

THE EFFECTS OF NUTRIENT LOADING ON C:N:P RATIOS OF MARINE
MACROALGAE IN KANE'OHE BAY, HAWAII

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By

Allison A. Chun Smith

Thesis Committee:

Marlin Atkinson, Chairperson
Ed Laws
Celia Smith

ABSTRACT

Field collections of marine macroalgae from Kane'ohe Bay, Hawai'i, were made to determine the effects of nutrients from stream discharge on C:N, C:P, and N:P ratios of macroalgae. Laboratory experiments in a 10 m flume were also conducted on reef community assemblages to determine the effects of controlled nutrient addition on C:N, C:P, and N:P ratios of specific macroalgae. Macroalgae from inshore sites near stream mouths had significantly higher tissue N per gm dry weight (1020 $\mu\text{mol N/g dw}$) and significantly lower C:N ratios (20:1) than did macroalgae from offshore sites further away from regular stream inputs (790 $\mu\text{mol N/g dw}$ and 26:1 respectively). Flume experiments showed that NH_4 addition of 12.5 mmol $\text{N/m}^2/\text{d}$ for 10 days and of 57 mmol $\text{N/m}^2/\text{d}$ for 6 days resulted in increased tissue N/g dw (from 840 to 1070 $\mu\text{mol N/g dw}$ and from 1010 to 1460 $\mu\text{mol N/g dw}$ respectively) and decreased C:N ratios (from 16:1 to 14:1 and from 16:1 to 11:1 respectively). Only the ten-day NH_4 addition experiment resulted in an increased N:P ratio (from 31:1 to 38:1). Phosphate addition of 1.8 mmol/ m^2/d for 10 days between the NH_4 additions resulted in increased tissue P/g dw (from 28 $\mu\text{mol/g}$ to 43 $\mu\text{mol/g}$) and decreased C:P and N:P ratios (C:P ratios decreased from 520:1 to 390:1, N:P ratios decreased from 38:1 to 25:1). Red algae in both field and flume were exceptional in their ability to acquire both N and P. Although present nutrient inputs into Kane'ohe Bay via streams are sufficient to alter the tissue N composition of nearshore macroalgae, these inputs probably do not affect an appreciable area of the bay. Results of ^{15}N studies, which estimated the contribution of N from streamwater sources in macroalgal tissue, showed that stream influence decreased drastically with distance from stream mouths.