BIOMASS PARTITIONING IN ADRIATIC SEAGRASS ECOSYSTEMS (*POSIDONIA OCEANICA, CYMODOCEA NODOSA, ZOSTERA MARINA*)

Mazzella L.[1], P. Guidetti[1*], M. Lorenti[1], M.C. Buia[1], V. Zupo[1], M.B. Scipione[1], A. Rismondo[2], D. Curiel[2]

[1] Laboratorio di Ecologia del Benthos, Stazione Zoologica "A. Dohrn" di Napoli, P.ta S. Pietro I-80077, Ischia Porto, Napoli, Italy

[2] Dipartimento di Biologia, Università di Padova, Via Trieste 75, 35121 Padova, Italy

Abstract

Biomass measurements of different plant compartments and associated flora and fauna (epiphytic and vagile invertebrates) were conducted on *Posidonia oceanica*, *Cymodocea nodosa* and *Zostera marina*. Samples were collected in February 1997 in two different areas (Otranto and Grado) located in Southern and Northern Adriatic, respectively. *P. oceanica* shows the highest total biomass, due in particular to scales, leaves and living rhizomes, while in *C. nodosa*, living rhizomes and roots dominate other components. In *Z. marina* dead rhizomes and roots account for up to 50 % of overall biomass. Highest values of total biomass of epiphytes have been observed in *C. nodosa*, while *Z. marina* shows highest biomass and numerical abundance of associated vagile invertebrates.

Key-words: biomass, phanerogams, coastal systems, Adriatic Sea

Introduction

The paramount importance of seagrass ecosystems for the coastal waters dynamic and functioning has been largely described for several seas (1). For the Mediterranean Sea, and in particular for the Adriatic Sea, early studies testify their importance for the coastal environments (2; 3). Interestingly, in the Adriatic Sea all five species recorded for the Mediterranean are present. These species colonize different coastlines and type of substrata or habitats, according to their life requirements and adaptation to the marine and/or lagoon environment (4; 5). In particular, *Posidonia oceanica* (L.) Delile is mainly present along the open coasts in Southern and North-Eastern Adriatic (6; 7), while *Cymodocea nodosa* (Ucria) Ascherson and *Zostera noltii* Hornem. are more evenly distributed and *Z. marina* (L.) is confined to the North (5). In the frame of the general decay of environmental quality in the Adriatic Sea, recent investigations demonstrate a massive regression of seagrass meadows in northern Adriatic (8; 9; 10).

In a framework of a large national Italian programme (PRISMA) aimed at understanding the dynamical processes at various scales and the evolution of biotic communities in the Adriatic Sea, a project finalized to investigate biomass partitioning and nutrient stocks and fluxes in some seagrass species and their ecosystems took start. In the present paper, first results are reported pertaining to biomass partitioning in three species, *Posidonia oceanica*, *Cymodocea nodosa* and *Zostera marina*, which have different architecture and differently influence the local environment by amplifying the substrate through their leaf canopy development and affecting the biodiversity of associated communities.

Materials and methods

Marine phanerogams were sampled in February 1997 by SCUBA diving or snorkelling, dependent on depth, in two different areas located in the South and North of the Adriatic Sea, namely Otranto (Lecce) for *P. oceanica* and Grado (Gorizia) for *C. nodosa* and *Z. marina*.

The *P. oceanica* meadow at Otranto was located at 6.5 m depth on a coarse sand bottom. Water temperature, during the sampling campaign, was about 11.8 °C and salinity was recorded as 38 ‰. Both *C. nodosa* and *Z. marina* were settled outside the eastern portion of the Lagoon of Grado, on a pelitic sand bottom at 1.2 and 0.5 m depth, respectively; water temperature was 8.9 °C and salinity 34% near the *C. nodosa* meadow, while *Z. marina* sampling site was characterized by a temperature of 8.8 °C and a salinity of 30 ‰.

Shoot density was measured in situ within 30 x 30 cm quadrats for *P. oceanica* (2 replicates) and *Z. marina* (10 replicates), and 20 x 20 cm quadrats (10 replicates) for *C. nodosa*. For each species, a total of 20 shoots were collected and examined for the phenological analysis, taking into account the number of leaves per shoot, leaf length, leaf width, brown tissue and the percentage of broken apex. Leaf Area Index (LAI) was determined by multiplying the mean leaf surface per shoot by the meadow shoot density.

Biomass was sampled by removing a clod within a quadrat 30 x 30 cm for *P. oceanica* (2 replicates) and by means of corers of 23.6 cm diameter (5 replicates) for the other above mentioned seagrasses. In order to determine dry weight, expressed as g x m^{-2} (mean ± s.d.), plant material was rinsed after sieving to remove sediment. The aboveground portion was subdivided into leaf blades, living sheaths, scales persisting on the rhizomes (only for *P. oceanica*), brown tissue, and separated from living roots, dead roots, living rhizomes, dead rhizomes and detritus. Biomass of algal epiphytes and sessile invertebrates, epiphytic on the leaves, was also estimated. For this purpose, the leaf surface was gently scraped with a razor blade following a treatment in 2% acetic acid for 1 hour. Subsequently, the various components were dried at 60 C° for 48 hours. At each sampling site, vagile fauna was collected by means of a "suction sampler" operated over a surface of 1 m^2, according to Russo *et al.* (11), sorted into the main taxa and lyophilized.

Results

The three meadows show different structure, with *C. nodosa* accounting for the highest values of density and *Z. marina* for the lowest; on the other hand, *P. oceanica* is responsible for the highest LAI (Tab. 1). Leaf length in the sampling period is highest in *Z. marina*, followed by *P. oceanica*, this latter showing a leaf width rarely exceeding 0.8 cm and the highest percentage of eroded apices (Tab.1).

Table 1 : Shoot density and phenological characteristics of the three investigated species.

Parameter	*P. oceanica*	*C. nodosa*	*Z. marina*
n° shoot / m^2	483.5 ± 7.8	977.5 ± 158.3	277.8 ± 44.6
leaf area index (m^2 / m^2)	2.72	0.43	1.26
n° leaves per shoot	7.2 ± 1.2	3.3 ± 0.7	5.6 ± 1.0
mean leaf lenght (cm)	12.4 ± 10.5	7.4 ± 7.3	21.3 ± 19.7
mean leaf width (cm)	0.63 ± 0.23	0.18 ± 0.05	0.38 ± 0.12
broken apex (%)	40.6	29.8	23.2

Three different figures are obtained when biomass partitioning in the three species is considered. *P. oceanica* accounts for the highest total biomass, with a striking difference in comparison to the other species (Fig. 1). Leaf scales, persisting on the rhizomes, and living rhizomes are responsible for the 73.1% of the total biomass, followed by leaves which represent the 19.0%, while living roots give a lower contribution (5.7%) to the total biomass (Fig. 1). In *C. nodosa* living rhizomes and roots account for the 85.7%, while, in *Z. marina*, dead rhizomes and roots account for 57.8% and leaves for 27.4% of the total plant biomass (Fig. 1).

Different results among the three species are also obtained when comparing the biomass of associated communities (Fig. 2). In this case, *C. nodosa* accounts for the highest biomass, imputable to algal epiphytes, which however, are represented by microalgae (Diatoms) in mucilage tubes and by entrapped sediment and in a lesser extent by some macroalgae. In *P. oceanica* equal importance of algal epiphytes (encrusting algae) and sessile invertebrates (Hydroida, Bryozoa and

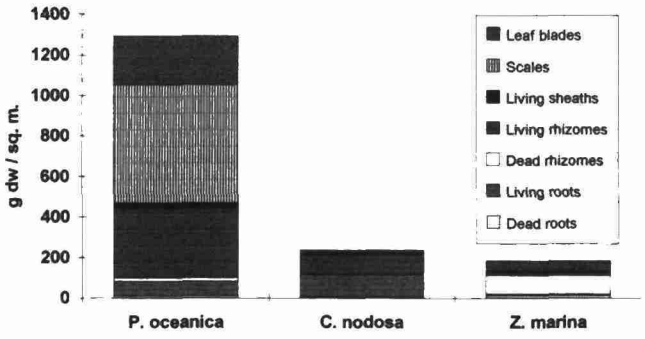

Fig. 1 - Biomass of different plant compartments of the three seagrass species.