

Growth and photosynthetic characteristics of three *Zostera* spp. (*Z. japonica*, *Z. marina* and *Z. caespitosa*) along vertical gradient: Implications for seagrass zonation

Sang Rul **Park** and Kun-Seop Lee

Department of Biological Sciences, Pusan National University, Geumjeong-gu, Busan, 609-735, Korea
E-mail: srv99park@pusan.ac.kr

Seagrasses have usually distinct zonation patterns in tropical and temperate areas. In Korea, three *Zostera* spp. (*Z. japonica*, *Z. marina* and *Z. caespitosa*) are distributed at different water depths, leading to specific zonation patterns from intertidal to subtidal zones. The growth and photosynthetic characteristics of those three *Zostera* species, which show distinct vertical zonation, were examined seasonally in Kojé Bay. *Zostera japonica* in the intertidal zone showed the lowest value in shoot height and blade width while *Z. caespitosa* in the subtidal zone exhibited the highest value in specific leaf area. The total chlorophyll (chl *a+b*) and carotenoids concentrations were significantly higher in *Z. japonica* than *Z. marina* and *Z. caespitosa*. The carbon stable isotope ($\delta^{13}\text{C}$) values suggested that inorganic carbon forms used as photosynthetic carbon sources depend on seagrass zonation. The average $r\text{ETR}_{\text{max}}$ was 17.4 ± 0.8 $\mu\text{mol electrons m}^{-2} \text{s}^{-1}$ for *Z. marina*, 13.9 ± 0.7 $\mu\text{mol electrons m}^{-2} \text{s}^{-1}$ for *Z. japonica* and 11.7 ± 0.5 $\mu\text{mol electrons m}^{-2} \text{s}^{-1}$ for *Z. caespitosa*. The F_v/F_m values were higher for *Z. caespitosa* (0.671 ± 0.011) than both *Z. japonica* (0.541 ± 0.013) and *Z. marina* (0.634 ± 0.010). According to the results of rapid light-response curve (RLC) parameters, *Z. japonica* was adapted to high light conditions, while *Z. caespitosa* was low light adapted species. After RLC, *Z. japonica* completely extinguished within 5 min, indicating that its leaf was energy-dependent quenching (qE). Dark respiration of *Z. caespitosa* showed the lowest values while *Z. japonica* had the highest values, suggesting that *Z. caespitosa* can survive with low photosynthetic activity due to low dark respiration rates. The results for the physiological and morphological characteristics were consistent with the observed zonation and differences of seagrasses, and thus variation in these characteristics among species can probably explain the zonation patterns of seagrass.