

MARTIN J. LECHOWICZ AND MICHAEL S. ADAMS

Department of Botany - University of Wisconsin
Madison, Wisconsin 53706, U.S.A.

A NOTE
ON AQUATIC MACROPHYTE PRODUCTIVITY
IN LAKE MAGGIORE

Abstract

Mean productivities of *Lagarosiphon major*, *Myriophyllum spicatum*, *Potamogeton crispus*, *P. lucens*, and *Trapa natans* in Lake Maggiore were measured by a ^{14}C technique. Rates varied from $6.64 \text{ mg C} \cdot \text{g}^{-1} \cdot \text{hr}^{-1}$ in growing tips of *M. spicatum* to $0.30 \text{ mg C} \cdot \text{g}^{-1} \cdot \text{hr}^{-1}$ in the still-submerged rosette leaves of *T. natans* at irradiance of about $0.7 \text{ ly} \cdot \text{min}^{-1}$ and temperature $21\text{-}25^\circ\text{C}$.

INTRODUCTION.

Phytoplankton primary productivity in Lake Maggiore has been studied (Gerletti, 1968; Goldman, Gerletti, Javornický, Melchiorri-Santolini and de Amezaga, 1968; Saraceni and Gerletti, 1968; Bonomi, Gerletti, Indri and L. Tonolli, 1970; Gerletti, 1972; Barbanti, Calderoni and Carollo, 1974), but no data on the lake's macrophyte productivity exist. Aquatic macrophytes are moderately abundant in certain localities and require consideration in a holistic, system level analysis of Lake Maggiore as suggested by Bonomi (1969). We have made a preliminary assessment of the primary productivity of four submersed macrophytes — *Lagarosiphon major*, *Myriophyllum spicatum*, *Potamogeton crispus* and *P. lucens* — and of the young, submersed leaves of the floating-leaved macrophyte, *Trapa natans*, in Lake Maggiore.

METHODS.

Primary productivity of *L. major*, *M. spicatum*, *P. crispus*, *P. lucens*, and *T. natans* growing in the embayment at Fondotoce was determined with a slightly modified ^{14}C method of Wetzel (Adams *et al.*, 1974). Young, fully expanded leaves or entire growing tips were used in the incubations except with *T. natans* where young leaves from the still submersed rosette were studied. Generally less than .05 g oven dry weight leaf tissue was incubated in a neutral glass bottle (Jena Glas Schott and Gen., Mainz, Germany) of 277-300 ml volume. Incubations were made on freshly collected leaves on the morning of June 5, 1974 and the mid-afternoons of June 4 and 5, 1974. Net irradiance

during the experiments was recorded at the Istituto Italiano di Idrobiologia in nearby Pallanza by a Kipp-Zonen solarimetric pile. On-site total alkalinity as determined by a conductivity titration method (Voltenweider, 1962) at the Istituto Italiano di Idrobiologia was 37 mg $\text{CaCO}_3 \cdot \text{liter}^{-1}$. One hour experiments were run with the incubation bottles in a water-filled, shallow reflective trough on deck; incubation bottle temperature was held between 21-25 °C. Replicates were arranged in a sequence that minimized effects of changing irradiance during an experimental series. Non-radioactive samples were run simultaneously to allow measurement of depletion in total available carbon during the hour incubation; no significant depletion of total available carbon occurred.

RESULTS AND DISCUSSION.

The mean productivities of the five macrophytes at irradiance of about 0.7 $\text{ly} \cdot \text{min}^{-1}$ and temperatures between 21-25 °C are shown with their standard error in Table 1. Analysis of variance indicates that all pairwise comparisons are very highly significantly different ($P \leq .001$) with only three exceptions: 1) *L. major* and *P. lucens* do not differ ($P = .92$), 2) *P. lucens* and *P. crispus* differ with only marginal significance ($P = .05$), and 3) *P. crispus* and *L. major* differ significantly ($P = .04$).

Table 1. - Macrophyte productivity.

<i>Lagarosiphon major</i>	4.32 ± .14	mg C · g ⁻¹ (dry wt.) · hr ⁻¹
<i>Myriophyllum spicatum</i>	6.64 ± .18	mg C · g ⁻¹ (dry wt.) · hr ⁻¹
<i>Potamogeton crispus</i>	3.32 ± .04	mg C · g ⁻¹ (dry wt.) · hr ⁻¹
<i>P. lucens</i>	4.42 ± .14	mg C · g ⁻¹ (dry wt.) · hr ⁻¹
<i>Trapa natans</i>	0.30 ± .002	mg C · g ⁻¹ (dry wt.) · hr ⁻¹

These data provide values for non-emergent macrophyte productivity in Lake Maggiore. Foregoing extended discussion, we note two points relevant to further study. First, since the *T. natans* submersed leaves' productivity is so low, the rapid growth of the submersed rosette to the surface may be attributed to fruit-stored energy reserves. Second, the Lake Maggiore non-emergent macrophyte community offers a potentially important contrast between two successful aquatic weedy

invaders. The Eurasian *M. spicatum* has entered and dominated many North American lakes while the South African *L. major* has invaded Lake Maggiore and other European lakes (Koch, 1950; Sculthorpe, 1967). *Myriophyllum spicatum*, recently introduced to Lake Mendota, Wisconsin, now represents 98% of the submersed macrophyte community biomass (Lind and Cottam, 1969); *L. major*, although present on our study site since at least 1947 (Koch, 1950) has apparently not disrupted the native macrophyte community. In Lake Maggiore, *L. major* appears to colonize sandy littoral areas largely unexploited by the native macrophytes; it may also still occur in deeper waters as reported by Mason (1970) in New Zealand and by Koch (1950) in Lake Maggiore. Our results suggest *L. major* productivity equals that of *P. lucens* and is exceeded by that of *M. spicatum*, at least under the early summer conditions of Lake Maggiore. These productivity relations help explain *L. major's* failure to dominate the Fondotoce macrophyte community in contrast to *M. spicatum's* dominance in Lake Mendota. Further analysis of the biology of these two aquatic weeds should be done, and could be useful in lake management.

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