

MODELLING NEW PRODUCTION FROM NITRATE REDUCTASE ACTIVITY AND LIGHT IN THE PERU CURRENT UPWELLING

Laura Salas-Collado¹, May Gómez¹, Richard C. Dugdale², Ico Martínez¹, Dolores Blasco³, Richard T. Barber⁴, Frances P. Wilkerson², Theodore T. Packard¹

¹ Marine Ecophysiology Group (EOMAR), IU-ECOQUA, University Las Palmas de Gran Canaria (ULPGC), Canary Islands, SPAIN.

laura.salas102@alu.ulpgc.es, may.gomez@ulpgc.es, ico.martinez@ulpgc.es, theodore.packard@ulpgc.es

² Romberg Tiburon Centre, San Francisco State University, San Francisco, U. S. A.

rdugdale@sfsu.edu, fwilkerson@sfsu.edu

³ Institut de Ciències del Mar (CSIC), Barcelona, SPAIN. *dolorsblasco@gmail.com*

⁴ Nicholas School of the Environment and Earth Sciences, Duke University, Beaufort, NC, USA.

rbarber@duke.edu

Abstract: New Production (NP) is limited by NO_3^- , NH_4^+ , and light (hv). Here we use a model derived from Michaelis-Menten kinetics to calculate NP from euphotic-zone phytoplankton NR activity and hv.

$$\text{NP} = -\partial[\text{NO}_3^-]/\partial t = [\text{NR}] * [\text{hv}]/(\text{K}_{\text{lt}} + [\text{hv}])$$

We calculated Peruvian upwelling NP at 15° S (C-Line) during austral fall, March-April-May 1977 from R/V WECOMA data of the Coastal Upwelling Ecosystem Analysis program. NP, at 50% hv, ranged from 1.37 $\mu\text{M C h}^{-1}$ at the upwelling centre, to 0.15 $\mu\text{M C h}^{-1}$ 9 km downstream, to 0.37 $\mu\text{M C h}^{-1}$ 57 km further downstream over the Peru Trench. It compared well with ¹⁴C carbon productivity measurements ranging from 0.29 - 2.65 $\mu\text{M C h}^{-1}$ and 0.04 - 1.37 $\mu\text{M C h}^{-1}$ for the 6 h (gross) and 24 h (net) productivity. Oceanographic conditions during April 1977 made the C-Line an ideal site to compare spring 1977 NP with fall 1976 NP data collected by the R/V Eastward. Those 1976 NP values ranged slightly higher (0.15 to 3.49 $\mu\text{M C h}^{-1}$) than those we found. The surface temperature background at the upwelling-centre in April 1977 reached 16.41 °C whereas in September 1976 it was 14.07 °C. For the C-Line, NO_3^- stayed above 10 μM , and NH_4^+ stayed below 0.1 μM . C-Line Chlorophyll, averaging 1.39 $\mu\text{g L}^{-1}$ in April 1977, was lower than what it was for the same stations 6 months earlier (3.85 $\mu\text{g L}^{-1}$). NR, averaging 0.045 $\mu\text{M h}^{-1}$ for C-Line stations in April 1977, was a fourth of what it was 6 months earlier in September 1976 (0.20 $\mu\text{M h}^{-1}$). In conclusion, overall NP for austral fall 1977, in nitrogen units, ranged from 22.6 to 206.8 nM N h⁻¹. In carbon units, median NP in austral fall was only 42% (0.76 $\mu\text{M C h}^{-1}$) of NP in austral spring (1.82 $\mu\text{M C h}^{-1}$).

Key words: primary production, nitrogen uptake, nitrate reductase, phytoplankton.

Acknowledgments: The Coastal Upwelling Ecosystem Analysis (CUEA) program was funded by the International Decade of Ocean Exploration (IDOE) office of the U.S. National Science Foundation. These are results from OCE-75-23718A01 (CUEA-12 grant to T.T. Packard).