J. theor. Biol. (1983) **105,** 273–286

Lake Geometry: Implications for Production and Sediment Accretion Rates

STEPHEN R. CARPENTER

Department of Biology, University of Notre Dame, Notre Dame, Indiana 46556, *U.S.A.*

(*Received* 27 *January* 1983, *and in revised form* 11 *May* 1983)

A geometric analysis distinguishes between the size and shape components of lake morphometry. Implications of shape for nutrient recycling are investigated using models that relate two ratios: (1) sediment surface area in contact with the epilimnion to epilmnetic volume, and (2) mean depth to maximum depth (the depth ratio). The epilimnion's sediment surface area to volume ratio declines with depth ratio, in lakes with thermoclines shallower than about 1·2 times the mean depth. As depth ratio decreases, therefore, potential nutrient recycling from the sediment surface, productivity, and sediment accretion rates are predicted to increase. This prediction is borne out by a significant netative correlation between productivity and depth ratio. The theoretical relationship of depth ratio to productivity and sediment accretion rate helps explain some limnological differences among lake districts. Glacially-formed lakes often have low depth ratios, and should therefore be more productive and fill with sediment more rapidly than otherwise similar lakes with high depth ratios, which often originate from volcanic or tectonic events.