), but other important comments on inhibition of phytoplankton are given in Chavez and Barber (1987), Price et al. (1986), Williams and Robertson (1989) and Marra and Heinemann (1987). I. C Solution A. Anhydrous crystalline sodium carbonate is added to stock carbonate solution of 0.3 g carbonate in 1.0 liter of Nanopure water. The lot number of the NEN (New England Nuclear) Na CO was 2653-074; the specific activity was 55.0 mCi/mmol. The designation number is NEC-088H. B. The solution is made up and stored in Teflon containers that are cleaned as described below. C. The C solution is refrigerated, but allowed to come to room temperature before addition to the seawater. D. The intended activity of the C solution is 100 ï¿½Ci/ml; however, in our procedure the activity added is measured for each profile, so variations in the initial activity are not a problem. II. Cleaning A. New bottles and labware are cleaned as follows: soak in a 2 % Micro solution for three days. Rinse three times with DI water, then soak overnight in DI water. Rinse again, then soak for two days in 0.5N HCl (Fisher trace metal grade). Rinse three times with Nanopure water. B. After each use, the incubation bottles are soaked in a 10 % acid wash for 12 to 24 hours and then rinsed well (3 times) with Nanopure water. C. Teflon stock bottles are cleaned by performing Micro and DI soaks as above. Then sequential three-day soakings are performed, filling first with 6 N HCl for three days, then with 2 N HNO for three days, and then with the cleanest available 0.5 N HNO for three days. Each filling should be followed with Nanopure rinses. Oven dry on a plastic tray at 65 C. D. Polyethylene or vinyl disposable gloves without talc are worn during Rosette handling and all other procedures. III. Sampling A. Eight light depths are sampled down to the 0.1 % I light depth with custom made Go-Flo bottles on a ``trace metal clean'' General Oceanics rosette. The rosette was made by General Oceanics according to Moss Landing Marine Laboratory's specification; it is called the EqPac ``clean rosette.'' The rosette was lowered on a Kevlar conducting hydroline with non-metal sheaves and a dedicated winch. B. Samples were taken before dawn, usually at 3:00 to 4:00 am. C. The 280 ml polycarbonate bottles are rinsed three times with sample water and filled. The water ``fell'' from the Go-Flo spout into the bottle without the use of a ``filling tube''. (McCarthy et al and Landry et al. always use a ``filling tube'' to reduce shear and turbulence that hurts microflagellates and ciliates. To avoid potential contamination, we do not use a ``filling tube.'') D. Inoculation of 100 ï¿½l of C solution is done in the radioactivity van with an Eppendorf disposable tip dispenser. E. In addition to two bottles from each light depth a third bottle is taken from surface (``100 % I '') and the 8 % I depth for the determination of time zero particulate C counts. The 100 % and 8 % samples are inoculated and immediately filtered and treated identically to the incubated filters. IV. Incubation A. The two replicate bottles from each depth are placed in a nylon mesh bag and closed with polyethylene cable ties. B. Each bag is attached to the polypropylene array line by ``tuna'' snaps that clip into rings that are spliced in the line at one-meter intervals. C. The array line has a 50-lb lead weight at the bottom and two floats at the top. D. A 20 m tag line connects the array line to the array spar buoy which has an aluminum radar reflector, 3M light reflector sheets, a reflective International Orange flag, a Novatech VHF transmitter and a Novatech xenon flasher. Batteries on the VHF and flasher are changed at each deployment. E. The array is picked up after about 24 hours or about 4 am. The nylon bags are taken off and placed in a box as the array is recovered. The recovery takes about 20 to 30 minutes after the spar buoy is caught with grapnel hooks. V. Filtration A. Following retrieval of the nylon bags from the array line the bags and bottles are taken to the radioactivity van. One ml is

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TT050

Website	https://www.bco-dmo.org/deployment/57711
Platform	R/V Thomas G. Thompson
Start Date	1995-08-18
End Date	1995-09-15
	Methods & Sampling PI: Richard Barber (Duke University) and John Marra (Lamont-Doherty Earth Observatory) dataset: Primary Production, 12 and 24 hour experiments dates: August 22, 1995 to September 10, 1995 location: N: 19.1981 S: 9.9586 W: 58.0017 E: 67.1666 project/cruise: Arabian Sea/TN050 - Process Cruise 5 (Late SW Monsoon) ship: Thomas Thompson Methods reported in: Barber, Richard T. 1993. In Situ Primary Production Protocols. U.S. Joint Global Ocean Flux Study **Processing Description** In Situ Primary Productivity Protocol A Description of Actual Procedures Used on the 1992 EqPac Survey and Time Series Cruises Richard T. Barber The conceptual basis for the anti-contamination procedures are, of course, the classic paper by Fitzwater, Knauer and Martin (1982), but other important comments on inhibition of phytoplankton are given in Chavez and Barber (1987), Price et al. (1986), Williams and Robertson (1989) and Marra and Heinemann (1987). I. C Solution A. Anhydrous crystalline sodium carbonate is added to stock carbonate solution of 0.3 g carbonate in 1.0 liter of Nanopure water. The lot number of the NEN (New England Nuclear) Na CO was 2653-074; the specific activity was 55.0 mCi/mmol. The designation number is NEC-088H. B. The solution is made up and stored in Teflon containers that are cleaned as described below. C. The C solution is refrigerated, but allowed to come to room temperature before addition to the seawater. D. The intended activity of the C solution is 100 ï¿½Ci/ml; however, in our procedure the activity added is measured for each profile, so variations in the initial activity are not a problem. II. Cleaning A. New bottles and labware are cleaned as follows: soak in a 2 % Micro solution for three days. Rinse three times with DI water, then soak overnight in DI water. Rinse again, then soak for two days in 0.5N HCl (Fisher trace metal grade). Rinse three times with Nanopure water. B. After each use, the incubation bottles are soaked in a 10 % acid wash for 12 to 24 hours and then rinsed well (3 times) with Nanopure water. C. Teflon stock bottles are cleaned by performing Micro and DI soaks as above. Then sequential three-day soakings are performed, filling first with 6 N HCl for three days, then with 2 N HNO for three days, and then with the cleanest available 0.5 N HNO for three days. Each filling should be followed with Nanopure rinses. Oven dry on a plastic tray at 65 C. D. Polyethylene or vinyl disposable gloves without talc are worn during Rosette handling

Description	and all other procedures. III. Sampling A. Eight light depths are sampled down to the 0.1 % I light depth with custom made Go-Flo bottles on a ``trace metal clean" General Oceanics rosette. The rosette was made by General Oceanics according to Moss Landing Marine Laboratory's specification; it is called the EqPac ``clean rosette." The rosette was lowered on a Kevlar conducting hydroline with non-metal sheaves and a dedicated winch. B. Samples were taken before dawn, usually at 3:00 to 4:00 am. C. The 280 ml polycarbonate bottles are rinsed three times with sample water and filled. The water ``fell" from the Go-Flo spout into the bottle without the use of a ``filling tube". (McCarthy et al and Landry et al. always use a ``filling tube" to reduce shear and turbulence that hurts microflagellates and ciliates. To avoid potential contamination, we do not use a ``filling tube.") D. Inoculation of 100 ï¿½l of C solution is done in the radioactivity van with an Eppendorf disposable tip dispenser. E. In addition to two bottles from each light depth a third bottle is taken from surface (``100 % I ") and the 8 % I depth for the determination of time zero particulate C counts. The 100 % and 8 % samples are inoculated and immediately filtered and treated identically to the incubated filters. IV. Incubation A. The two replicate bottles from each depth are placed in a nylon mesh bag and closed with polyethylene cable ties. B. Each bag is attached to the polypropylene array line by ``tuna" snaps that clip into rings that are spliced in the line at one-meter intervals. C. The array line has a 50-lb lead weight at the bottom and two floats at the top. D. A 20 m tag line connects the array line to the array spar buoy which has an aluminum radar reflector, 3M light reflector sheets, a reflective International Orange flag, a Novatech VHF transmitter and a Novatech xenon flasher. Batteries on the VHF and flasher are changed at each deployment. E. The array is picked up after about 24 hours or about 4 am. The nylon bags are taken off and placed in a box as the array is recovered. The recovery takes about 20 to 30 minutes after the spar buoy is caught with grapnel hooks. V. Filtration A. Following retrieval of the nylon bags from the array line the bags and bottles are taken to the radioactivity van. One ml is taken from the 100 % and 8 % I depth bottles and added to scintillation vials containing 1 ml of beta phenethylamine then 10 ml of Ecolume is added. The purpose of this procedure is to determine an added C activity. B. The samples are then filtered through Whatman GFF filters. C. The filters are placed in scintillation vials and 0.5 ml of 0.5 N HCl added. The acidified filters are left for 24 hours in the hood. D. 10 ml of Ecolume is then added and the vials capped and left for 24 hours. VI. Counting and Calculations A. The time zero, total activity and incubated samples are counted on the liquid scintillation counter with a wide window. B. Carbon uptake for each light level is calculated as follows: Carbon = ([DPM - DPM] 1.05 24000)/DPM time) DPM = CPM/efficiency of filters DPM = CPM/efficiency of filters DPM = (CPM/efficiency tot) bottle volume 1.05 = factor for preferential uptake of C over C 24000 = weight in mg/m of the inorganic carbon in seawater C. Carbon uptake for the water column down to the 1.0 % and 0.1 % light level is calculated using a trapezoidal integration. We note that each P.I. in JGOFS uses a different integration scheme. This is an area where some discussion might be useful. Literature Cited Chavez, F.P. and R.T. Barber (1987). An estimate of new production in the equatorial Pacific. Deep-Sea Research, 34: 1229--1243. Fitzwater, S.E., G.A. Knauer and J.H. Martin (1982). Metal contamination and its effects on primary production measurements. Limnology and Oceanography, 27: 544--551. Marra, J. and K. R. Heinemann (1987). Primary production in the north Pacific central gyre. Deep-Sea Research, 43: 1821--1829. Price, N. M., P. J. Harrison, M. R. Landry, F. Azam and K. J. F. Hall (1986). Toxic effect of latex and Tygon tubing on phytoplankton, zooplankton and bacteria. Marine Ecology: Progress Series, 34: 41. Williams, P. J. LeB. and N. I. Robertson (1989). A serious inhibition problem from a Niskin sampler during plankton productivity studies. Limnology and Oceanography, 34: 1300--1304.

TT053

Website	https://www.bco-dmo.org/deployment/57714
Platform	R/V Thomas G. Thompson
Start Date	1995-10-29
End Date	1995-11-26
	Methods & Sampling PI: Richard Barber (Duke University) and John Marra (Lamont-Doherty Earth Observatory) dataset: Primary Production, 12 and 24 hour experiments dates: November 01, 1995 to November 21, 1995 location: N: 23.0515 S: 10.0823 W: 57.3007 E: 67.1664 project/cruise: Arabian Sea/TN053 - Process Cruise 6 (bio-optics) ship: Thomas Thompson Methods reported

Description	in: Barber, Richard T. 1993. In Situ Primary Production Protocols. U.S. Joint Global Ocean Flux Study **Processing Description** In Situ Primary Productivity Protocol A Description of Actual Procedures Used on the 1992 EqPac Survey and Time Series Cruises Richard T. Barber The conceptual basis for the anti-contamination procedures are, of course, the classic paper by Fitzwater, Knauer and Martin (1982), but other important comments on inhibition of phytoplankton are given in Chavez and Barber (1987), Price et al. (1986), Williams and Robertson (1989) and Marra and Heinemann (1987). I. C Solution A. Anhydrous crystalline sodium carbonate is added to stock carbonate solution of 0.3 g carbonate in 1.0 liter of Nanopure water. The lot number of the NEN (New England Nuclear) Na CO was 2653-074; the specific activity was 55.0 mCi/mmol. The designation number is NEC-088H. B. The solution is made up and stored in Teflon containers that are cleaned as described below. C. 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Each filling should be followed with Nanopure rinses. Oven dry on a plastic tray at 65 C. D. Polyethylene or vinyl disposable gloves without talc are worn during Rosette handling and all other procedures. III. Sampling A. Eight light depths are sampled down to the 0.1 % I light depth with custom made Go-Flo bottles on a ``trace metal clean" General Oceanics rosette. The rosette was made by General Oceanics according to Moss Landing Marine Laboratory's specification; it is called the EqPac ``clean rosette." The rosette was lowered on a Kevlar conducting hydroline with non-metal sheaves and a dedicated winch. B. Samples were taken before dawn, usually at 3:00 to 4:00 am. C. The 280 ml polycarbonate bottles are rinsed three times with sample water and filled. The water ``fell" from the Go-Flo spout into the bottle without the use of a ``filling tube". (McCarthy et al and Landry et al. always use a ``filling tube" to reduce shear and turbulence that hurts microflagellates and ciliates. To avoid potential contamination, we do not use a ``filling tube.") D. Inoculation of 100 ï¿½l of C solution is done in the radioactivity van with an Eppendorf disposable tip dispenser. E. In addition to two bottles from each light depth a third bottle is taken from surface (``100 % I ") and the 8 % I depth for the determination of time zero particulate C counts. The 100 % and 8 % samples are inoculated and immediately filtered and treated identically to the incubated filters. IV. Incubation A. The two replicate bottles from each depth are placed in a nylon mesh bag and closed with polyethylene cable ties. B. Each bag is attached to the polypropylene array line by ``tuna" snaps that clip into rings that are spliced in the line at one-meter intervals. C. The array line has a 50-lb lead weight at the bottom and two floats at the top. D. A 20 m tag line connects the array line to the array spar buoy which has an aluminum radar reflector, 3M light reflector sheets, a reflective International Orange flag, a Novatech VHF transmitter and a Novatech xenon flasher. Batteries on the VHF and flasher are changed at each deployment. E. The array is picked up after about 24 hours or about 4 am. The nylon bags are taken off and placed in a box as the array is recovered. The recovery takes about 20 to 30 minutes after the spar buoy is caught with grapnel hooks. V. Filtration A. Following retrieval of the nylon bags from the array line the bags and bottles are taken to the radioactivity van. One ml is taken from the 100 % and 8 % I depth bottles and added to scintillation vials containing 1 ml of beta phenethylamine then 10 ml of Ecolume is added. The purpose of this procedure is to determine an added C activity. B. The samples are then filtered through Whatman GFF filters. C. 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TT054

Website	https://www.bco-dmo.org/deployment/57715
Platform	R/V Thomas G. Thompson
Start Date	1995-11-30
End Date	1995-12-28
Description	**Methods & Sampling** PI: Richard Barber (Duke University) and John Marra (Lamont-Doherty Earth Observatory) dataset: Primary Production, 12 and 24 hour experiments dates: December 04, 1995 to December 23, 1995 location: N: 19.1986 S: 10.0002 W: 58.0027 E: 67.1654 project/cruise: Arabian Sea/TN054 - Process Cruise 7 (Early NE Monsoon) ship: Thomas Thompson Methods reported in: Barber, Richard T. 1993. In Situ Primary Production Protocols. U.S. Joint Global Ocean Flux Study - **Processing Description** In Situ Primary Productivity Protocol A Description of Actual Procedures Used on the 1992 EqPac Survey and Time Series Cruises Richard T. Barber The conceptual basis for the anti-contamination procedures are, of course, the classic paper by Fitzwater, Knauer and Martin (1982), but other important comments on inhibition of phytoplankton are given in Chavez and Barber (1987), Price et al. (1986), Williams and Robertson (1989) and Marra and Heinemann (1987). I. C Solution A. Anhydrous crystalline sodium carbonate is added to stock carbonate solution of 0.3 g carbonate in 1.0 liter of Nanopure water. The lot number of the NEN (New England Nuclear) Na CO was 2653-074; the specific activity was 55.0 mCi/mmol. The designation number is NEC-088H. B. The solution is made up and stored in Teflon containers that are cleaned as described below. C. The C solution is refrigerated, but allowed to come to room temperature before addition to the seawater. D. The intended activity of the C solution is 100 ï¿½Ci/ml; however, in our procedure the activity added is measured for each profile, so variations in the initial activity are not a problem. II. Cleaning A. New bottles and labware are cleaned as follows: soak in a 2 % Micro solution for three days. Rinse three times with DI water, then soak overnight in DI water. Rinse again, then soak for two days in 0.5N HCl (Fisher trace metal grade). Rinse three times with Nanopure water. B. After each use, the incubation bottles are soaked in a 10 % acid wash for 12 to 24 hours and then rinsed well (3 times) with Nanopure water. C. Teflon stock bottles are cleaned by performing Micro and DI soaks as above. Then sequential three-day soakings are performed, filling first with 6 N HCl for three days, then with 2 N HNO for three days, and then with the cleanest available 0.5 N HNO for three days. Each filling should be followed with Nanopure rinses. Oven dry on a plastic tray at 65 C. D. Polyethylene or vinyl disposable gloves without talc are worn during Rosette handling and all other procedures. III. Sampling A. Eight light depths are sampled down to the 0.1 % I light depth with custom made Go-Flo bottles on a ``trace metal clean" General Oceanics rosette. The rosette was made by General Oceanics according to Moss Landing Marine Laboratory's specification; it is called the EqPac ``clean rosette." The rosette was lowered on a Kevlar conducting hydroline with non-metal sheaves and a dedicated winch. B. Samples were taken before dawn, usually at 3:00 to 4:00 am. C. The 280 ml polycarbonate bottles are rinsed three times with sample water and filled. The water ``fell" from the Go-Flo spout into the bottle without the use of a ``filling tube". (McCarthy et al and Landry et al. always use a ``filling tube" to reduce shear and turbulence that hurts microflagellates and ciliates. To avoid potential contamination, we do not use a ``filling tube.") D. Inoculation of 100 ï¿½l of C solution is done in the radioactivity van with an Eppendorf disposable tip dispenser. E. In addition to two

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Project Information

U.S. JGOFS Arabian Sea (Arabian Sea)

Website: http://usjgofs.whoi.edu/research/arabian.html

Coverage: Arabian Sea

The U.S. Arabian Sea Expedition which began in September 1994 and ended in January 1996, had three major components: a U.S. JGOFS Process Study, supported by the National Science Foundation (NSF); Forced Upper Ocean Dynamics, an Office of Naval Research (ONR) initiative; and shipboard and aircraft measurements supported by the National Aeronautics and Space Administration (NASA). The Expedition consisted of 17 cruises aboard the R/V Thomas Thompson, year-long moored deployments of five instrumented surface buoys and five sediment-trap arrays, aircraft overflights and satellite observations. Of the seventeen ship cruises, six were allocated to repeat process survey cruises, four to SeaSoar mapping cruises, six to mooring and benthic work, and a single calibration cruise which was essentially conducted in transit to the Arabian Sea.

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Program Information

U.S. Joint Global Ocean Flux Study (U.S. JGOFS)

Website: http://usjgofs.whoi.edu/

Coverage: Global

The United States Joint Global Ocean Flux Study was a national component of international JGOFS and an integral part of global climate change research.

The U.S. launched the Joint Global Ocean Flux Study (JGOFS) in the late 1980s to study the ocean carbon cycle. An ambitious goal was set to understand the controls on the concentrations and fluxes of carbon and associated nutrients in the ocean. A new field of ocean biogeochemistry emerged with an emphasis on quality measurements of carbon system parameters and interdisciplinary field studies of the biological, chemical and physical process which control the ocean carbon cycle. As we studied ocean biogeochemistry, we learned that our simple views of carbon uptake and transport were severely limited, and a new "wave" of ocean science was born. U.S. JGOFS has been supported primarily by the U.S. National Science Foundation in collaboration with the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, the Department of Energy and the Office of Naval Research. U.S. JGOFS, ended in 2005 with the conclusion of the Synthesis and Modeling Project (SMP).

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Funding

Funding Source	Award
Office of Naval Research (ONR)	unknown Arabian Sea ONR
National Science Foundation (NSF)	unknown Arabian Sea NSF

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