

Lecture 9 Seagrass Communities

- General characteristics and distribution
- Morphology and anatomy
- Ecophysiology
- Production and biomass
- Succession
- Nursery and refuge protection
- Anthropogenic effects

Why Study Seagrasses?

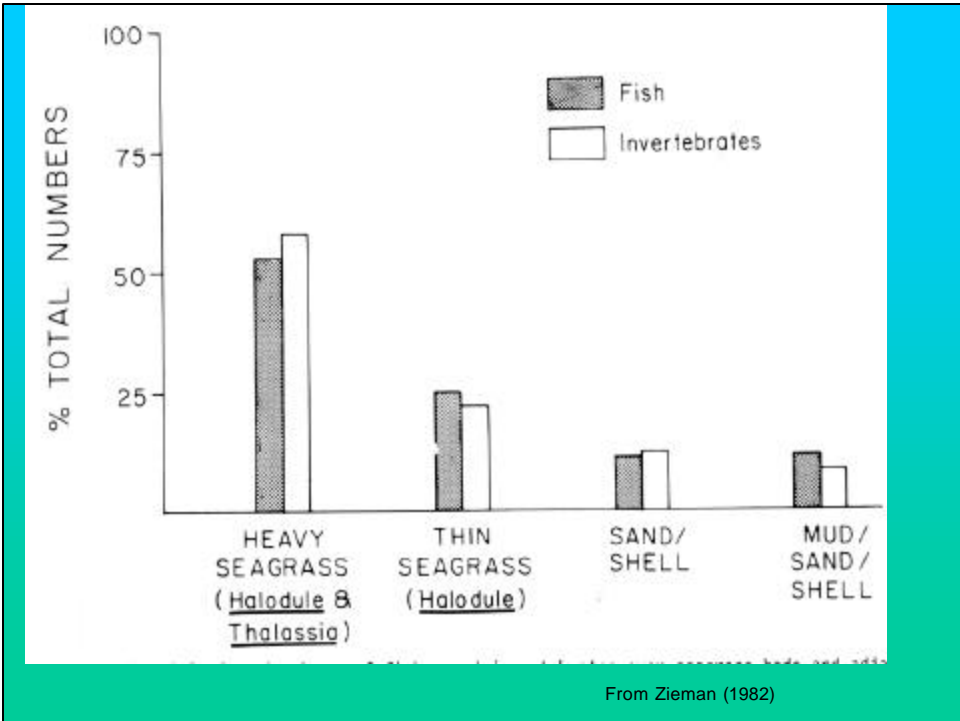
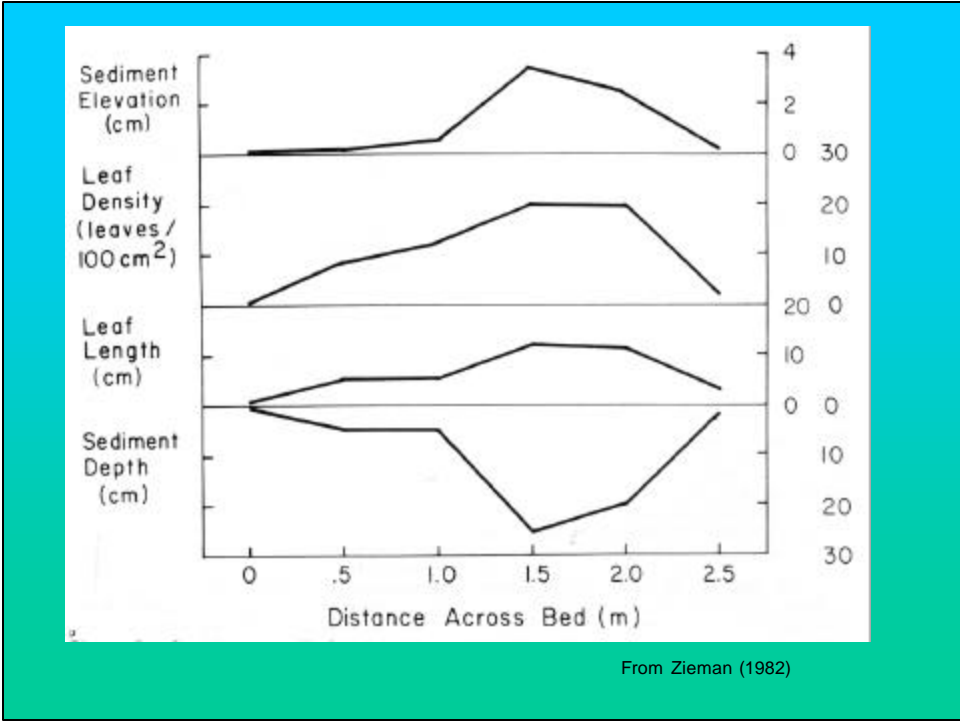
- highly productive, with 50% of production entering food web as detritus
- clonal flowering plants, about 50 species worldwide
- support a very diverse algae microflora
- provide habitat for the majority of commercially valuable marine species

Global Productivity Estimates

Location or Plant Group	Mean Annual PP (g C m ⁻²)
Marshes	1000-3000
Seagrasses (tropical)	1000
Kelp beds (<i>Macrocystis</i>)	700-800
<i>Laminaria</i> kelp beds (Arctic)	400-500
Seagrasses (temperate)	400-600
Upwelling Areas	500-600
Nearshore and Estuarine	300-500
Subarctic	150-300
Oligotrophic	50-150
Arctic	<50

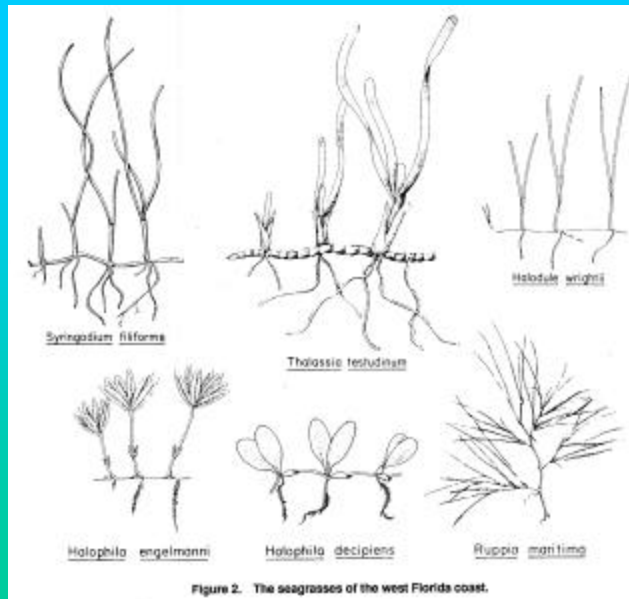
Seagrasses-Characteristics and Distribution

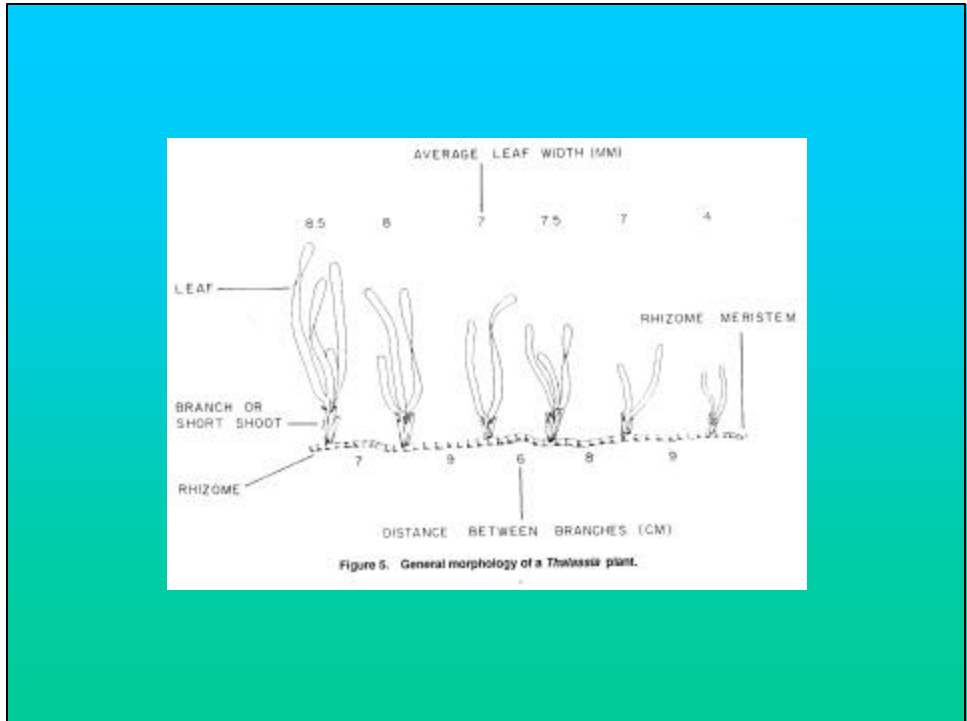
- Approximately 48 species of seagrasses in the class Angiospermae, which contains 250,000 species
- All are monocots in four families (12 genera)
- Earliest work by Peterson at Danish Biological Station- recognized importance to fish abundance in 1891 publication
- Distribution is limited to temperate and tropical waters worldwide, but little information on occurrence in South America
- Requirements for survival:
 - salt tolerance
 - submergence
 - anchoring system in turbulent environment
 - hydrophilous pollination



Seagrasses-Morphological Adaptations

- Flattened, strap-like leaves
- Extensive root/rhizome system
- Halophytic
- Light sensitive
- Nutrient uptake through roots *and* leaves
- Reproduction: sexual (pollination) and asexual through prolific vegetative propagation
- Hydrophilic pollination
 - category 1: pollen transported above water surface (*Elodea*)
 - category 2: pollen transported on water surface (*Halodule*, *Ruppia*)
 - category 3: pollen transported beneath water surface (*Thalassia*)





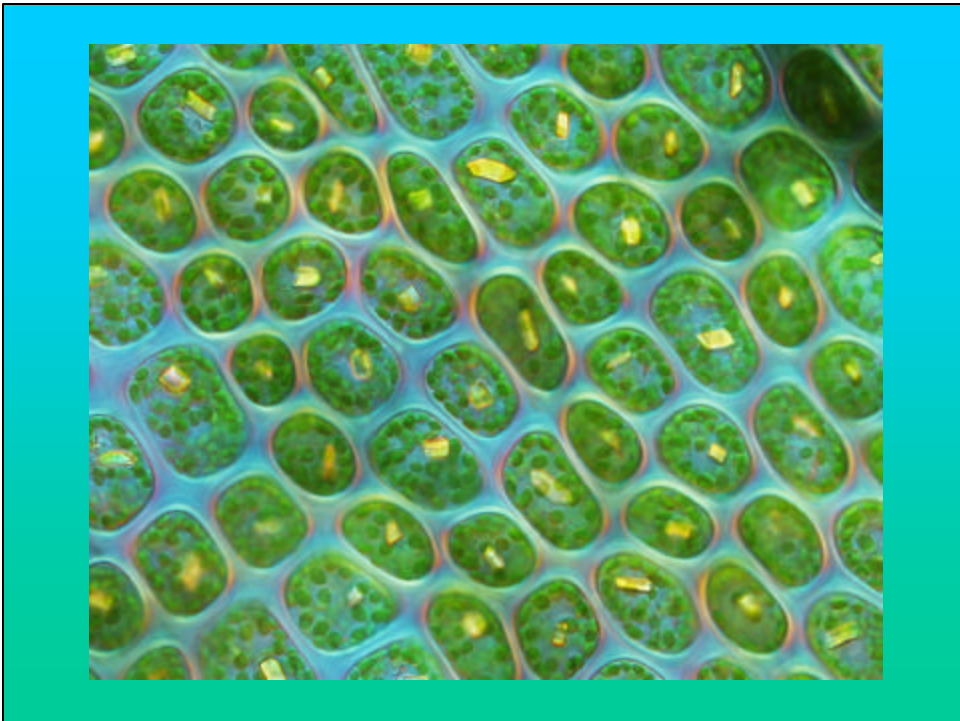
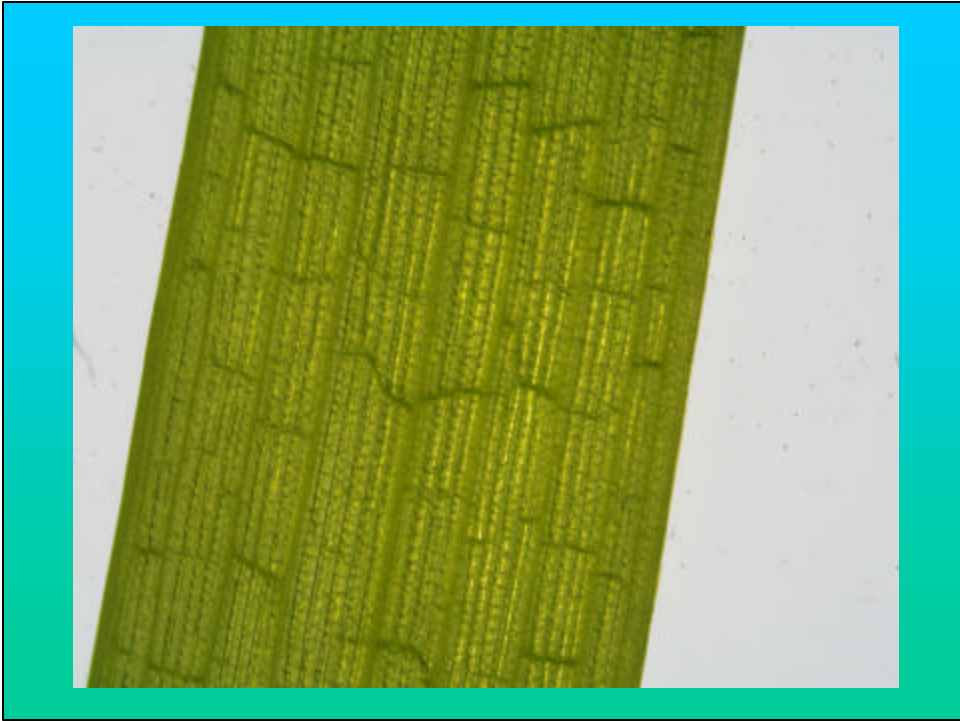
Seagrasses-Anatomical Adaptations

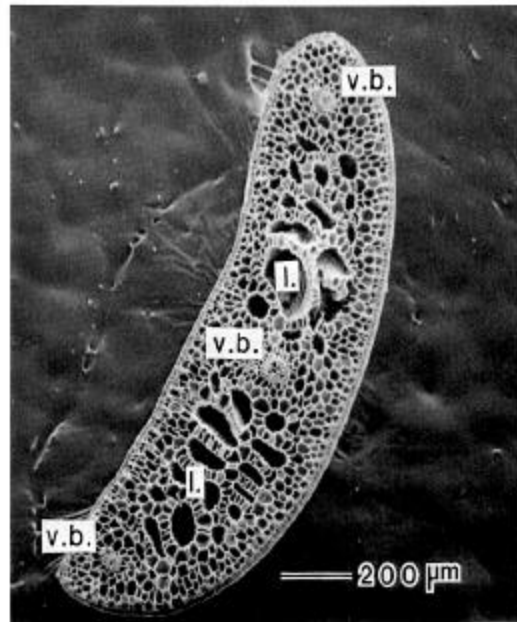
Leaves

- Lack stomata but have thin cuticle to allow gas and nutrient exchange
- Possess large thin-walled aerenchyma that facilitate gas diffusion within the leaf, provides buoyancy to the leaves, joined to form lacunae

Roots and Rhizomes

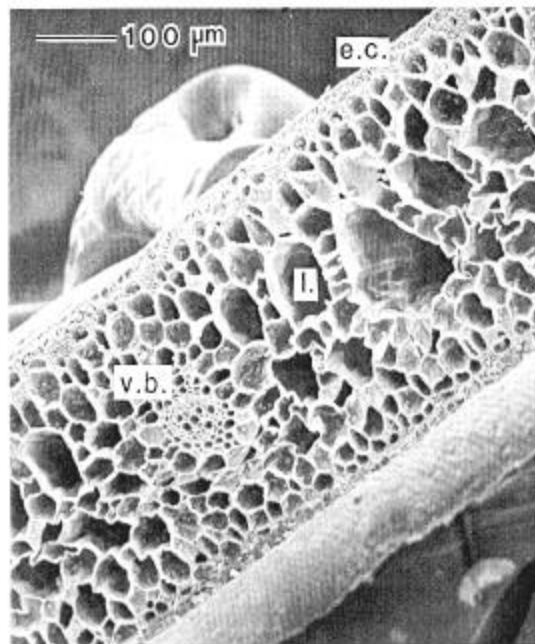
- Lacunae are extensive and continuous with leaf tissues
- Oxygen transport to the roots creates an oxic environment around the roots, facilitating nutrient uptake
- All produce root hairs





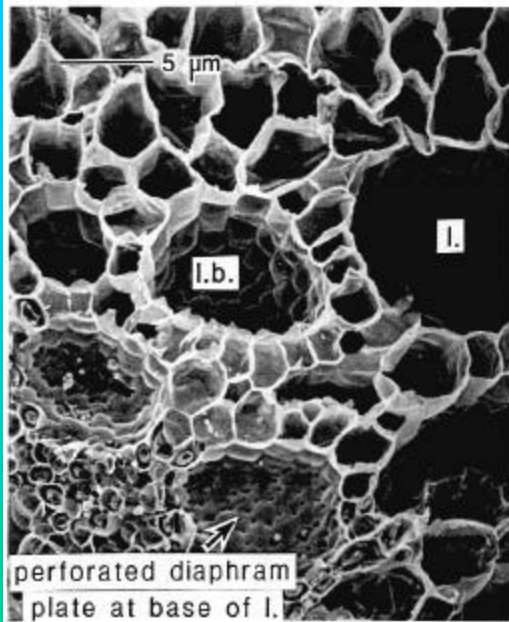
From Cooper & McRoy (1988)

Fig. 6. *Phyllospadix torreyi*, leaf cross-section. v.b. vascular bundle; l. lacuna.



From Cooper & McRoy (1988)

Fig. 5. *Phyllospadix scouleri*, leaf cross-section. v.b. vascular bundle; l. lacuna; e.c. epidermal cell.



From Cooper & McRoy (1988)

Fig. 13. *Phyllospadix serrulatus*, perforated lacunal diaphragms. l. lacuna; l.b. lacuna base.

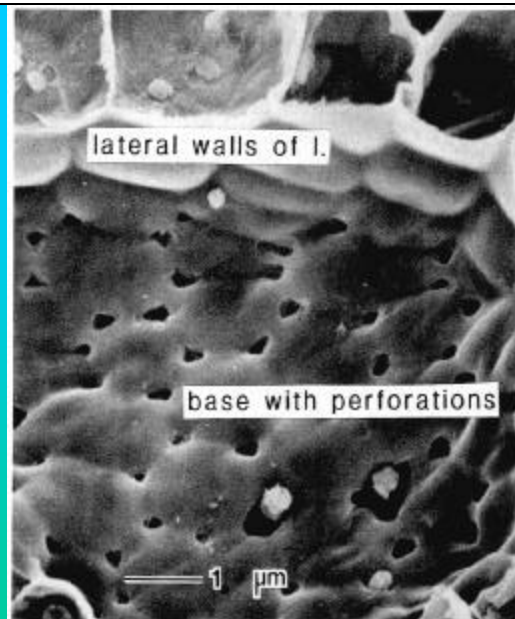
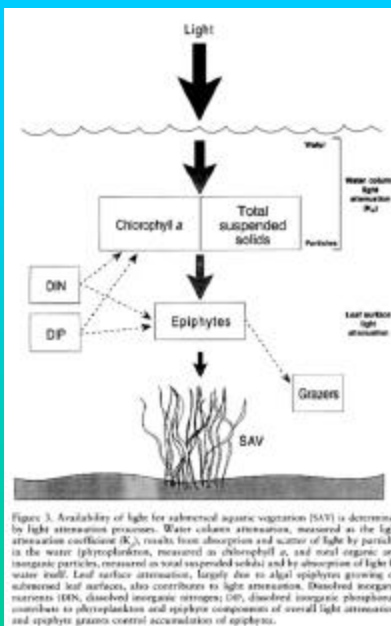


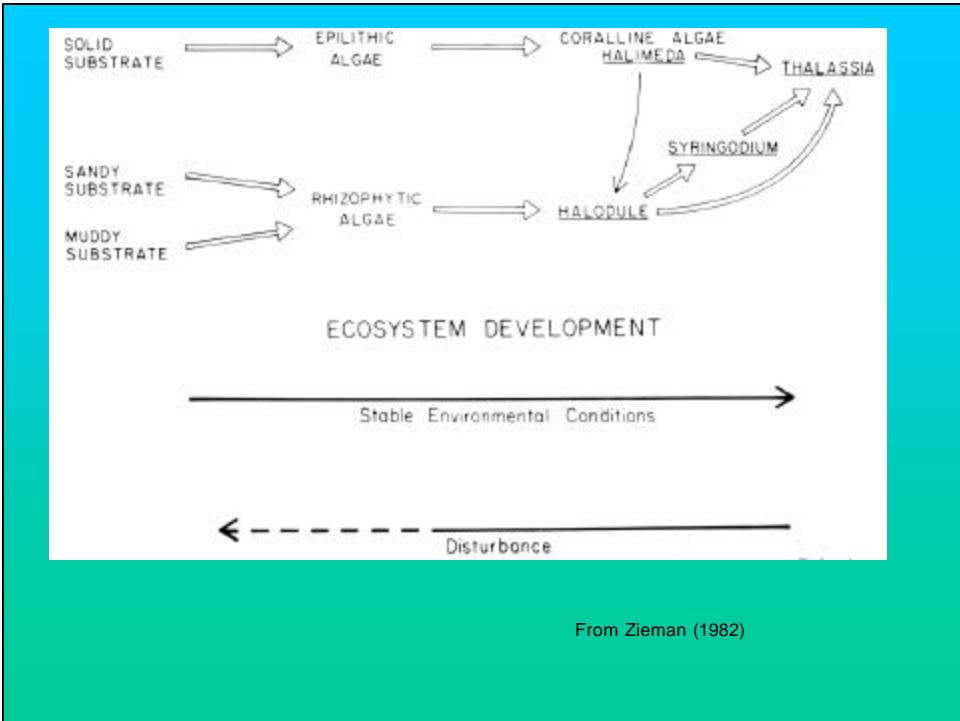
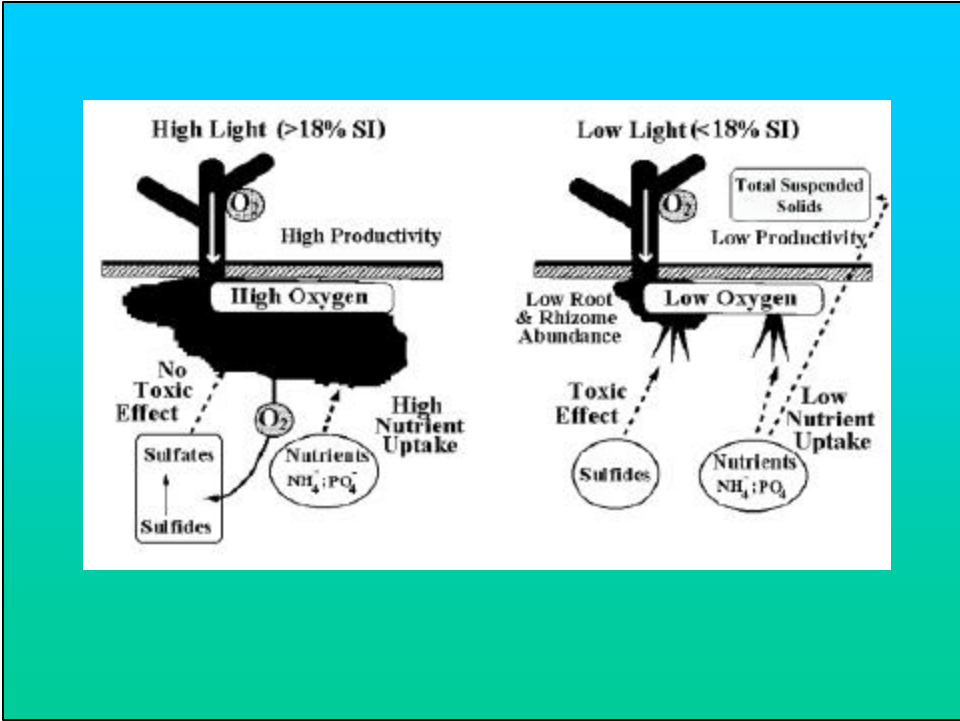
Fig. 14. *Phyllospadix serrulatus*, perforated lacunal diaphragms. l. lacuna.

From Cooper & McRoy (1988)

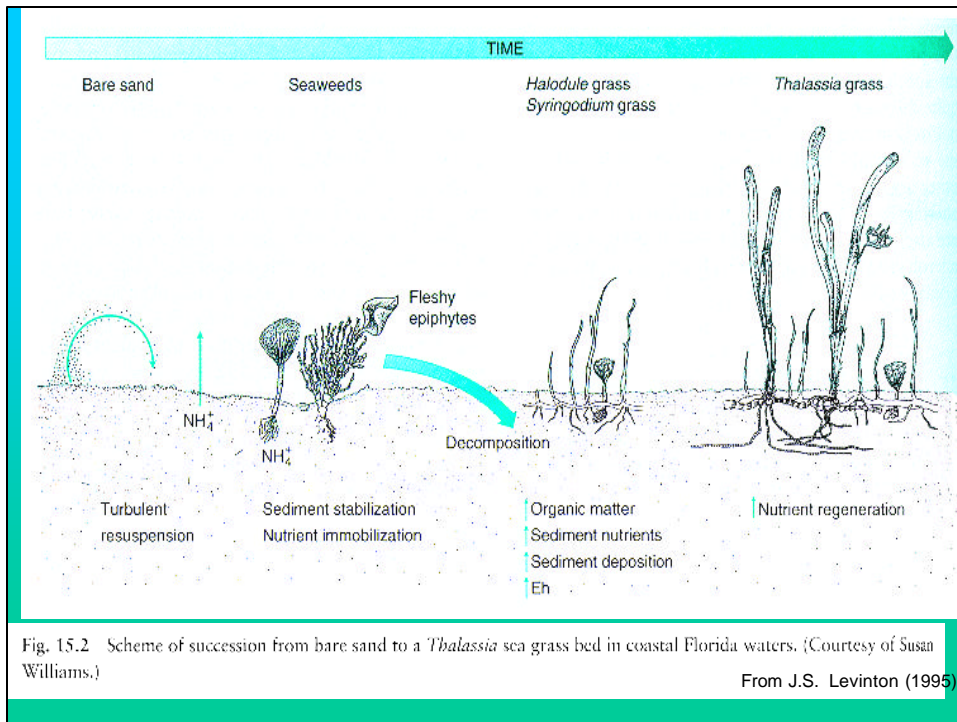
Seagrasses-Ecophysiology and Productivity

- Wide temperature tolerance, 0-36 degrees C (tolerance), 0-30 degrees C (growth)
- Wide salinity tolerance, 0-90 ppt (tolerance), 0-56 ppt (growth)
- Minimum 18% surface irradiance PAR requirements
- Blade productivity: 0.2-18.7 g C/m²/day
- Biomass up to 8,000 g drywt/m²



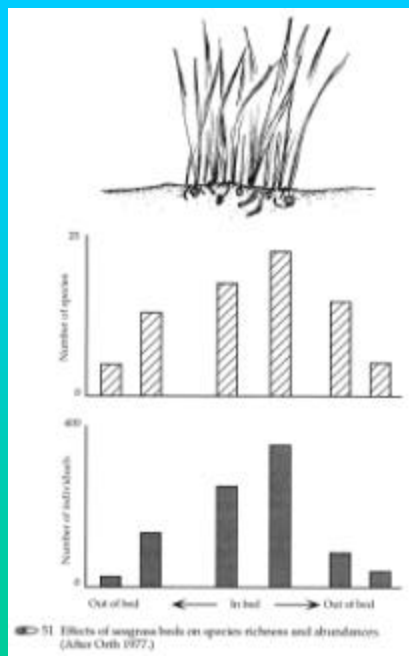
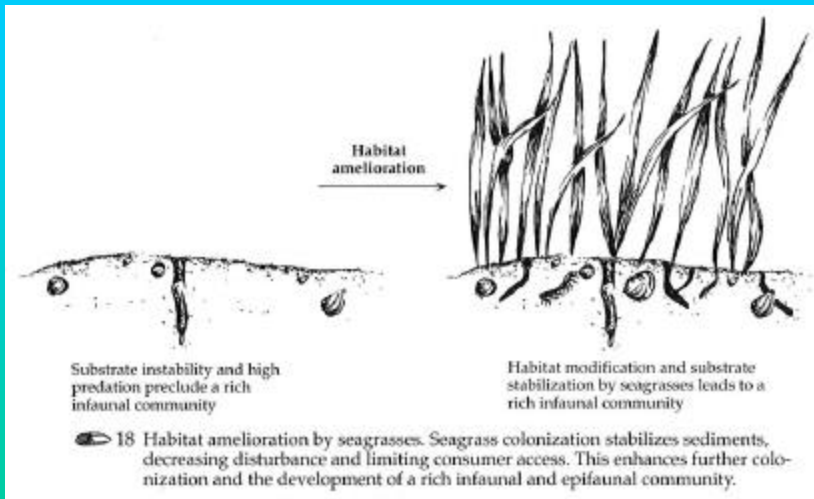


From Zieman (1982)



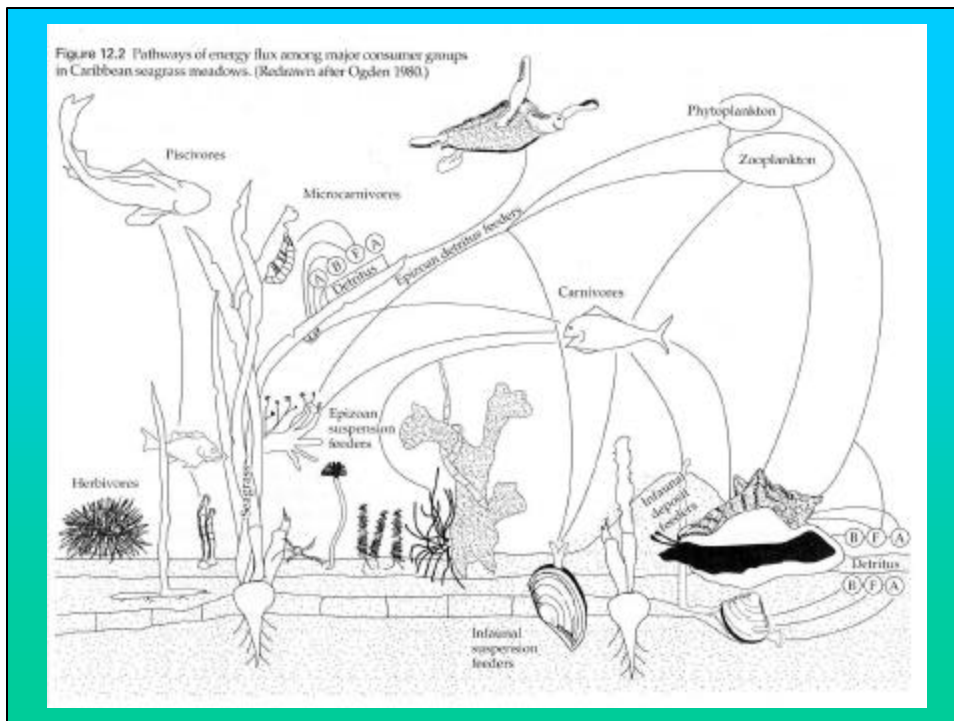
Nursery and Refuge protection:

- invertebrates and fish more abundant in vegetated vs unvegetated habitats
- dense structure provides refuge from predators
- role of food not as important as shelter from predation
- role of seagrass beds as nursery areas more obvious in subtropical/tropical latitudes



Habitat structure and organism distribution and abundance:

- structural complexity afforded by different leaf morphologies
- function of density, leaf area, leaf morphology, canopy height, reproductive state, epiphyte cover, drift and attached macroalgae
- habitat structure can be measured from scales of mm to tens of meters
- artificial leaves support same community of epiphytes and consumers as does natural leaves
- heterogeneity in landscape features also important





Seagrasses-Environmental Issues

Causes of seagrass losses

- Natural disturbances
 - storms, floods, droughts effect levels of turbidity and sedimentation
- Anthropogenic disturbances
 - boating and ship traffic: prop washing, prop scarring, turbulence
 - dredging and filling activities
 - nutrient loading (eutrophication)
- Management
 - Mitigation: restoration vs creation
 - Transplantation