FINAL TECHNICAL REPORT

ONR GRANT NO: N00014-91-J-1653
TITLE: Phytoplankton Photosynthesis in Natural Mixed Layers
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This report describes the technical accomplishments of the subject grant. This work forms a part of a broader, ongoing effort to more completely describe the physiological responses of marine phytoplankton species to the time-course of natural solar radiation variation on time scales of minutes to days. The investigative approach involves *in situ* instrumentation, laboratory observations and computer models. Collaborators on this ongoing project include Daniel Kamykowski, Thomas Curtin, Gerald Janowitz and Hidekatsu Yamazaki.

The objective of the work under the subject grant was to develop the capability to conduct simultaneous, *in situ* comparison studies of the photosynthetic responses within and between selected phytoplankton species under natural irradiance fluctuation utilizing the Self-contained Underwater Photosynthesis Apparatus (SUPA). This objective was met by fabricating a twin SUPA based on the existing design and incorporating the necessary modifications to hardware and software to permit simultaneous operation from existing support equipment.

While fabricating the new SUPA the design was modified slightly to streamline operations during field deployments of twin instruments. The new design is more robust, permitting assembly in the laboratory instead of on-site. Also, the new design can be filled with the test culture immediately prior to deployment instead of hours before. This minimizes exposure to conditions other than those being investigated. These mechanical improvements are being incorporated in the original SUPA also. Changes in the data acquisition system of the SUPAs have improved measurement resolution for dissolved oxygen to 0.6 uM and for total carbon dioxide to 0.4 uM. This level of resolution is adequate to detect photosynthetic rates in low density laboratory cultures in the SUPAs on time scales of minutes. A new software operating system was developed to accommodate simultaneous operation of both SUPAs and dual vertical positioning winches. This new software is menu driven and handles communications with both instruments over a single SAIL current loop. The PAR, temperature, pH and dissolved oxygen sensors were calibrated by comparison with laboratory grade instruments. Additional baseline comparisons of the twin SUPAs are underway using phytoplankton cultures in the laboratory.