FACTORS CONTROLLING MACROPHYTE BREAKAGE IN JACKSON LAKE, GRAND TETON NATIONAL PARK, WYOMING

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Objectives

The research described here is part of a two year study to characterize the structure and function of the littoral macrophyte community in Jackson Lake, Wyoming. The objectives for the second year were to perform experiments to:

1) Index water movement in the littoral zone of the lake;
2) Identify the zones where the greatest plant breakage occured;
3) Determine the mechanisms and the absolute force required to break the main axis of a plant, and;
4) Measure the productivity of several species of macrophytes.

Methods and Results

Field work was conducted at Jackson Lake from June through August, 1984. During the summer, experiments were conducted at the UW-NPS research dock, the north-west entrance to Spaulding Bay, south-west shore near South Landing and off the north-west shore of Elk Island (Figure 1).

Water movement was measured with dissolution cubes (Doty, 1971) that were set into the littoral zone at the following depths (measured in feet): 2, 5, 10, 15, 20, 25 and 30. Cubes were monitered for three days. At the end of this period, the total cube dissolution was calculated. Using the SPSS analysis of variance model, we found that there was a significant difference in water movement between depths ($p < .01$) and between locations ($p < .001$). Therefore, plants located in shallow zones experience greater exposure to water movement than plants in deep water. Figure 2 illustrates the relationship between relative water movement (cube dissolution) and depth.

To identify zones of high plant breakage, plant segments were suspended in the lake from cinder blocks at depths of 2, 5, 10, 15, 20, 25 and 30 feet at the four experimental locations identified on Figure 1. During the course of the summer, *Elodea canadensis*, *Myriophyllum sp.*, *Potamogeton alpinus* and *Ranunculus aquatilus* were used to identify patterns of plant breakage. The plant material was monitered for three days by SCUBA diving. On each of these three days, two plant segments were removed from each depth. Change in length was then determined for each segment. We used the SPSS logistic regression model to

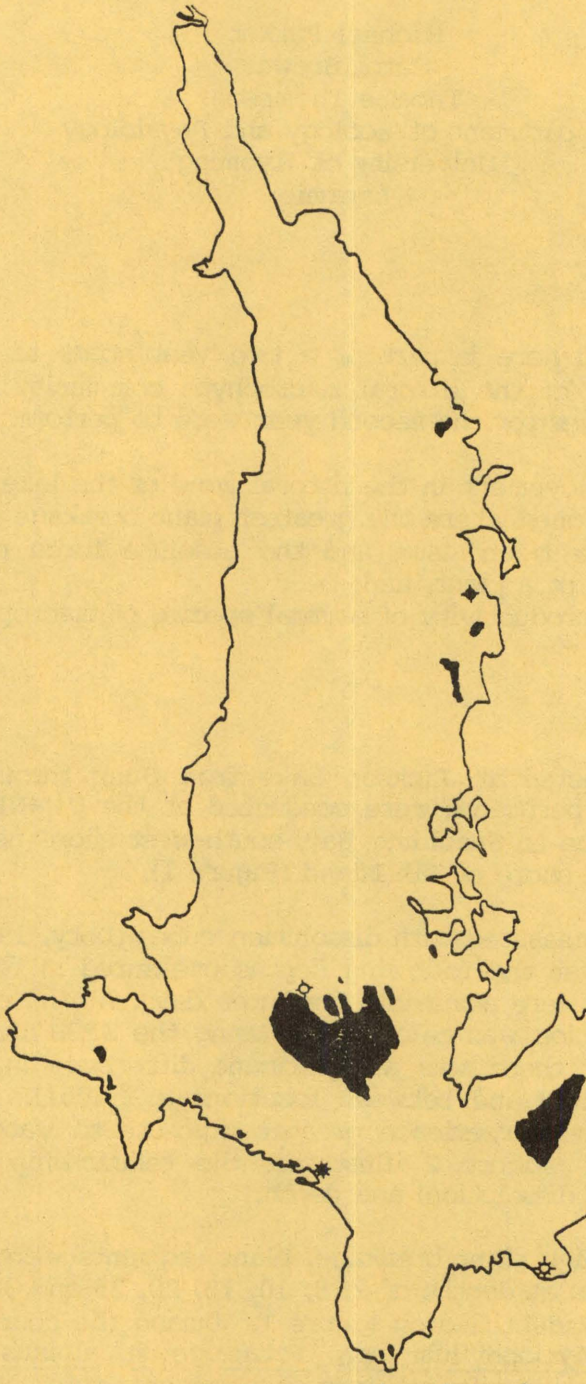

Figure 1. Jackson Lake, Grand Teton National Park.
Experimental locations during 1984.

- ◆ UW-NPS Research Center
- ✲ South Landing
- ✱ Spaulding Bay
- ⌖ Elk Island

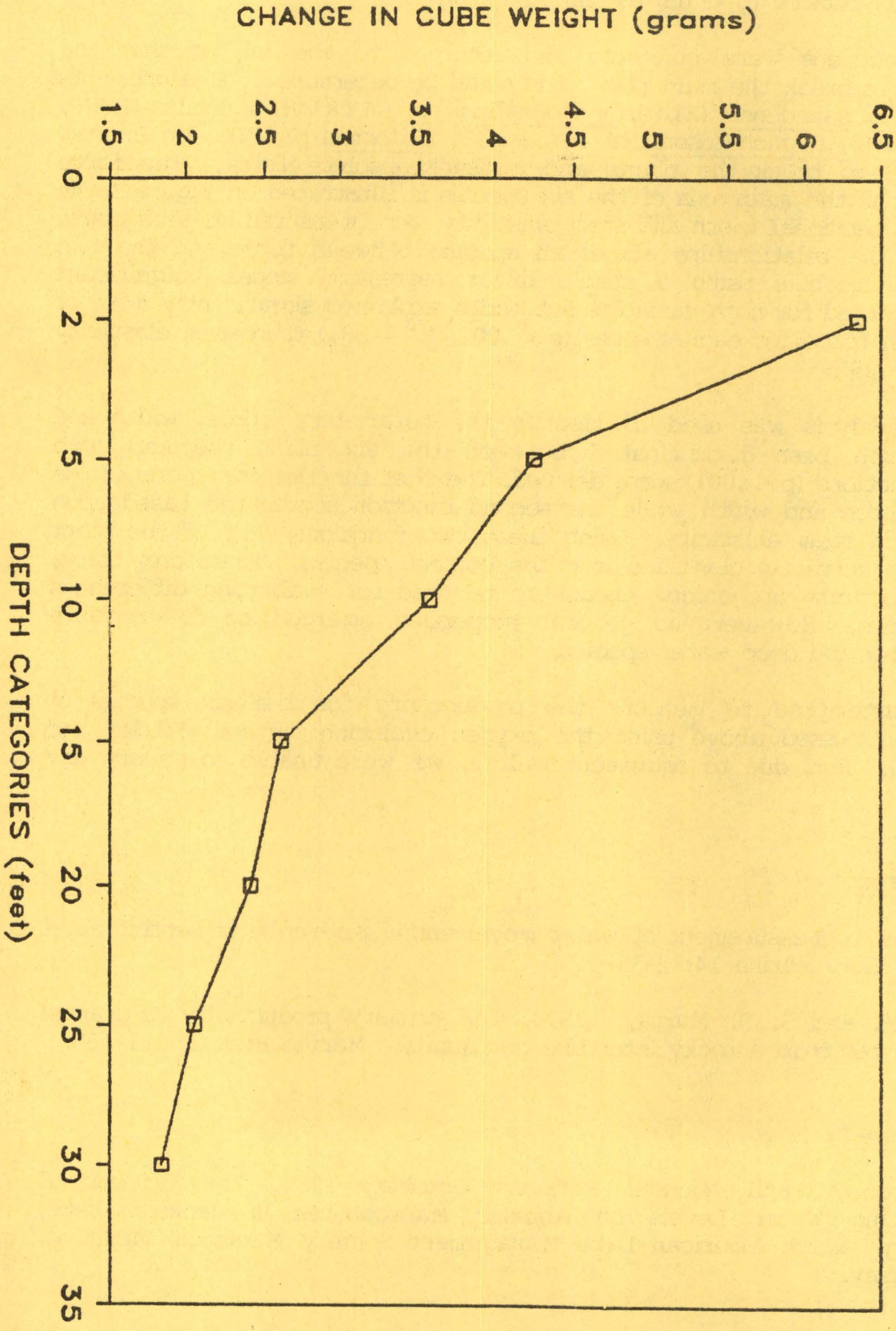

Figure 2. Relationship between relative water movement (cube dissolution) and cube depth.

determine if initial segment length, depth, location, or duration of segment exposure were significantly related to plant breakage. Only duration of exposure was significantly related ($p < .05$) to plant breakage.

In August, specimens were collected and returned to the lab so that the absolute force to break the main plant axis could be determined. Measurements were made on E. canadensis (ELO), Myriophyllum sp. (MYR) R. aquatilus (RAN), P. alpinus (P .AL), P. richardsonii (P RI), and P. filiformis (P .FI). An Instrom 1125 was used to break the plants and measure absolute force. The force required to break the main axis of the six species is illustrated on Figure 3. In addition, cross sectional width and stem elasticity were measured on each plant. We evaluated the relationships across all species between force and the two morphological variables using a simple linear regression model. Significant regressions emerged for both variables but width explained significantly more of the variance in force for each species ($p < .001$, $R^2 = .81$) than stem elasticity ($p < .01$, $R^2 = .25$).

Discriminant analysis was used to identify the parameters (force, width and elasticity) which best discriminated between the six plant species. Two significant functions ($p < .001$) were derived. The first function incorporated the variation in force and width while the second function segregated based upon the variation in stem elasticity. Using these two functions, 73% of the plant segments were correctly classified into the correct species. Therefore, force, width, and elasticity are unique enough to be used for evaluating differences between species. However, no general properties emerged to differentiate between shallow and deep water species.

Finally, we attempted to measure the productivity for the six species of macrophytes discussed above using the oxygen evolution method (Littler and Murray, 1974). But, due to equipment failure, we were unable to collect any usable data.

Literature Cited

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Brewer, Carol A. and Michael Parker. October, 1984. The Effects of Fluctuating Water Levels on Aquatic Macrophytes in Jackson Lake, Wyoming. North American Lake Management Society Meetings, McAffee, New Jersey.

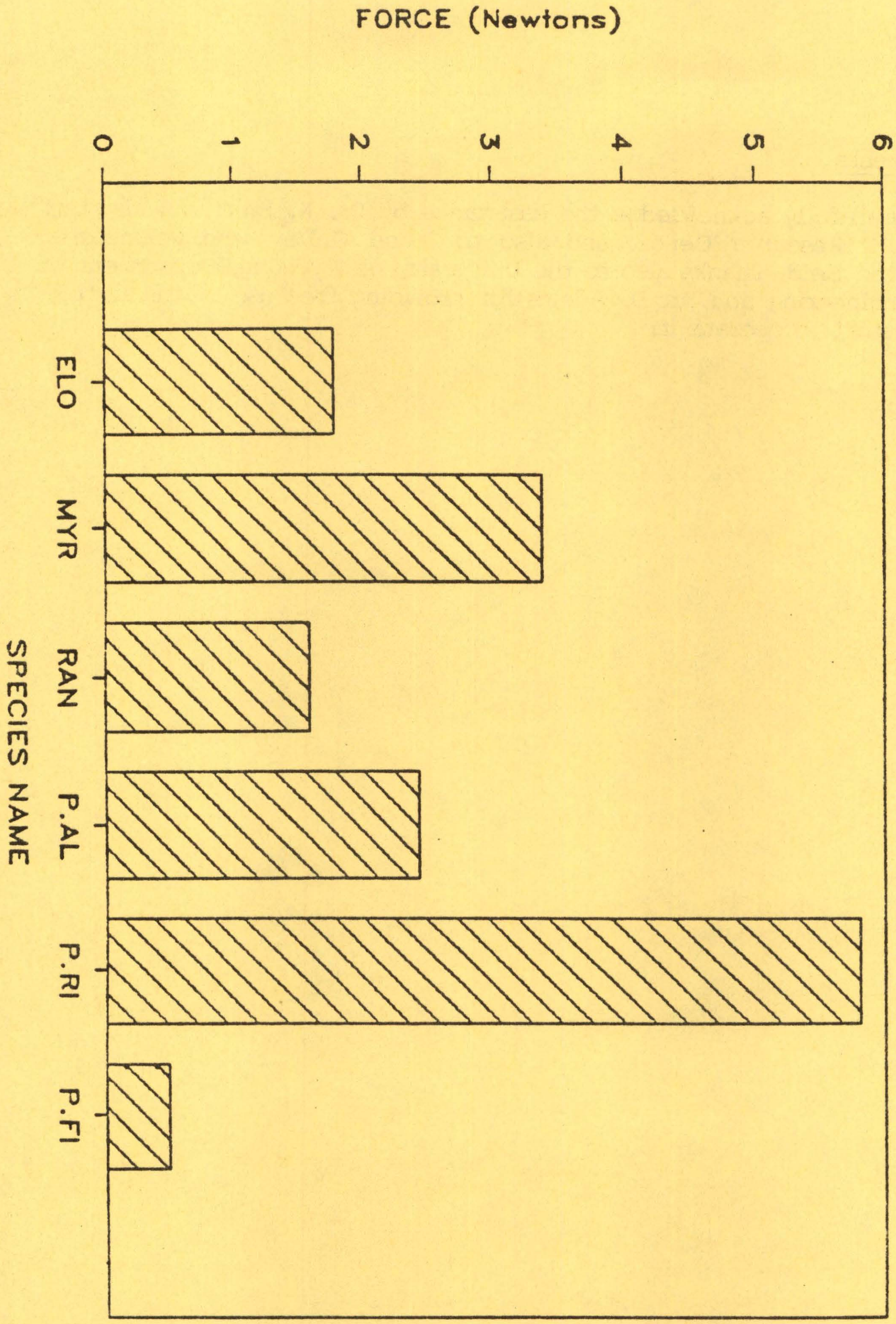

Figure 3. Force (in newtons) to break the main axis of six plant species.

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