Seagrass Ecology

I. Importance
   - highly productive
   - nursery for wide range of species
   - sediment stabilization
   - water filtration (e.g., nutrient removal)
   - nutrient recycling

II. Distribution
   - worldwide in temperate and tropical seas
     (similar freshwater communities, too)
     - Zostera & Phyllospadix in **temperate** areas
     - greater diversity in **tropical** areas
   - soft-sediments (except surfgrasses)
   - mostly subtidal (occasionally intertidal)

III. Key Taxa
   - seagrasses (50-60 species)
     - flowering plants
     - clonal
   - epiphytic algae (hundreds of species)
   - animals (every major Phylum)
     - molluscs (conch, scallops)
     - crustaceans (shrimps, crabs)
     - fishes
     - birds (ducks, geese, wading birds)
     - reptiles (green sea turtles)
     - mammals (manatees, dugongs)
IV. Productivity – very high!

- up to **3 kg per m² year**, excluding production by algae!
  - one of most productive ecosystems on earth (similar to tropical rain forests, kelp forests, & coral reefs)
- rhizome production hasn’t been considered (often represents the majority of biomass)
- much of production is used as detritus (rather than being grazed by herbivores)
  - but is this natural? (we’ve killed most of the big grazers, e.g., turtles and manatees)

V. Biological Interactions

- herbivory
- predation
- facilitation
- invasive species
Herbivory

- natural roles of megaherbivores vs. smaller herbivores unclear
- role of herbivory itself in controlling seagrasses is unclear
  - bottom up or top down control?

Predation

- seagrass beds provide structural protection from predators for small animals (like kelp beds and coral reefs)
- densities inside seagrass beds often an order of magnitude or more higher than outside
- increased density of seagrass provides more protection
- importance of seagrass in mediating predation greater in tropics than temperate areas

Facilitation

- protection from predators
- provision of habitat
  - epiphytic algae
  - rhizophytic macroalgae

Invasive Species

- invasive seagrass Zostera japonica in Pacific Northwest - a "good" invasive?
  - only slight effect on distribution of native Zostera marina
  - positive effects on...
    -- species richness
    -- density of most native species
    -- foraging of water birds
Invasive Species

- invasive mussel *Musculista senhousia* in California
  - negative effect on native *Zostera marina*
    - reduces growth of rhizomes & shoots (where dense)
  - *Zostera* has negative effect on *Musculista*
    - where dense, reduces growth of *Musculista* (lower flow, less planktonic food)

VI. Human Impacts

- eutrophication & overfishing
- physical disturbance (e.g., boat scars)

Pattern:

- algal overgrowth kills seagrasses

Eutrophication or Overfishing?

**Explanation 1:**
- nutrient pollution (e.g., runoff, sewage) causes eutrophication
  - rapid growth of algae
- algae outcompete seagrasses

**Explanation 2:**
- overfishing of top predators releases smaller predators from their control
- small predators reduce abundance of small herbivores
- algae abundance increases
- algae outcompete seagrasses

Restoration: a solution for some human impacts

*Zostera marina* "plug" being transplanted to an area that had lost this species

Eelgrass restoration

- Batiquitos Lagoon, Carlsbad, CA
  - 0.25 acre transplanted in 1997/1998
  - 53 acres present in 2000, 39 acres in 2001