

An underwater photograph showing a dense, healthy bed of seagrass, likely Zostera marina, with long, green blades reaching upwards. The water is clear and blue, with sunlight filtering through from the surface.

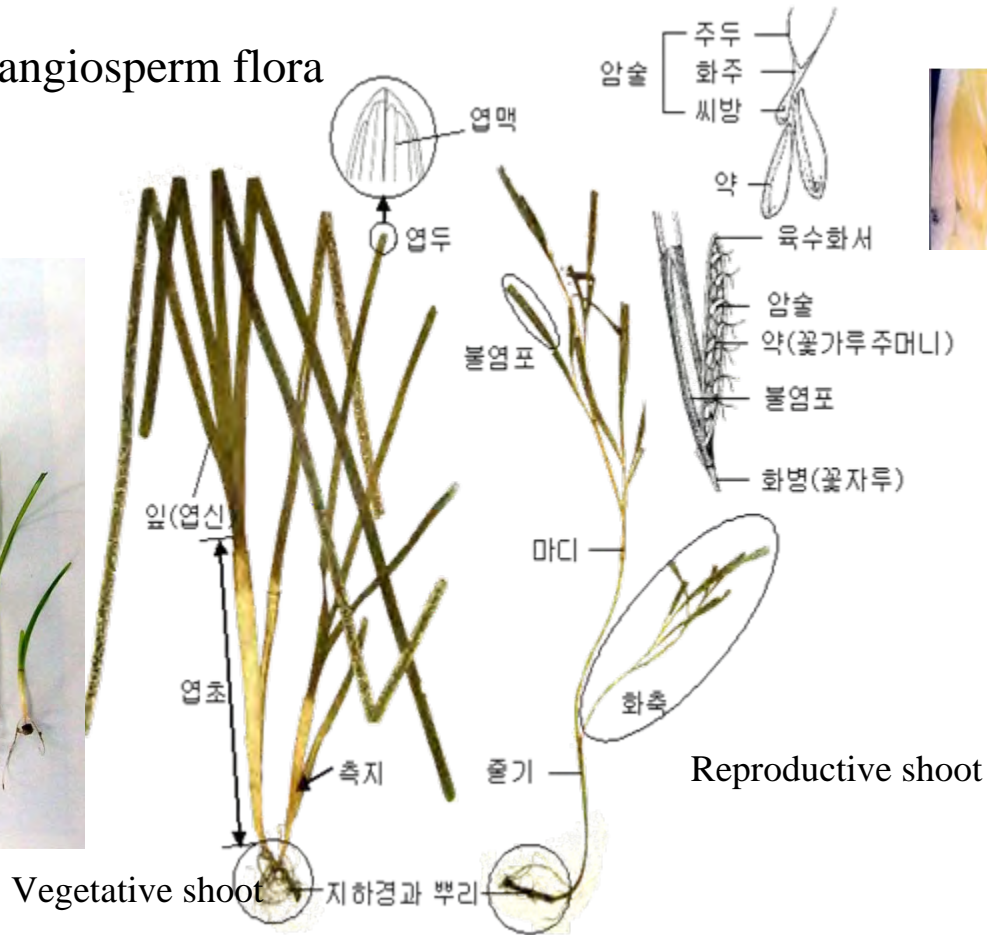
# Seasonal variation in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values for the temperate seagrass *Zostera marina* and its relation to leaf production

Sang Yong Lee and Yong-Gun Gong

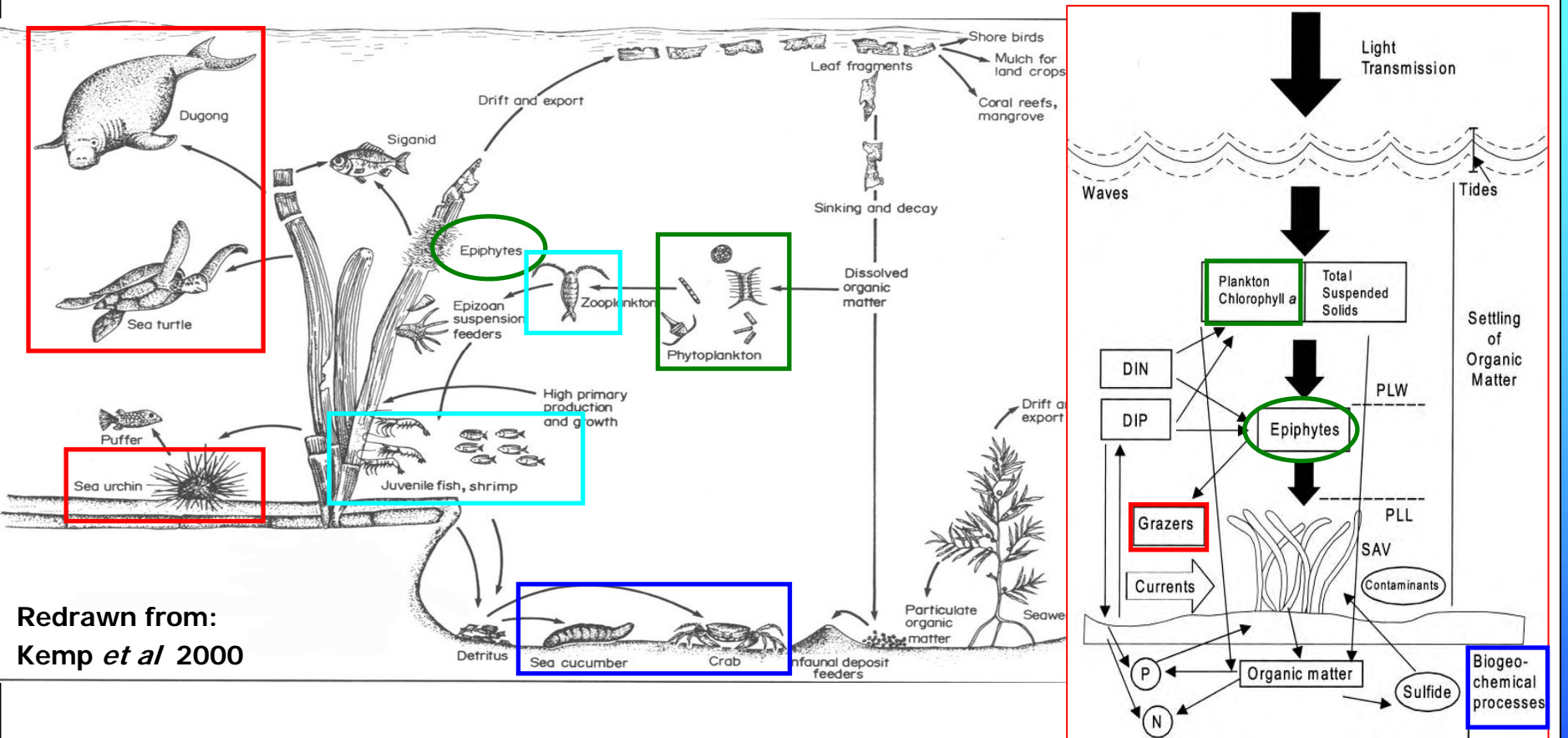
Seaweed Research Institute,  
National Fisheries Research & Development Institute (NFRDI)

# Seagrasses ?

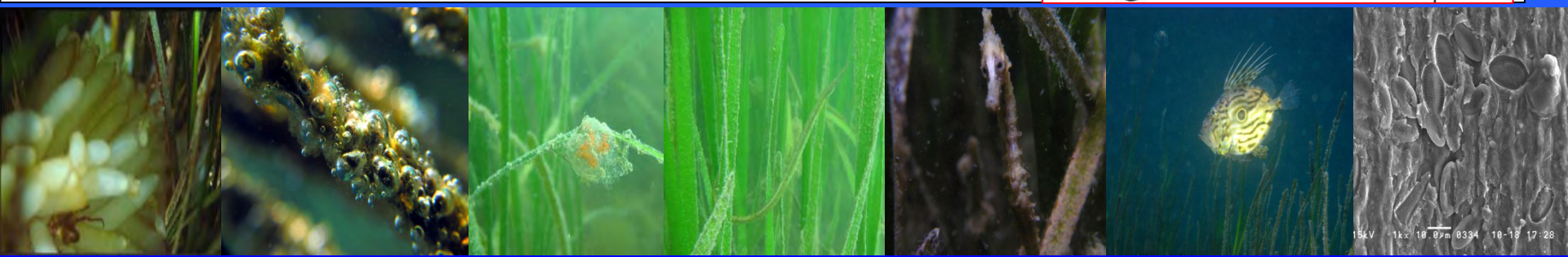
- marine angiosperm flora



# Importance of seagrass and seagrass meadows

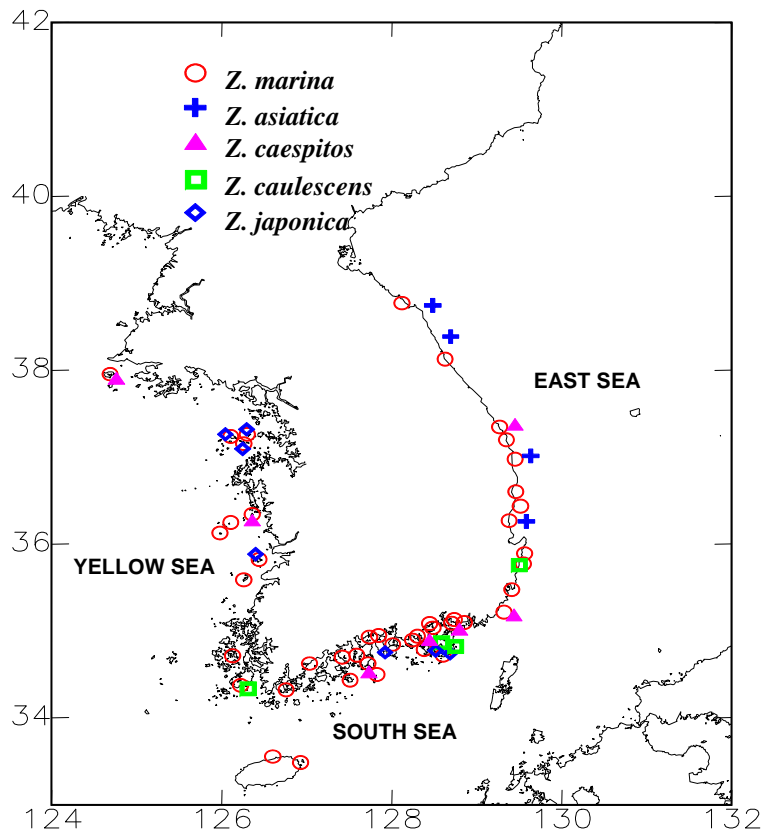


Redrawn from:  
Kemp *et al* 2000

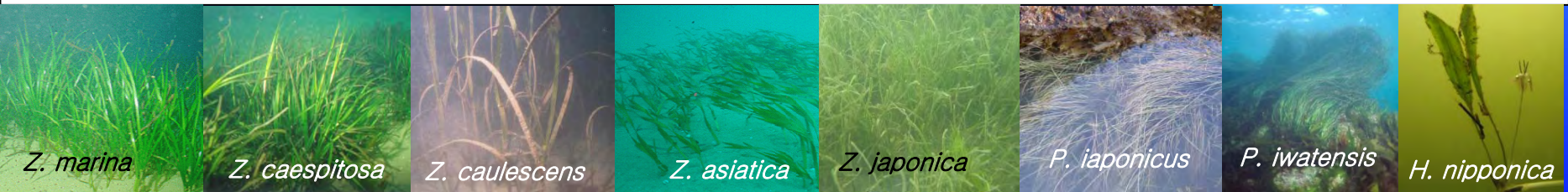
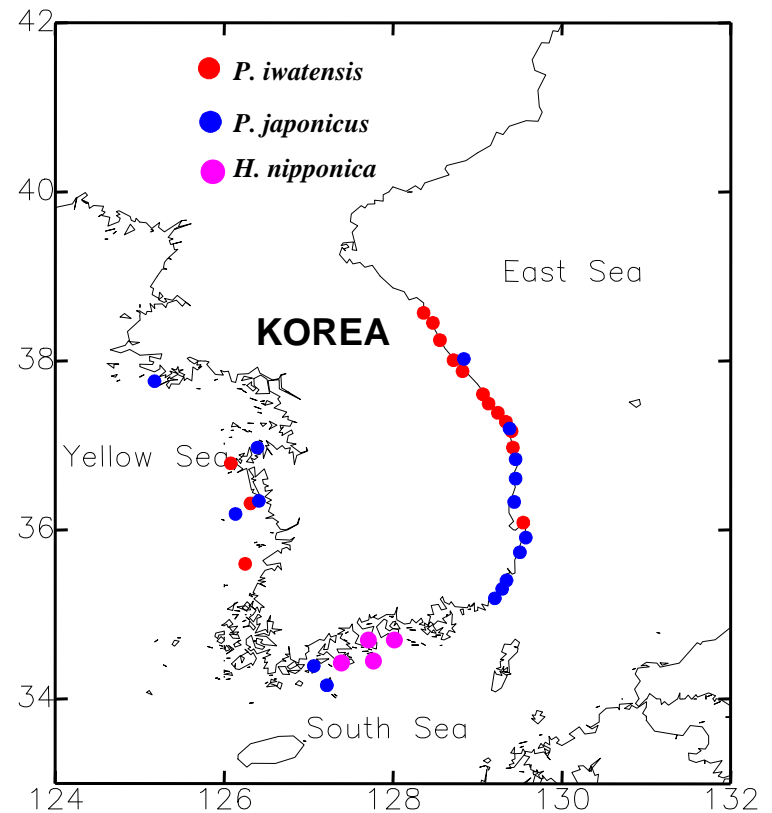


# Distribution of Korean Seagrasses

## ➤ Genus *Zostera*



## ➤ Genus *Phyllospadix* & *Halophila*



# Habitat characteristics of Korean Seagrass, *Zostera marina*



## Introduction

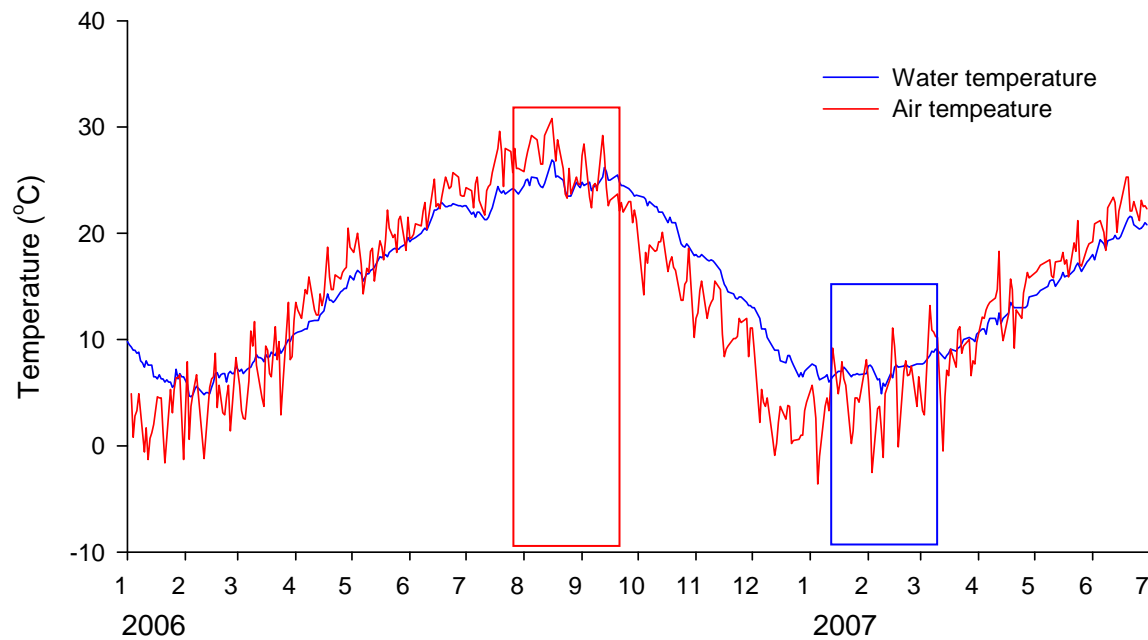
- The content of tissue nutrients (carbon, nitrogen & phosphorus) in seagrass leaves and rhizomes **reflect conditions during growth** of the seagrass tissues (Touchette & Burkholder, 2000)
- The **Carbon stable isotope ratio ( $\delta^{13}\text{C}$ )** of seagrass tissue reflects source carbon, irradiance and temperature (Hemminga & Mateo, 1996)
- The **Nitrogen stable isotope ( $\delta^{15}\text{N}$ )** of seagrass tissues indicate the amount of dissolved inorganic nitrogen in the water column
- The success of stable isotope ratios **in food web ecology** depends upon isotope ratio changing **in predictable ways** as elements cycle through the biosphere (Peterson & Fry, 1987)
- This study represents the seasonal variability of  $^{13}\text{C}/^{12}\text{C}$  and  $^{15}\text{N}/^{14}\text{N}$  in **plant parts** and at different habitats of *Zostera marina*

## Material & Methods

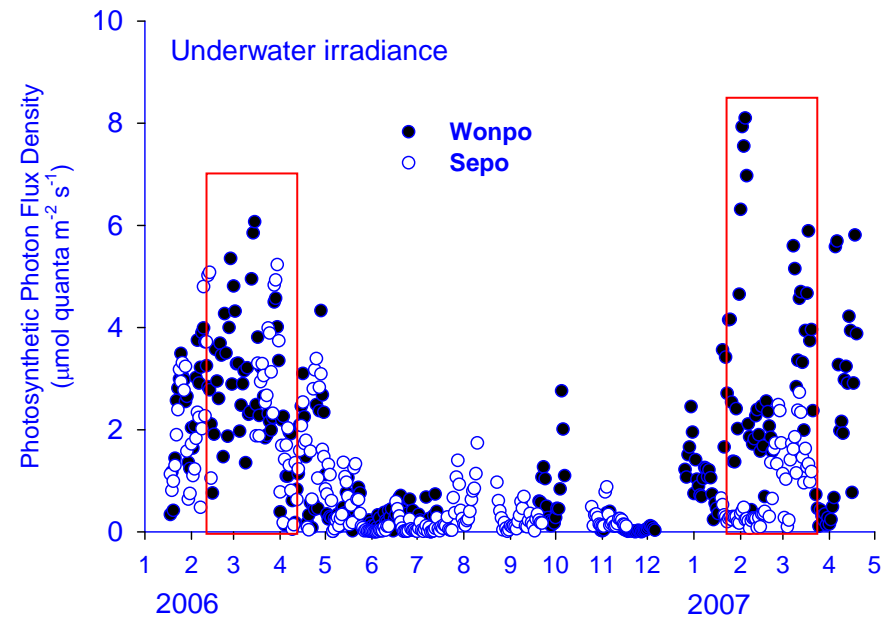
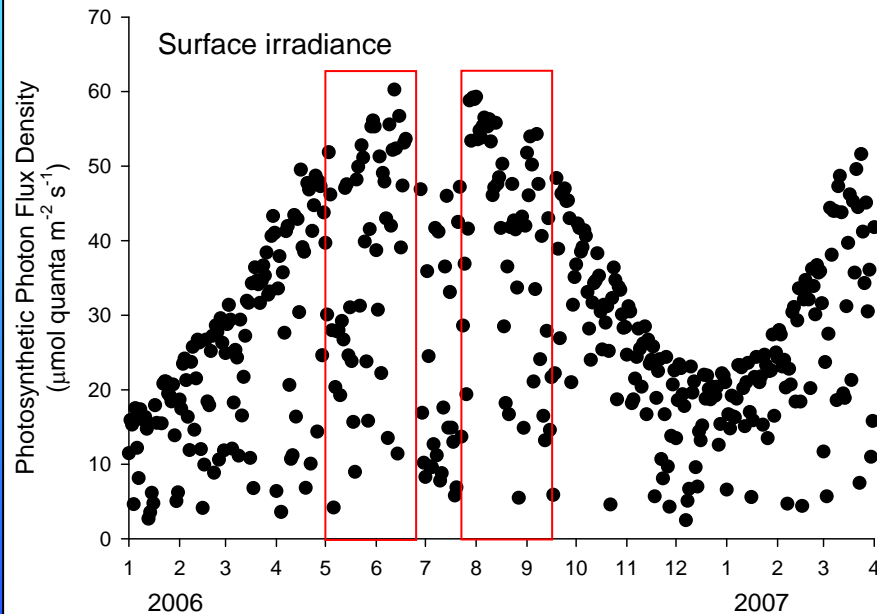
- **Study area:** the study locations were at the southern end of Gamak bay, Yeosu, Korea
  - ✓ **Wonpo site**, comprises a widely of monospecific meadow of *Z. marina*, situated in approximately 0.5-2.0m at **sandy mud** habitat
  - ✓ **Sepo site**, comprises a mosaic of monospecific stands of *Z. marina*, situated in approximately 1.0-3.0m at **coarse sand** habitat
- **Sampling collection and processing**
  - ✓ *Z. marina* plants were collected from sampling was done February 2006 to March 2007
  - ✓ Air & water temperature, underwater light intensity etc.
  - ✓ Biological parameters (morphology, shoot density, biomass, leaf production)
- **Isotope analysis**
  - ✓ The stable isotope ratio were determined using an elemental analyzer connected on-lined to an isotope ratio mass spectrometer (GV Instruments), Hanyang Univ.
- **Statistical analysis**
  - ✓ Differences in habitats were analyzed using one-way ANOVA with the main effect of site and time

# Results

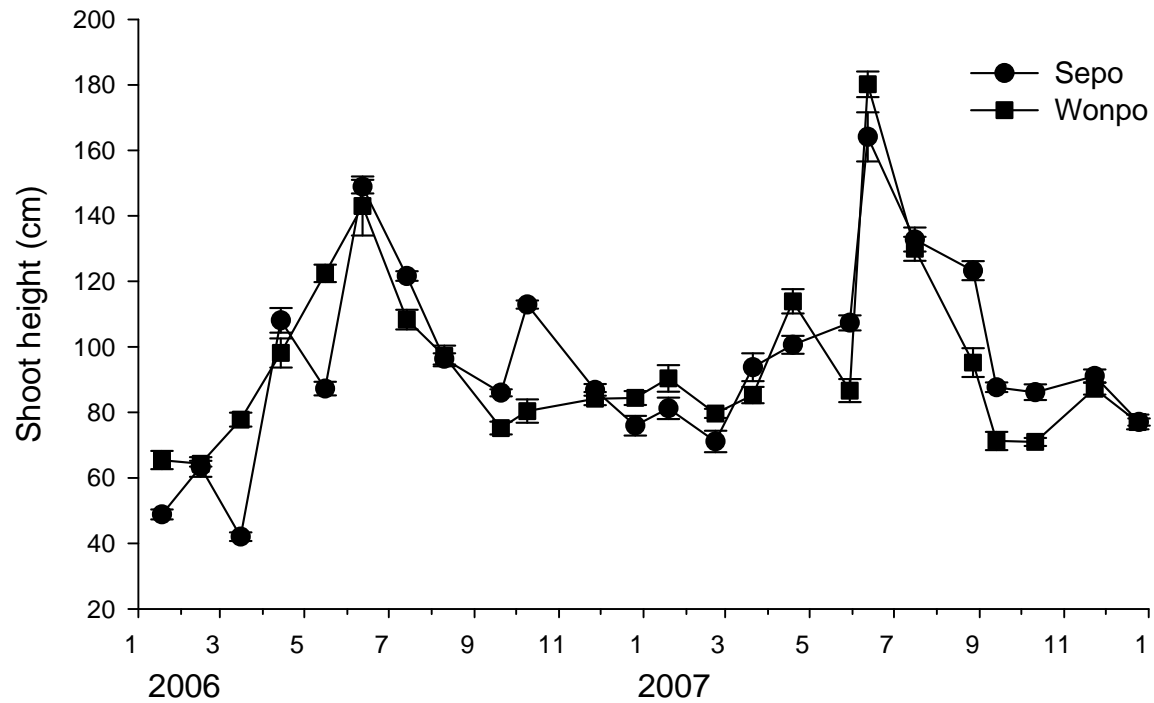
## ➤ Seasonal variations of air and water temperature



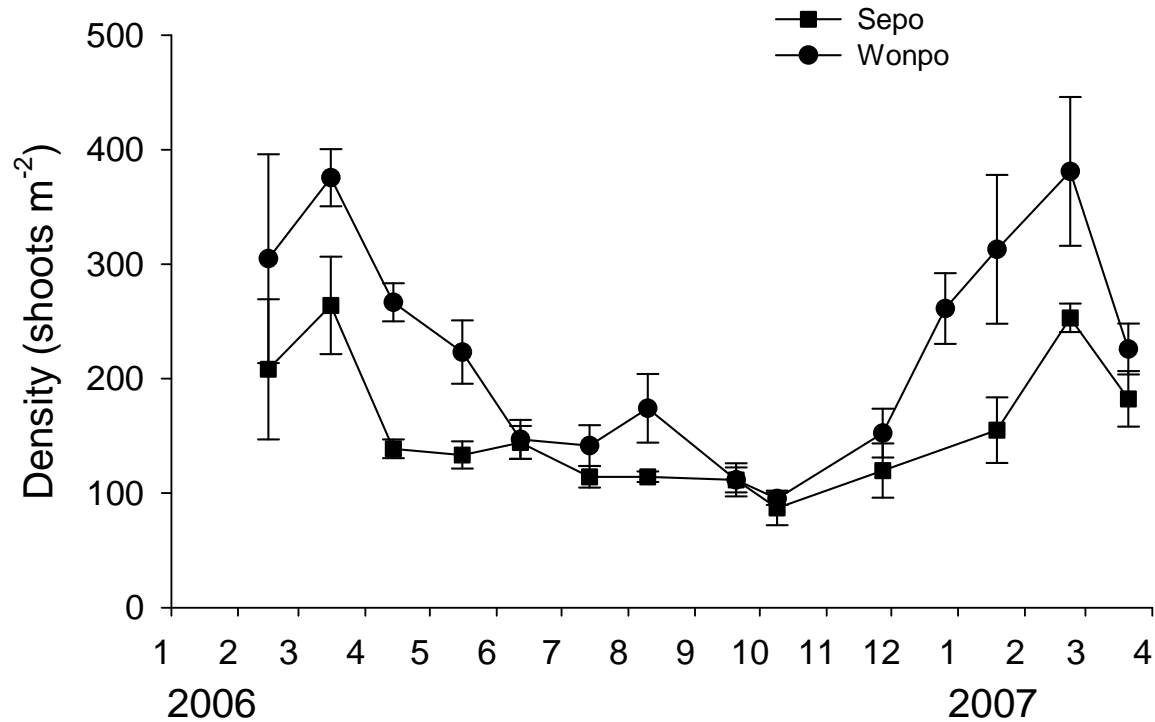
## ➤ Seasonal variations of air and underwater irradiance



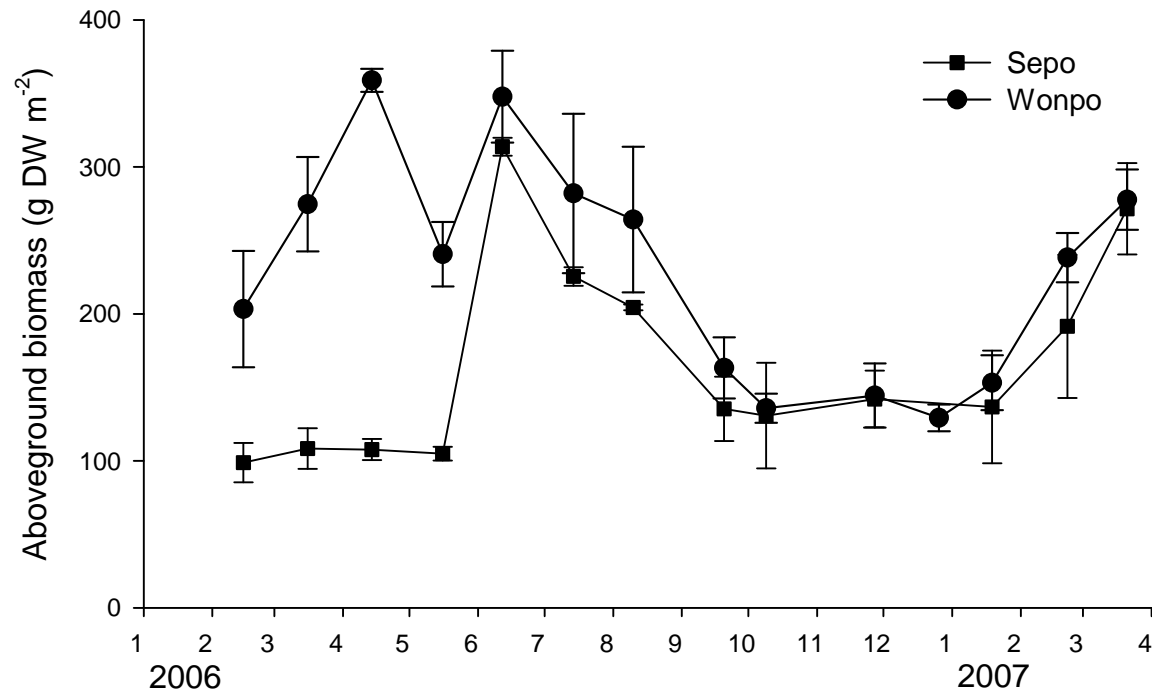
## ➤ Seasonal variations of shoot height



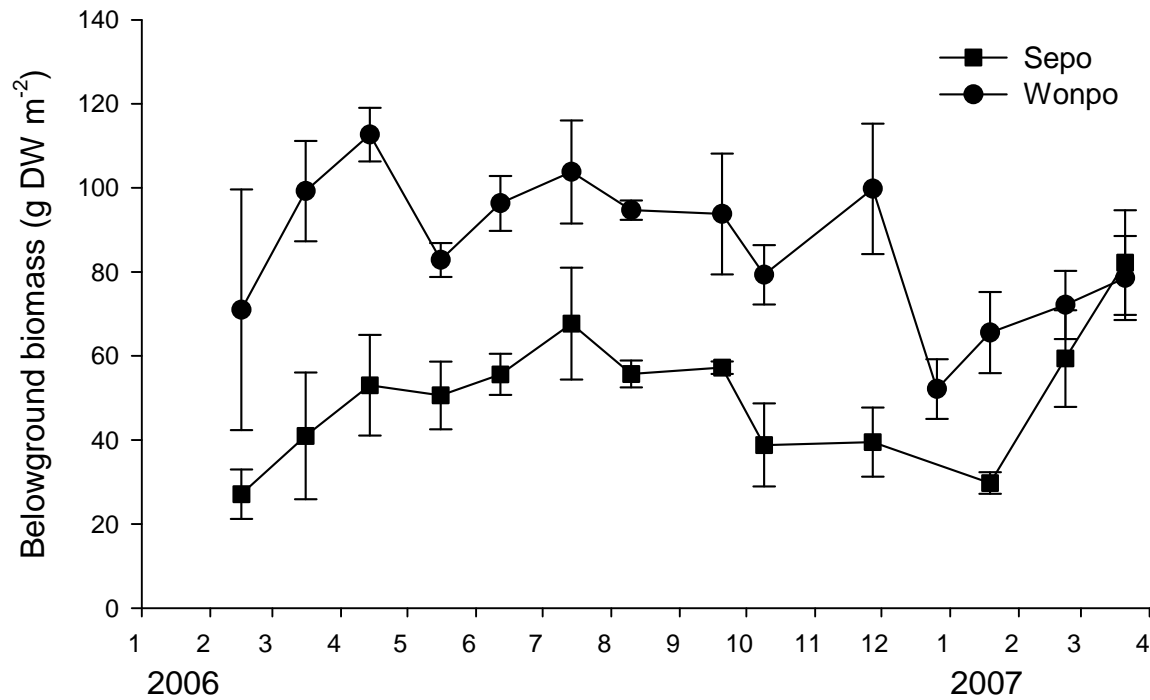
## ➤ Seasonal variations of shoot density



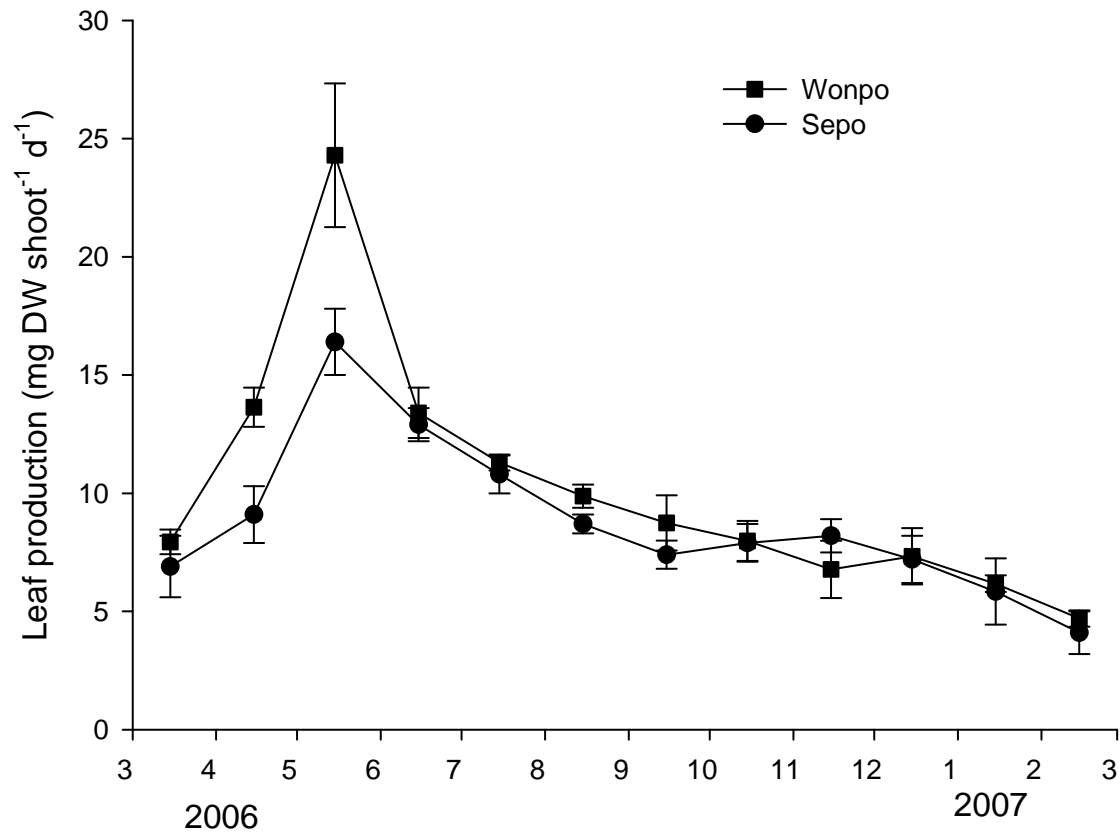
## ➤ Seasonal variations of aboveground biomass



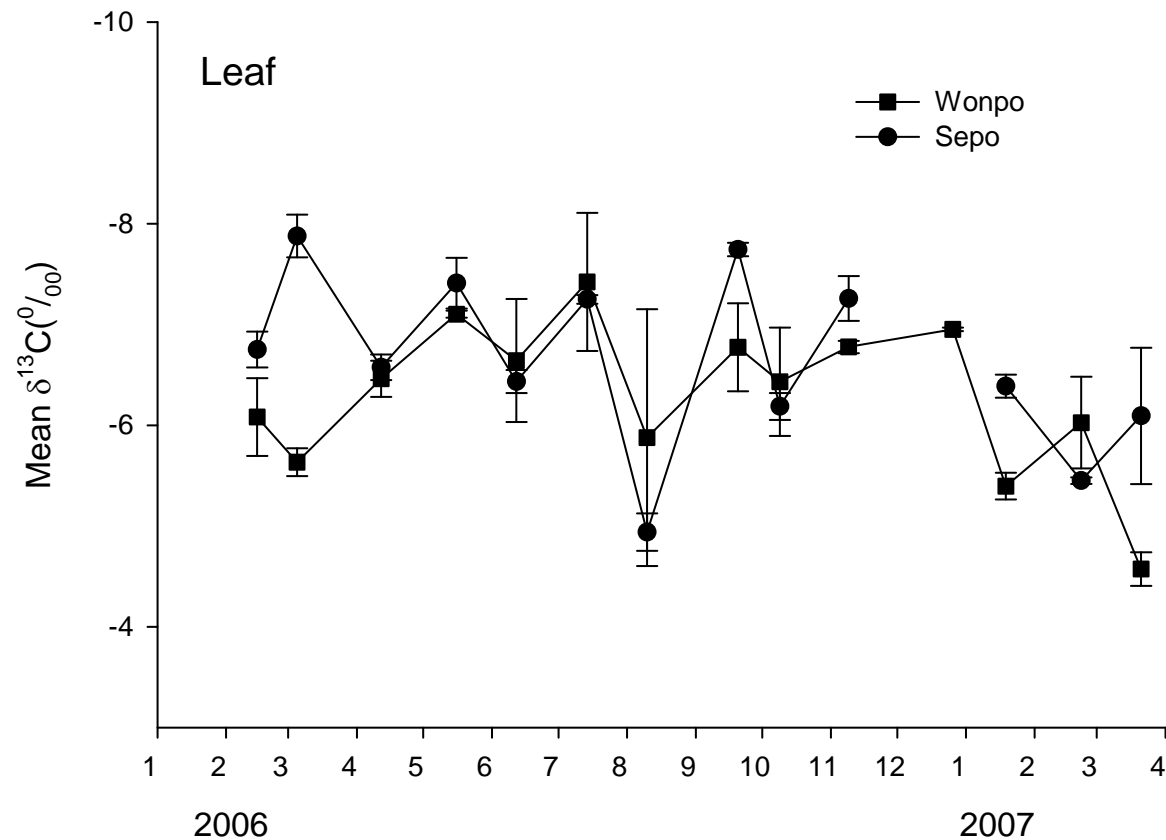
## ➤ Seasonal variations of belowground biomass



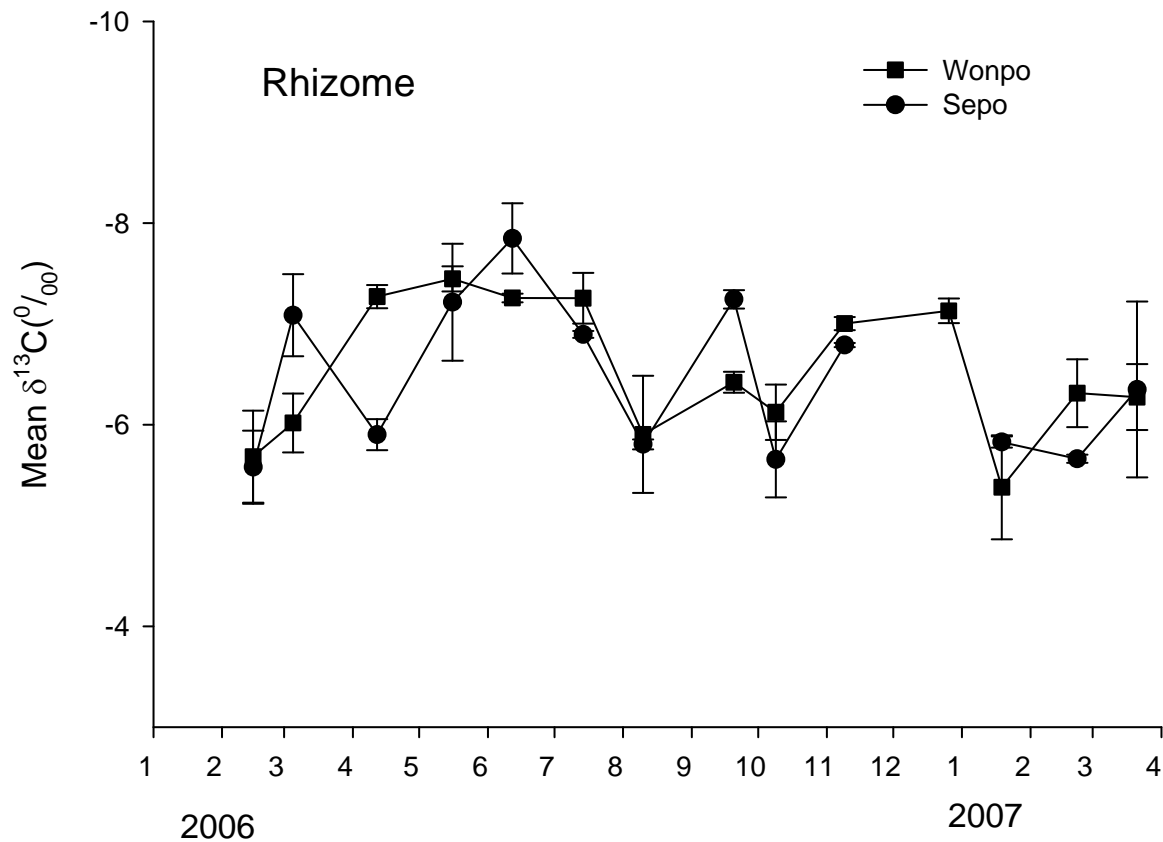
## ➤ Seasonal variations of leaf production



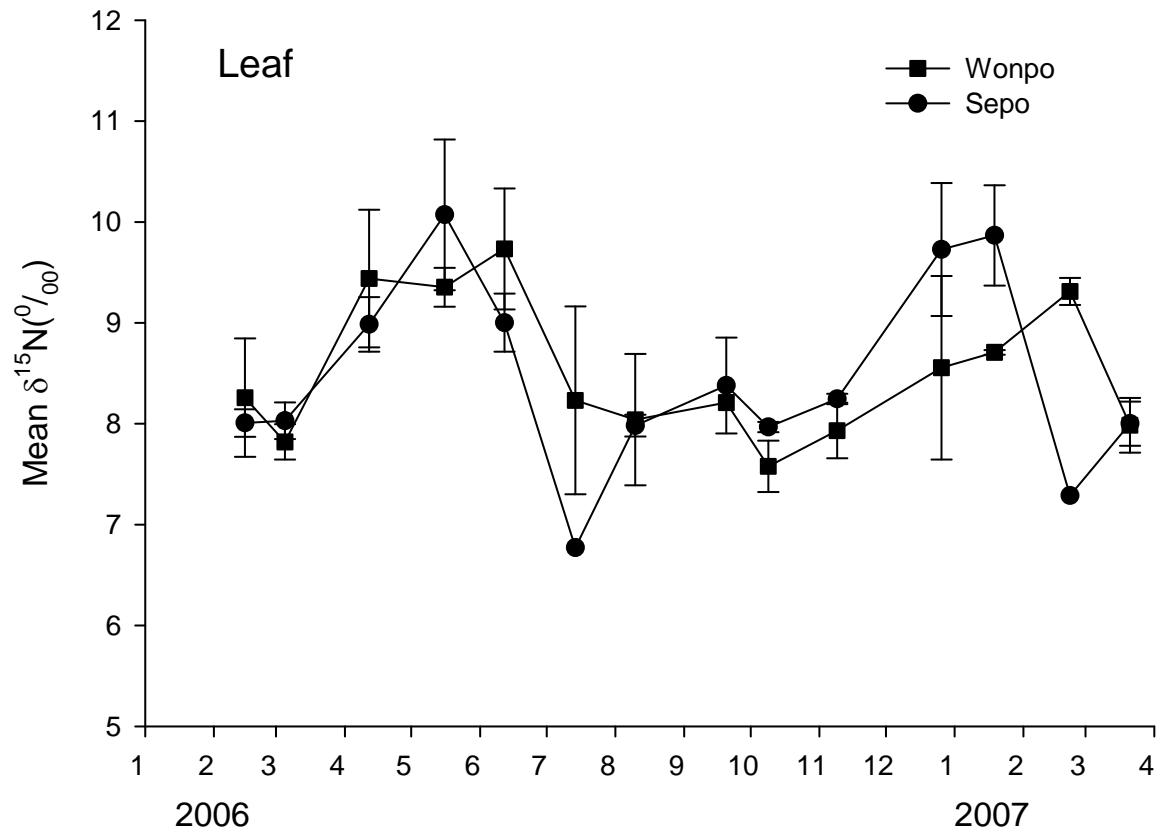
## ➤ Seasonal variations of $\delta^{13}\text{C}$ in seagrass leaf blades



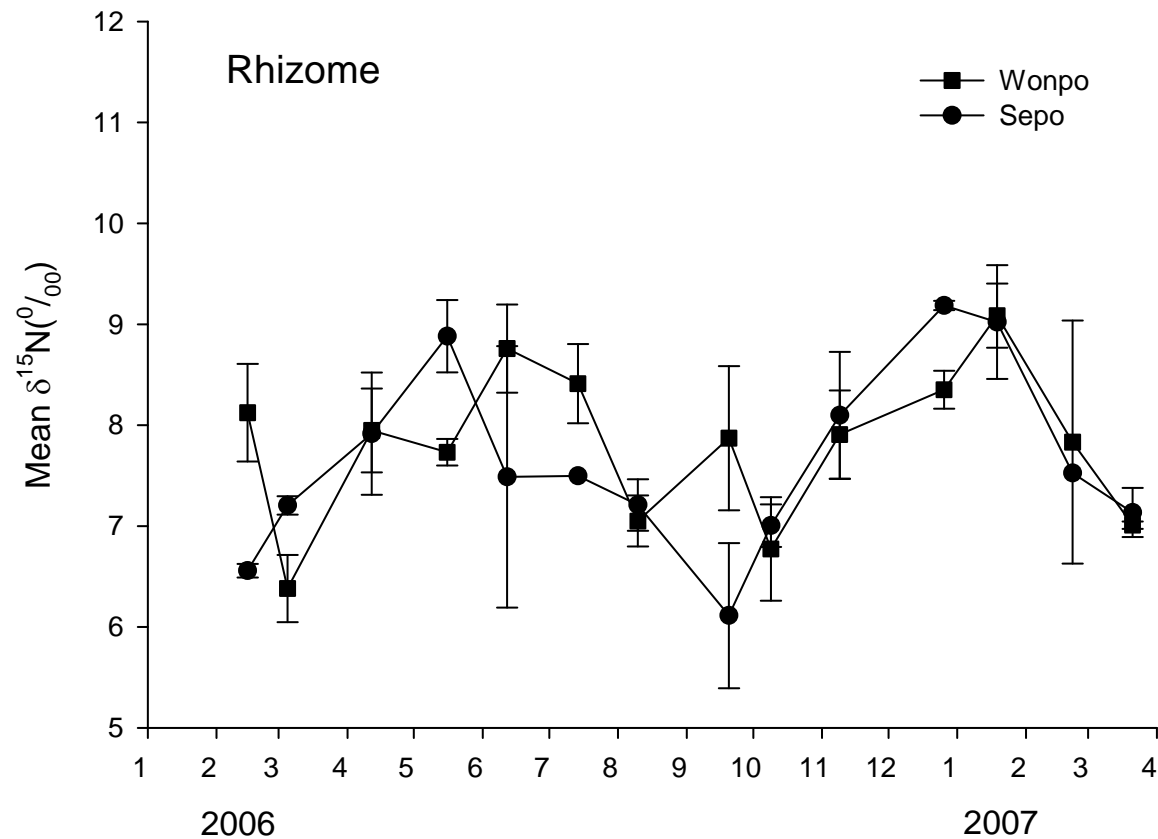
## ➤ Seasonal variations of $\delta^{13}\text{C}$ in seagrass rhizomes



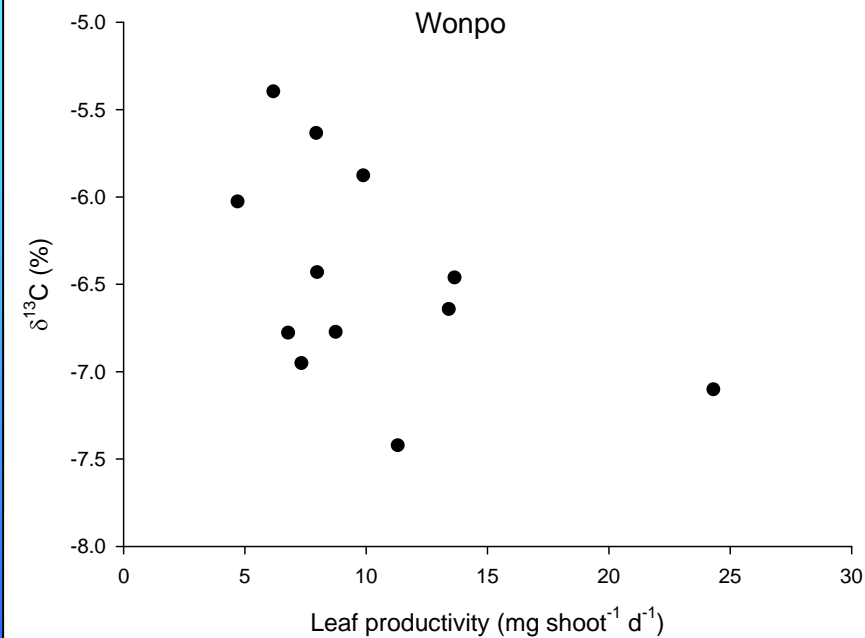
## ➤ Seasonal variations of $\delta^{15}\text{N}$ in seagrass leaf blades



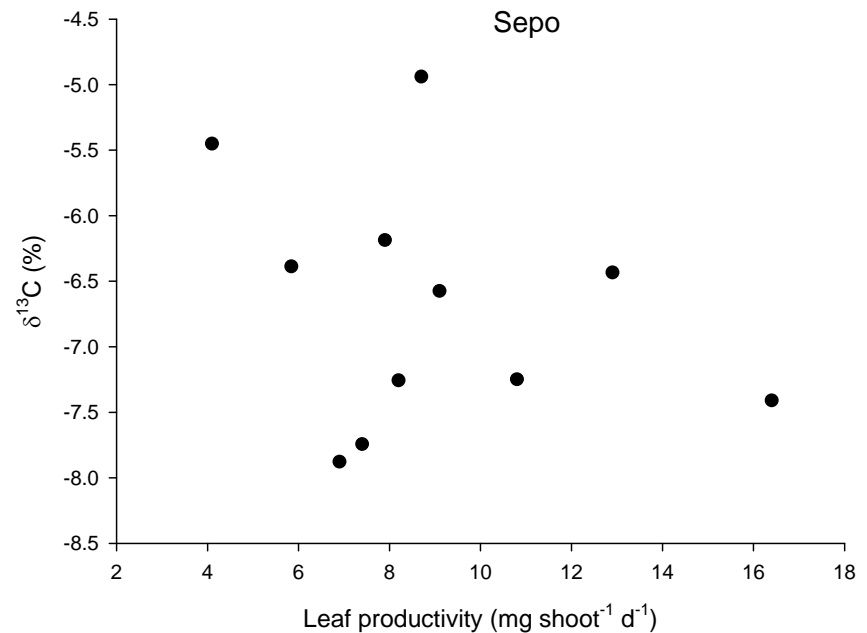
## ➤ Seasonal variations of $\delta^{15}\text{N}$ in seagrass rhizomes



## ➤ Relationship of seagrass leaf productivity to leaf $\delta^{13}\text{C}$

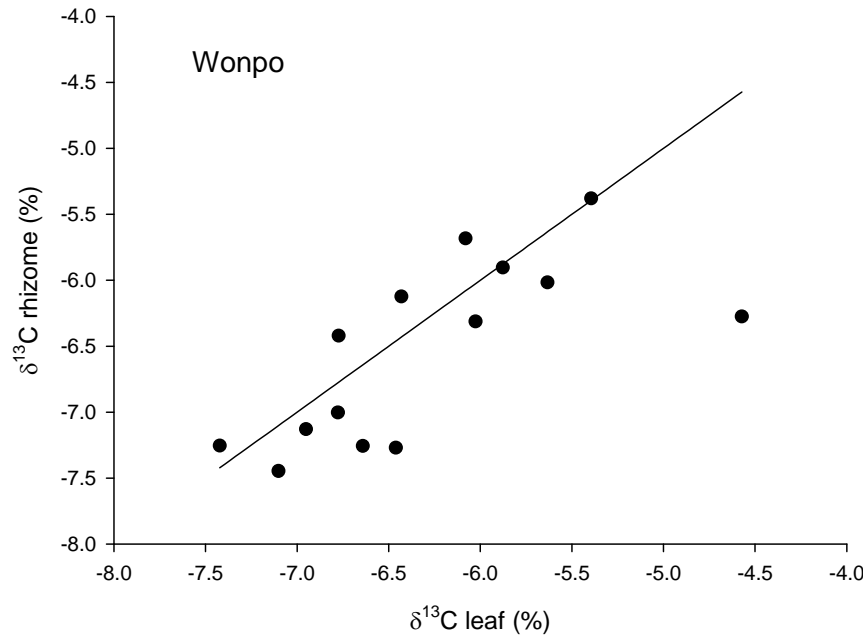


( $r^2 = 0.219$ ,  $p=0.125$ )

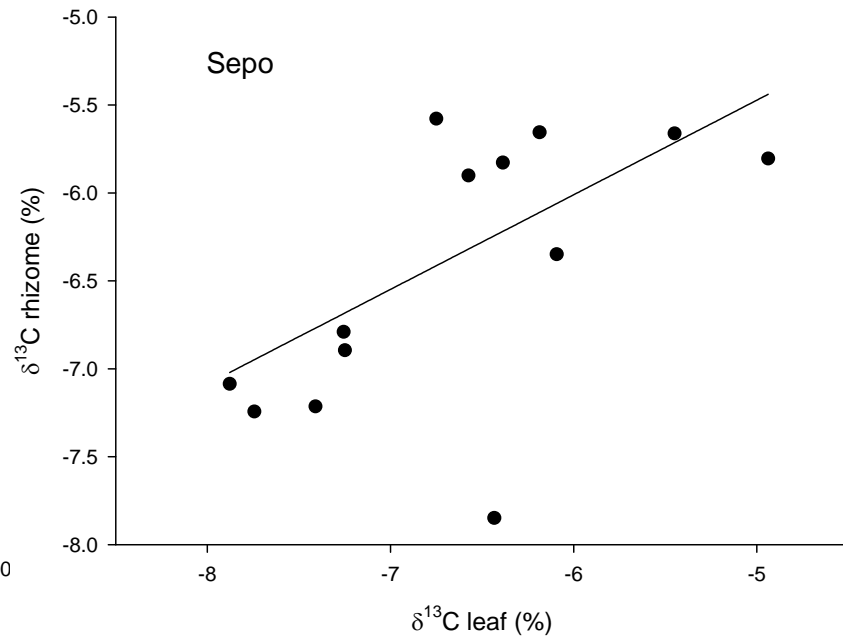


( $r^2 = 0.077$ ,  $p=0.410$ )

## ➤ Relationship of seagrass leaf $\delta^{13}\text{C}$ to rhizome $\delta^{13}\text{C}$

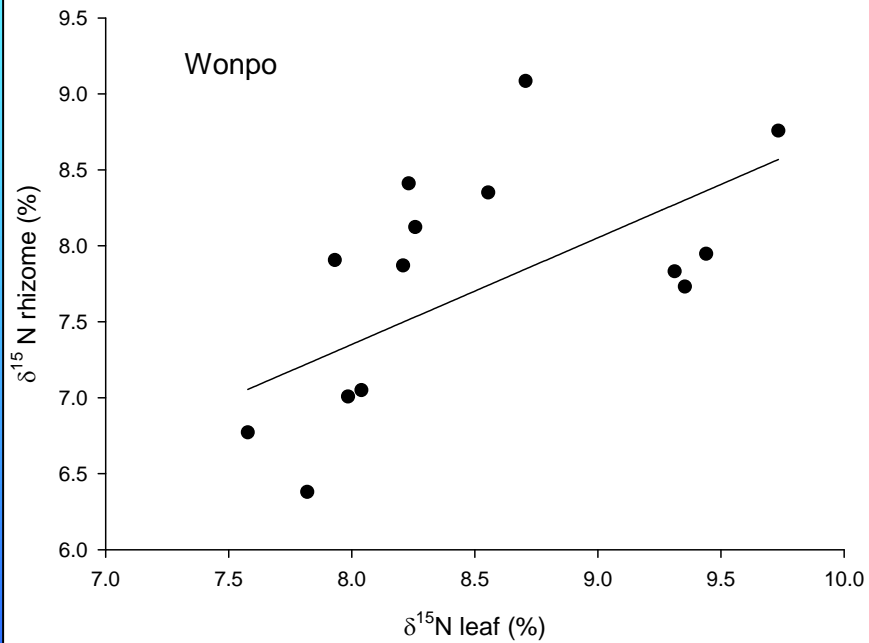


( $r^2 = 0.504$ ,  $p=0.004$ )

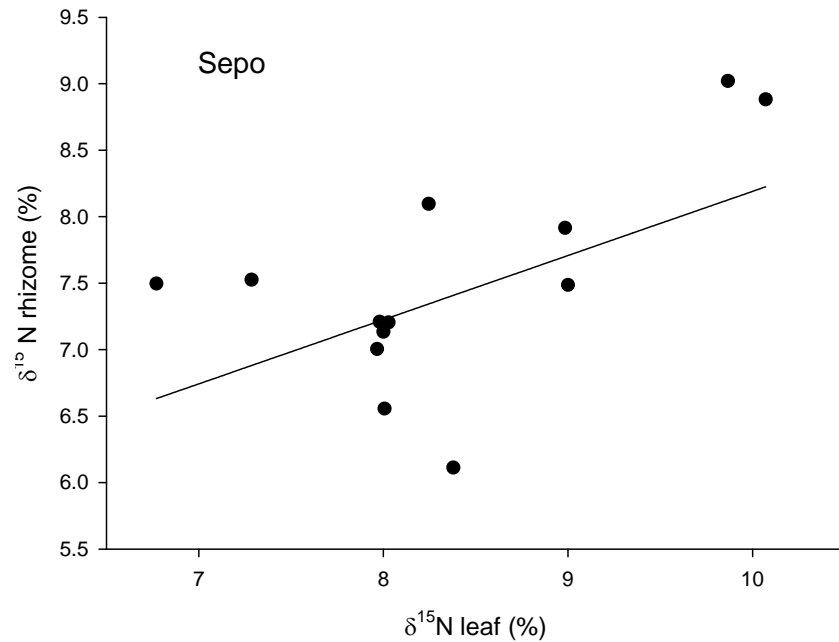


( $r^2 = 0.393$ ,  $p=0.022$ )

## ➤ Relationship of seagrass leaf $\delta^{15}\text{N}$ to rhizome $\delta^{15}\text{N}$



( $r^2 = 0.327$ ,  $p=0.033$ )



( $r^2 = 0.381$ ,  $p=0.025$ )

## Conclusions

- Shoot density, biomass leaf production were significantly greater at Wonpo muddy site than At Sepo sandy site.
- $\delta^{13}\text{C}$  values of seagrass leaves ranged from -8.22 to -4.70‰, and rhizomes ranged from -7.85 to -5.38‰
- $\delta^{13}\text{C}$  values trend towards less discrimination in summer than in winter
- $\delta^{13}\text{C}$  values did not differ significantly between two sites.
- $\delta^{15}\text{N}$  values of seagrass leaves ranged from 6.77 to 10.82‰, rhizomes ranged from 6.26 to 9.08‰
- $\delta^{15}\text{N}$  values of seagrass leaves at Sepo sandy site were significantly lower than at Wonpo muddy site
- Difference between sites are probably due to variation in habitat characteristics and nutrient sources