

**NASA EXPORTS North Pacific - Net Primary Production
R/V Roger Revelle, Aug-Sep 2018**

Prepared by: James Fox, Department of Microbiology, Oregon State University
Email: james.fox@oregonstate.edu

I. Introduction

The objective was to measure net primary production rates that can be related to independent measures of carbon stocks to derive estimates of phytoplankton growth rate. 24 h NPP were determined at Ocean Station Papa as part of the NASA EXPORTS north pacific field campaign. This procedure follows the well-established procedure introduced by Steeman-Nielsen in 1952 and used extensively in oceanography. The method relies on light-dependent incorporation of radiolabeled bicarbonate into phytoplankton biomass. The method is extremely sensitive, and thus allows the use of trace quantities of radiolabeled bicarbonate (^{14}C) to serve as a tracer of CO_2 fixation.

II. Calibration / Maintenance

For NPP data, two measurements are used for calibration:

- 1) Activity of ^{14}C added to each sample. Two subsamples of the ^{14}C spiked seawater that is to be incubated for NPP determination are transferred to scintillation vials. 0.9 ml water and 0.2 ml phenethylamine are added to each sample, and vials are immediately capped and shaken. These samples are measured by scintillation counter along with the NPP samples following incubation, filtration, acidification, and degassing.
- 2) Dark incubations. To account for any ^{14}C labeling that may have occurred during sample preparation or filtering, post incubation, or by chemolithoautotrophs, samples are incubated for the same time periods (24 h) in the dark. Samples were made dark by wrapping each. Treatment of dark samples was identical for all other handling.

The error associated with the NPP measurement is 5%.

III. Deployment / Sample collection

Discrete seawater samples were collected from different depths using a trace-metal clean CTD rosette. All sample processing done prior to incubation was done using a hepa-filter to maintain a trace-metal free environment. Bottles used for each incubation were acid-washed for 24 h at 50°C before being rinsed 5 times with ultra-pure water and air dried in a filtered air environment.

Samples spiked with ^{14}C -bicarbonate were incubated at different light levels in on-deck incubators to provide depth resolved primary production relationships. Incubator light levels were established using neutral density screening and given as percent of surface light. Prior to

incubation, subsamples were taken to determine the ^{14}C activity added, incubation duration 24 h (dawn-dawn).

Following incubations, each sample was filtered onto a 0.2 micron membrane filter. Filters were transferred to a scintillation vial, 0.9 ml water added, and then acidified with 0.1 ml 1M HCl. Samples were degassed overnight before counting on the scintillation counter.

IV. Data processing

Disintegrations per minute (DPM) values were converted to the reported NPP values by first averaging replicates and subtracting the average DPM for samples incubated in the dark.

Carbon fixed was determined by dividing the resultant DPM value by the ^{14}C DPM value determined to have been added to each sample and multiplied by 0.002131 to account for CO_2 concentration in seawater.