

PRIMARY PRODUCTIVITY ASSESSMENT OF MARINE
BENTHIC MACROPHYTES : A COMPARATIVE
STUDY ON THE METHODOLOGY

A Thesis

Presented to the Faculty of the
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In Partial Fulfillment
of the Requirements for the Degree
Master of Science in Biology

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ABSTRACT

The assessment of primary productivity of benthic macrophyte in terms of photosynthetic capacity, production rates and daily or annual budgets were performed employing oxygen and plant growth method. Experiments were performed either under laboratory or in situ conditions.

The net oxygen exchange rates were measured in "closed systems": laboratory chamber, bottles (with or without using neutral light filters) and plastic bag. The influence of methodological and environmental factors on the differences in the net oxygen exchange rates observed are discussed. Consequently, the I_c and I_s values derived from the P-L curves vary. Similarly the daily or annual budgets computed differ as to the balance between oxygen output (photosynthesis) and oxygen uptake (respiration).

The highest P_{max} and R rates were determined in the bag experiments while the lowest values were obtained in the laboratory experiments.

An evaluation on the suitability and feasibility of the methods and techniques employed was done.

The laboratory method showed the best reproducibility of results. Since parameters can easily be controlled this method is suitable for physiological short term measurements of the photosynthetic capacity of a benthic macrophyte. The bag experiments seem to be the most reliable measure of production rates and the daily or annual budgets.

Under local conditions the plant growth method is the most feasible measure of primary production however values obtained are on the lower range due to uncontrolled losses.

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INTRODUCTION

Primary production may be defined generally as the formation of organic compounds of higher energy level using external energy sources. Primary production studies are concerned with the evaluation of the capacity of primary producers or of an ecosystem to build up primary organic compounds of higher chemical potentials at the expense of external energy, both radiant and chemical, for further transformation and flow to a higher system level. Vollenweider (1974) adds that primary production studies are also concerned with the composition, properties and fate of the structural elements of primary producers in the system which act as carriers of the primary production processes.

In tropical shallow water systems such as the intertidal coral reef areas the basic source of primary production is the photosynthesis of benthic macrophytes (algae and seagrasses) and symbiotic zooxanthellae of corals (Odum and Odum, 1956). These producers contribute much to the productivity of the reef systems which are considered amongst the most productive compared to that of other freshwater, marine and terrestrial ecosystems (Bunt, 1975). Estimates by Ferguson, Thayer and Rice (1981) and McRoy and Helfferich (1977) of net organic production by tropical marine macrophytes in such areas may reach up to a range from 500 to 5000 mg C/m². day