

PHOSPHATE-UPTAKE OF EXPERIMENTAL CORAL AND ALGAL
COMMUNITIES UNDER STEADY VERSUS OSCILLATORY FLOW

A THESIS SUBMITTED TO THE GRADUATE DIVISION OF THE
UNIVERSITY OF HAWAI'I IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE
IN
OCEANOGRAPHY

DECEMBER 2003

By
Melissa D. Bos

Thesis Committee:

Marlin Atkinson, Chairperson
Mark Merrifield
Fred Mackenzie

ABSTRACT

Relationships between nutrient-uptake and net carbon production are variable on reefs. Nutrient-uptake appears to be governed by diffusion of nutrients through nutrient-depleted boundary layers near the surfaces of autotrophs. Nutrient-uptake may occur at different rates under steady and oscillatory flows because the boundary layers may be different. Rates of phosphate-uptake were measured for five experimental communities, two coral and three algal, for a total of 24 experiments. Uptake rate constants (S) ranged from 0.82 to 6.9 m day^{-1} over water velocities of 10 to 50 cm s^{-1} . Uptake was proportional to water velocity and was close to mass-transfer limitation. Phosphate-loading rates, between 0.22 and 1.9 $\text{mmol m}^{-2} \text{day}^{-1}$, were typical of natural loading. Excretion rates increased over time and ranged from 0 to 2.1 $\text{mmol m}^{-2} \text{day}^{-1}$. S was not significantly different under steady versus oscillatory flow. The rate of phosphate-uptake may be enhanced by nitrogen-loading.