Hydrobiologia **326/327:** 259–265, 1996.
S. C. Lindstrom & D. J. Chapman (eds), Fifteenth International Seaweed Symposium.

The relationship between stand biomass and frond density in the clonal alga *Mazzaella cornucopiae* (Rhodophyta, Gigartinaceae)

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Key words: biomass-density relationship, Gigartinaceae, *Mazzaella cornucopiae*, seaweed, self-thinning

Abstract

The negative relationship between stand biomass and plant density observed in terrestrial plants was tested among fronds of a clonal red alga, *Mazzaella cornucopiae*. Stand biomass and frond density were estimated bimonthly for 1 year on 7 permanent quadrats. A positive linear correlation was found between biomass and density for the whole data set, suggesting the lack of self-thinning among fronds of this intertidal alga at natural densities. Higher frond densities could favor increased water retention among fronds, thus minimizing desiccation during low tides. In this way, stands could maintain higher production of biomass. Fronds may also be cushioned better against wave action at higher frond densities, thus decreasing the detachment of larger fronds. The temporal variation of the relationship between biomass and density was plotted separately for these 7 quadrats. Four quadrats showed positive linear correlation between both variables (the other three quadrats showed non-significant positive linear correlation). Their four slopes are statistically similar to that found for the entire data set. It is possible, then, that there is only one positive slope for the biomass-density relationship in this population. If this is true, standing biomass could be estimated from the density of fronds.

Introduction

For species of terrestrial plants occurring in monospecific, even-aged, and crowded stands, a bilogarithmic plot of stand biomass versus plant density results in a negative correlation (Weller, 1987, 1989). This relationship, hereafter referred to as the Biomass-Density relationship, must not be confused with the self-thinning lines. The self-thinning lines describe the temporal variation of the relationship between stand biomass and plant density of different plant stands plotted separately. As plant stands age, they reach a point where density-dependent mortality results in a decrease in plant density while stand biomass increases, resulting in a negative slope in the biomass-density plot. All data points used to describe the self-thinning lines for different species define the Biomass-Density relationship for the plant kingdom (Weller, 1987, 1989).

The population ecology of clonal plants can be studied from two points of view: the ecology of genets and the ecology of ramets, which are the actually or potentially independent members of a genet (Jackson *et al.*, 1985). In clonal red seaweeds such as those of the family Gigartinaceae, the genet is the entire thallus originated by a single spore, and it is composed by several foliose fronds produced by a crustose holdfast. Fronds can be considered as ramets, because of their potential capacity of independent life, together with an associated portion of holdfast. There have been few studies of the Biomass-Density relationship in marine algae at genet or ramet levels (Schiel & Choat, 1980; Cousens & Hutchings, 1983; Martínez & Santelices, 1992; Santos, 1995), which present somehow different conclusions (see Discussion for more details). The objective of this research was to study the Biomass-Density relationship at the frond level in a clonal red alga of the family Gigartinaceae, *Mazzaella cornucopiae* (Postels *et* Ruprecht) Hommersand (=*Iridaea*