THE EFFECT OF TURTLE GRAZING ON *PTEROCLADIA* BIOMASS IN PUNALU'U BAY, HAWAI'I

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PROJECT LEADER
YUKO OKANO

ADVISOR
LEON HALLACHER, PROFESSOR OF BIOLOGY
UNIVERSITY OF HAWAII AT HILO

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INTRODUCTION

Punalu'u Bay is located in the southern Ka'u district of the island of Hawai'i (Fig. 1), and is a very unique area in terms of the abundance of green sea turtles. The bay also has abundant red algae, *Pterocladia,* growing nearshore. It is the primary diet of Punalu'u's green sea turtles, *Chelonia mydas* (Balazs, 1982). During this project, the effects of grazing by the turtles on *Pterocladia* was monitored. The purpose of this study was to make preliminary estimates of the effects of grazing by *Chelonia mydas* on *Pterocladia.*

MATERIALS AND METHODS

In the experiment, turtles were excluded from grazing by wire cages. Two metal cages were built, and submerged parallel to the east shore of the bay; one was located south of the other (Fig. 2). The approximate depth of the two sites was two to three feet.

The approximate size of each cage was; 55 cm in width, 64 cm in length , and 31 cm in height (Fig. 3). Each had a solid concrete base which weighed about 50 pounds to minimize the effects of strong surge or wave action. The bottom of the inside of each cage was completely filled with algae covered rocks. Two of these

rocks were chosen as "experimental" rocks from which algal samples would be taken. Two rocks outside of but near each cage were chosen as controls. There were total of 4 rocks at each site from which algal samples were taken.

Samples were taken approximately once every 3 weeks, and continued for 15 weeks, from September 4, 1992 through December 7, 1992. However, the experiment on the north cage was terminated on November 21, 1992, due to the cage-lost. During each sampling event, all experimental and control rocks were carried to shore by an inner tube. Algal samples were then scraped off the rocks and carried back to the laboratory. These samples were standardized by using a very small quadrat which was square inch in area.

Once samples were brought to the laboratory, these were rinsed in fresh water to remove salts, dried for 1 week or more, and weighed.

Dry weights (g/in^2) were statistically compared to test for differences between the mean weights of experiment and control algal samples. The null hypothesis was; that the difference between the mean experimental and control weights was not significant. The alternative was that the difference between the mean experimental and control weights was significant.

RESULTS

Experimental replicates from the north and south cages showed dramatic increases in algal biomass while controls had very small change (Fig. 4 & 5).

Biomass at first sampling was from 0.02 g/in^2 to 0.08 g/in^2 for both experimentals and controls at the north and south sites. However, the maximum amount of south experimental sample was 0.80 g/in^2 on December 7 while the maximum of the south control was 0.08 g/in^2 on September 4. The maximum amount of north experimental biomass was 0.48 g/in^2 on Octorber 27, and the north control had a maximum value of 0.08 g/in^2 on November 21.

Toward the end of the experimental algal biomass declined on experimental rocks. Biomass declined on both experimental rocks in the north cage between October 27, 1992 and November 21, 1992. One south experimental rock had a decrease in biomass from November 21, 1992 to December 7, 1992. The most probable explanation for biomass decline on experimental rocks was hydrodynamic fragmentation by strong wave action in the bay (Fralick & Andrade, 1981). When swells come into the bay, currents in the bay become quite strong. There were several storms that passed south of the Big Island during the period when biomass decline occurred (Honolulu Advertiser, 1992). During one of these storms, wave height in Punalu'u bay was reported as high as 8 to 15 feet. Algae inside the experimental cages would be affected by strong waves more than controls since it was much longer resulting in a higher drag ratio and resistance to water motion. The maximum length of south experimental algae was 11.2 cm while that of the south control was 6.6 cm during the period. North experimental samples recorded 8.0 cm in the maximum length while the north control had 4.4 cm.

The means of both north and south experimentals were significantly higher than

those of north and south controls, at 95 % of confidence interval (Fig. 6).

CONCLUSION

In conclusion, experimental algal biomass was significantly higher than control biomass, indicating that *Pterocladia* is subject to intense grazing pressure at Punalu'u. Green sea turtles are major contributors to this pressure. First, they feed almost exclusively on *Pterocladia*. Second, the turtle population at Punalu'u is large. Third, turtles are large animals that eat large amounts of food. However, what still remains to be tested is how much grazing pressure is attributable to *Chelonia mydas* and how much to other herbivores such as fish.

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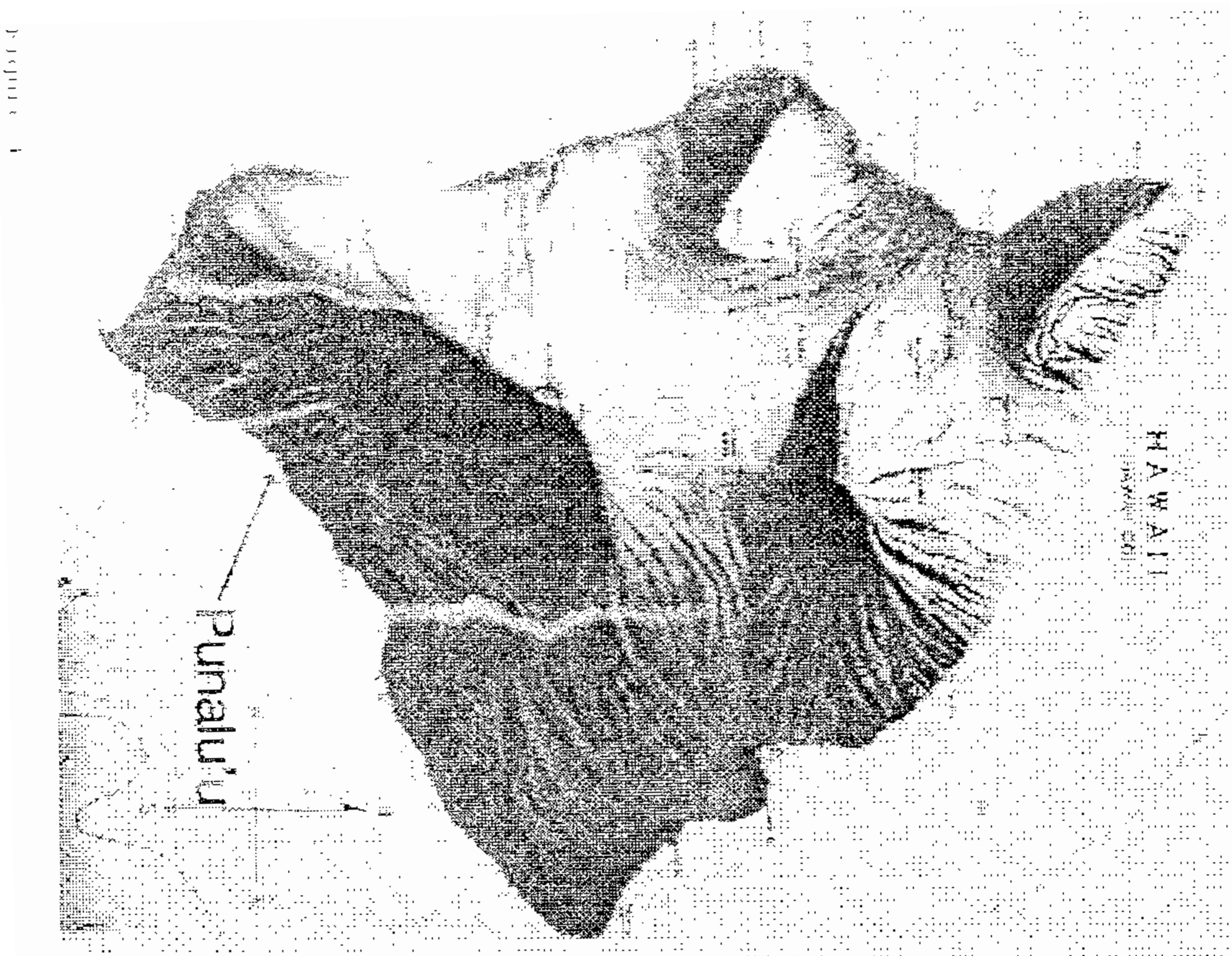
Punalu'u
HAWAII

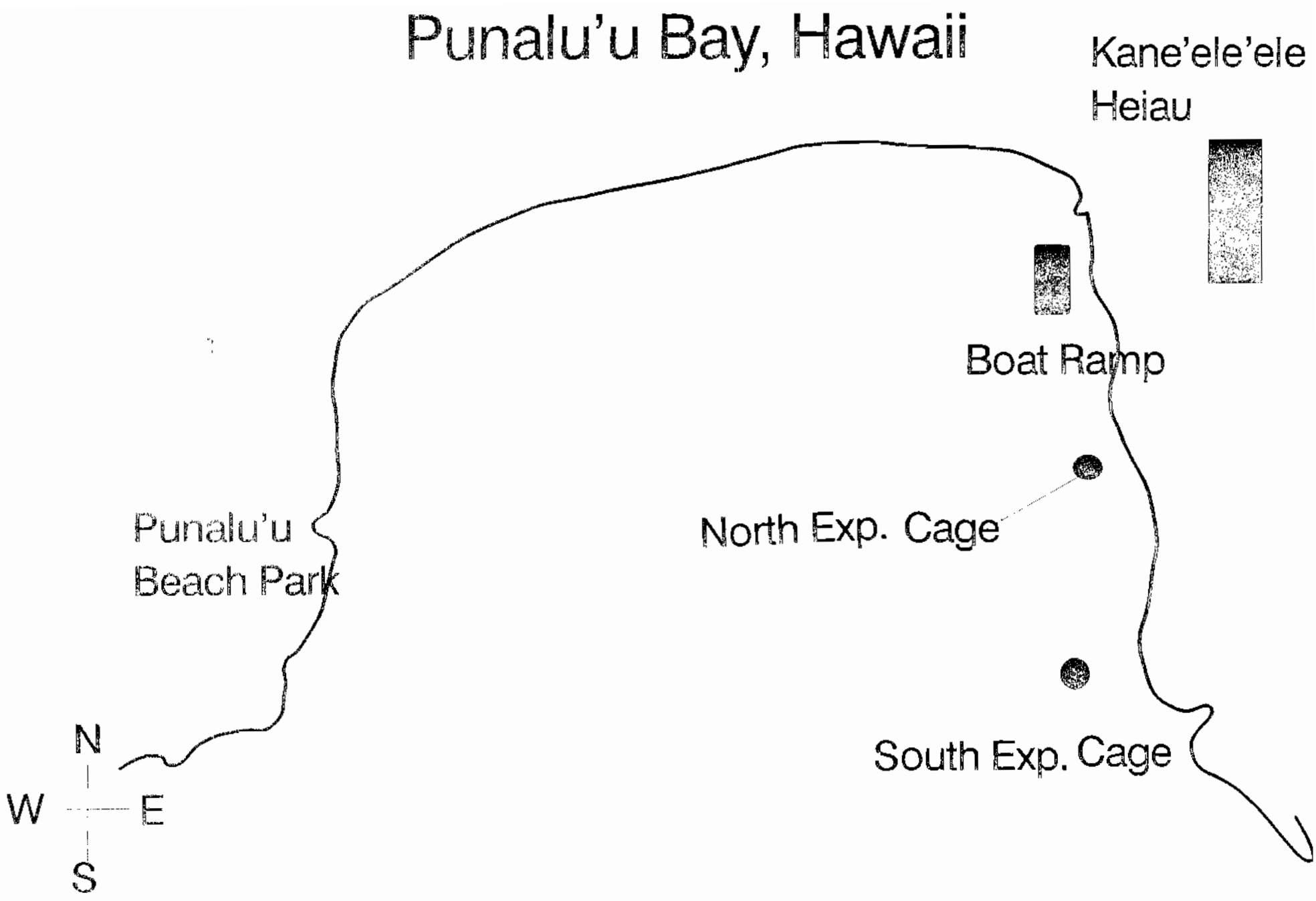
Punalu'u Bay, Hawaii
Kane'ele'ele Heiau
Boat Ramp
North Exp. Cage
South Exp. Cage
Punalu'u Beach Park
N
W
E
S

Figure-2

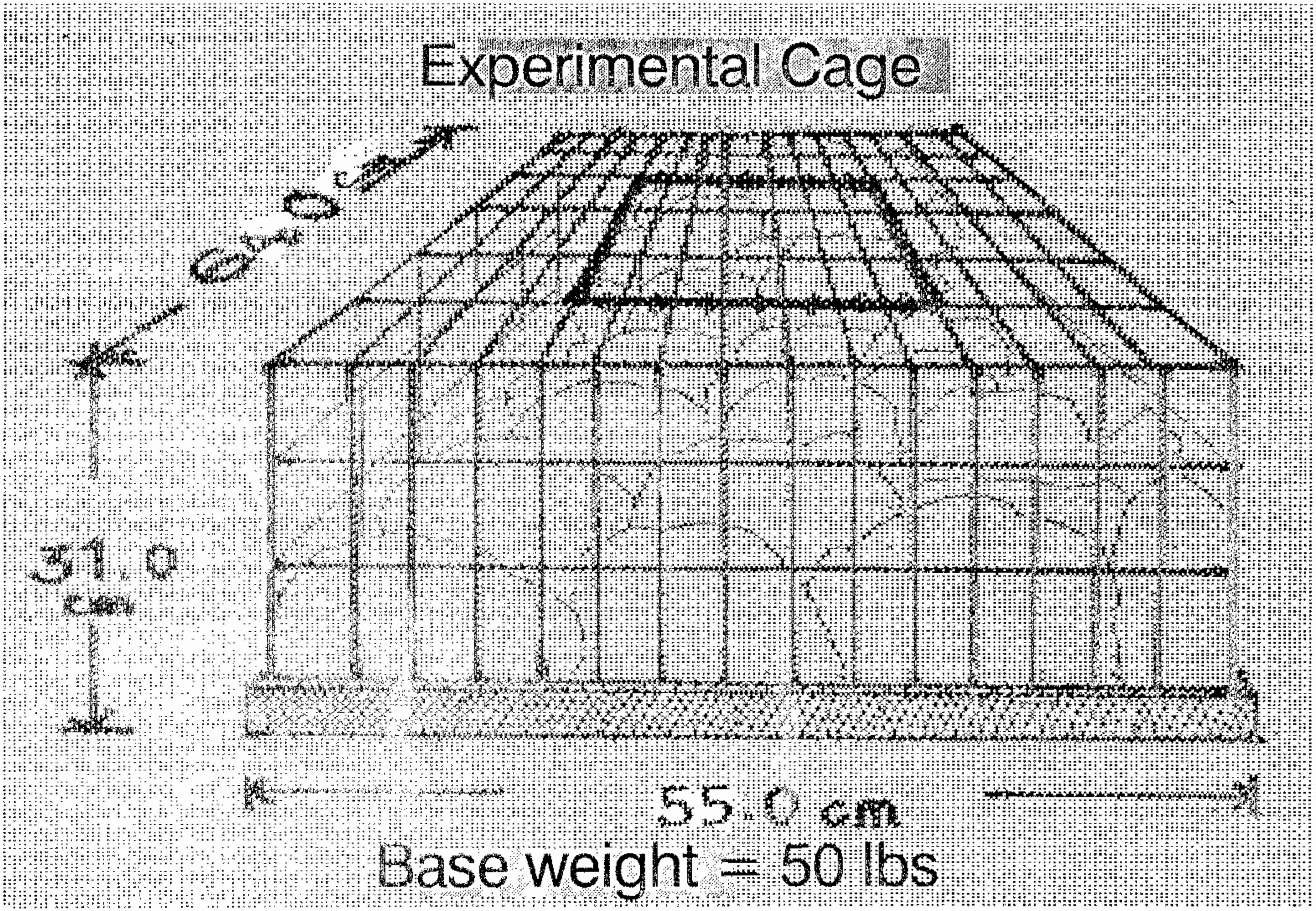

Figure 3

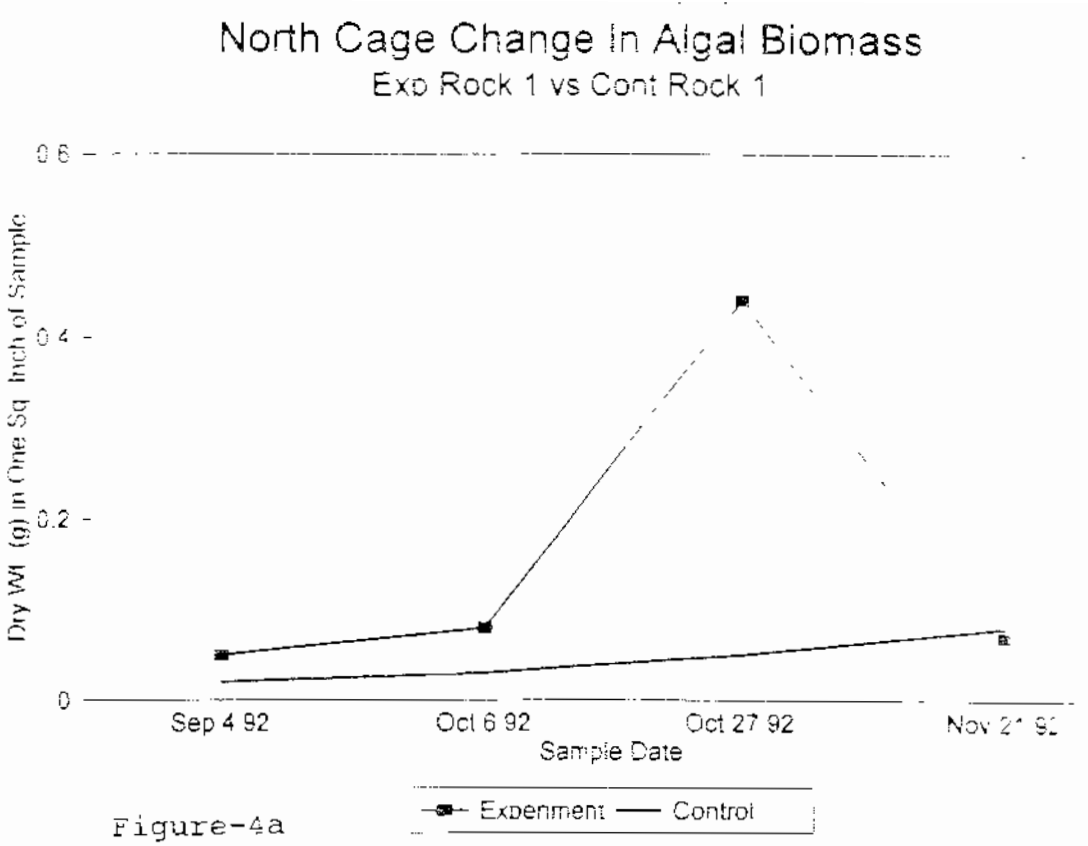

Figure-4a

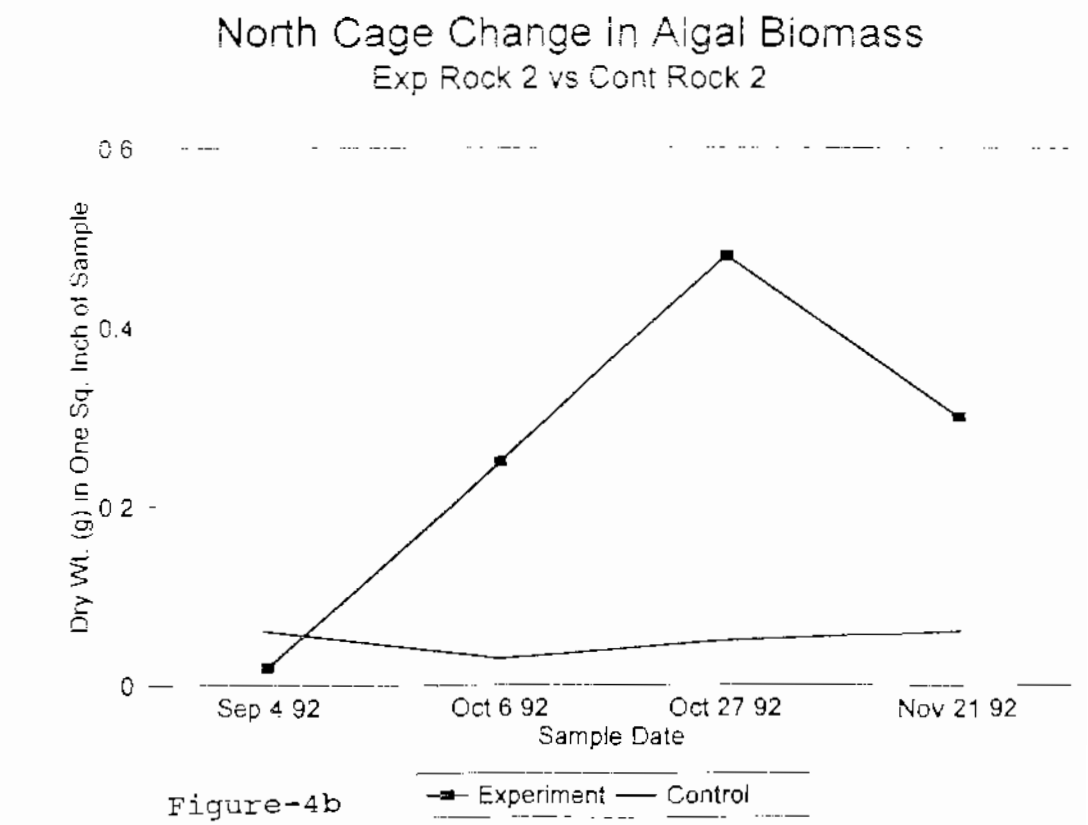

Figure-4b

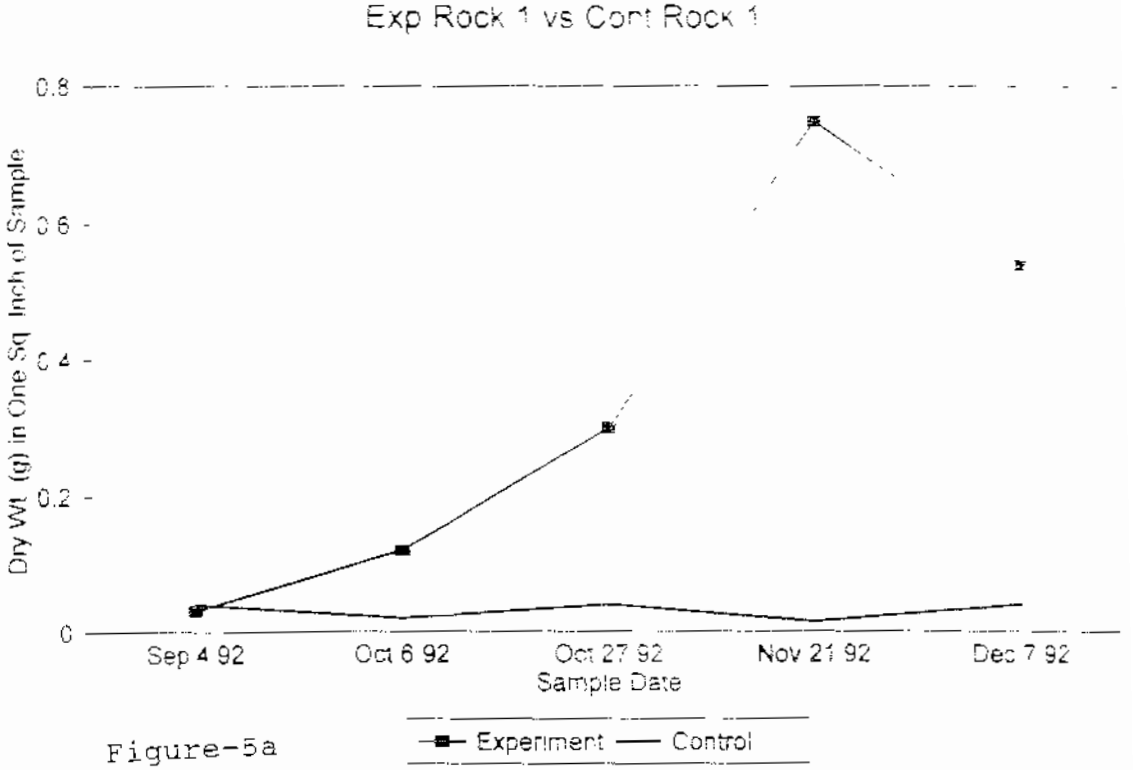

Figure-5a

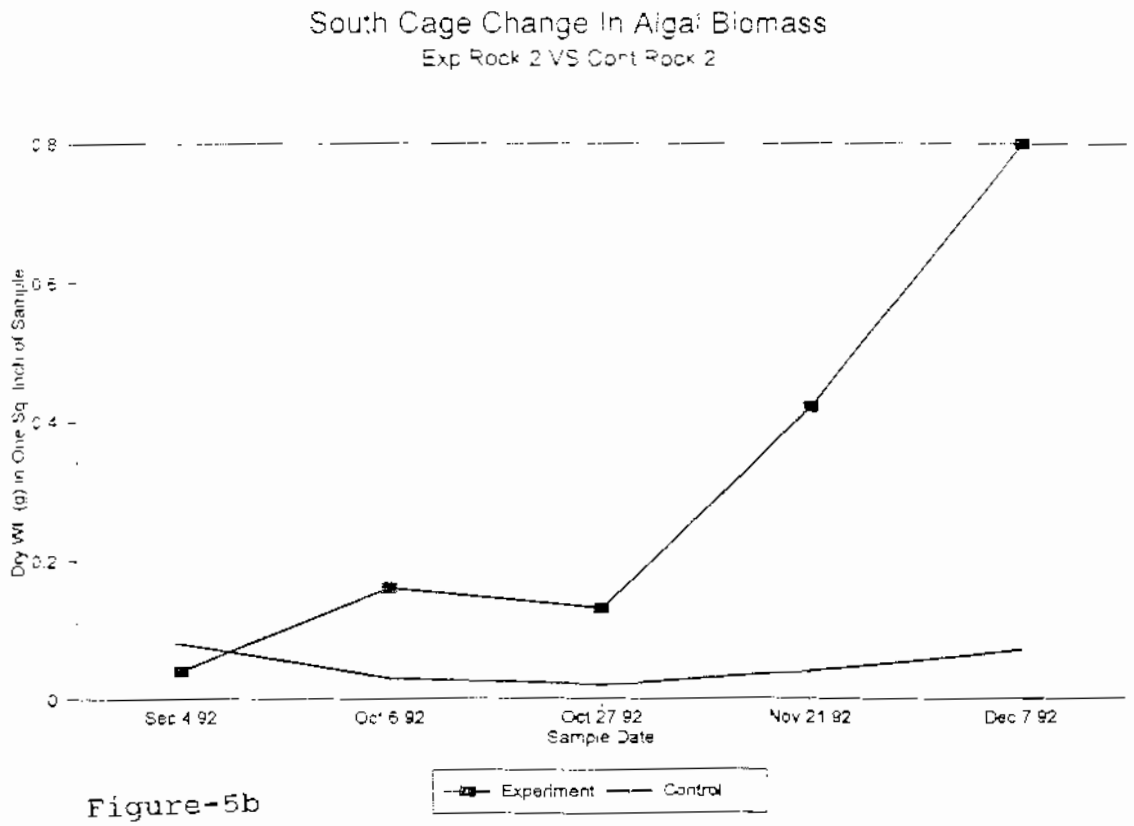

Figure-5b

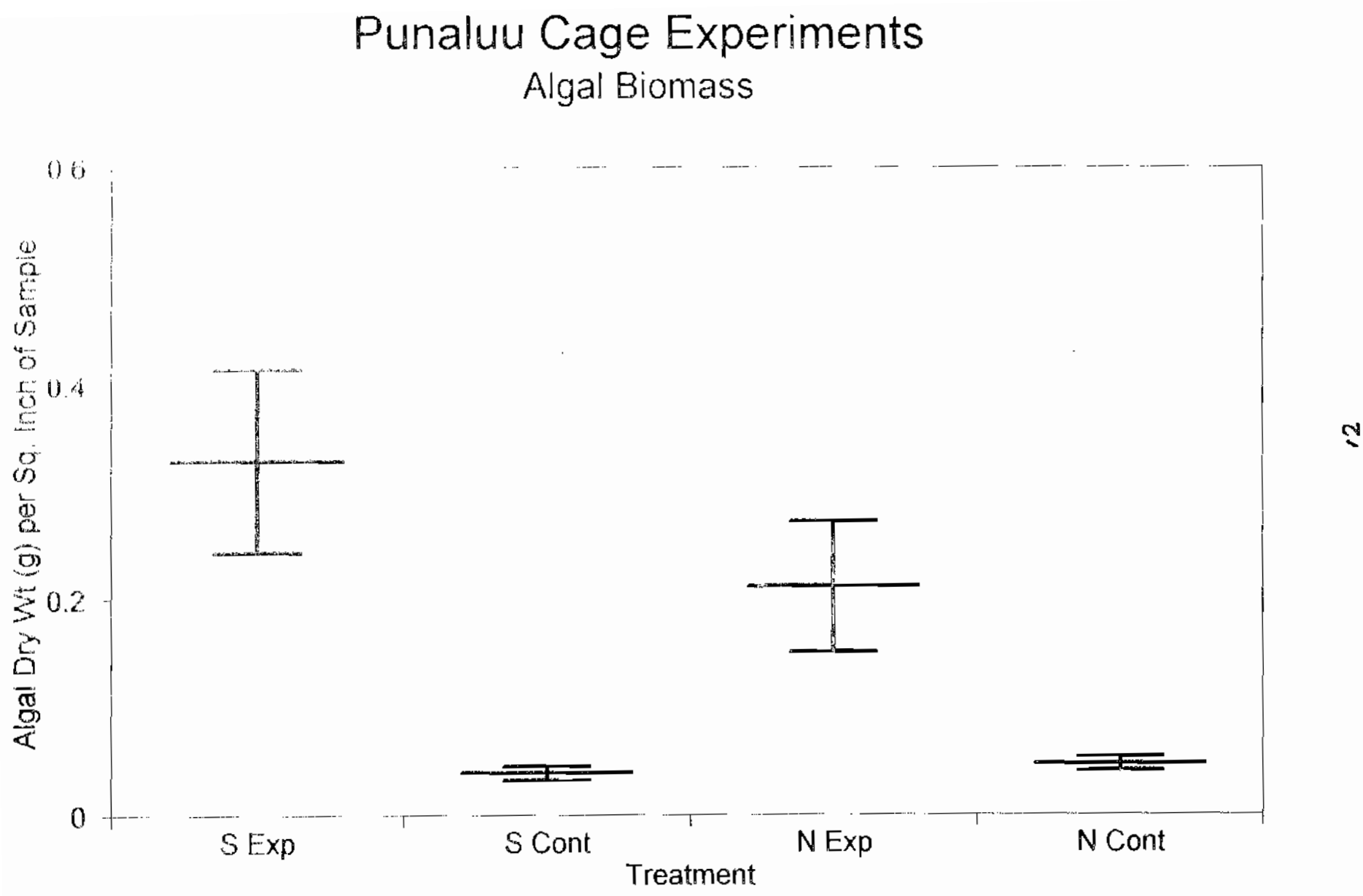
Punaluu Cage Experiments
Algal Biomass
Algal Dry Wt (g) per Sq. Inch of Sample
0.6
0.4
0.2
0
S Exp
S Cont
N Exp
N Cont
Treatment

Figure-6