

Multicellular Primary Producers

Seaweeds or Limu

- Different from phytoplankton
 - Multicellular (& macroscopic)
 - Benthic - attached to substrate and thus limited to coastal regions by photic zone
- Also called macrophytes or macroalgae (some consider them plants)

Seaweeds or Limu (graphic)

More Seaweeds or Limu

- Domain Eukaryotes
- Representative Divisions of Kingdom Protista include Phaeophyta and Rhodophyta (marine only) and Chlorophyta (also FW and terrestrial)
 - Major difference based on types of photosynthetic pigments
- Typically need hardened substrate, particularly in intertidal areas
- Usually extend down to 30-40 meters

Limu Characteristics (graphic)

Seaweed Structure

- Most organized as thallus with blade, stipe, and holdfast
- Blades are frequently flattened with cellular layering
 - Photosynthetic cells near surface
 - No top or bottom of blade
 - No network of “veins”
 - Some have pneumatocysts (gas-filled bulbs) to keep blades near surface
- Stipes may or may not be present
 - May have photosynthetic cells
 - Usually don't have conductile tissue

Thallus (graphic)

Pneumatocyst (graphic)

More Seaweed Structure

- Holdfasts secure the seaweed to substrate
 - Not important for water & nutrients
 - Extent of holdfast determines location seaweed is likely to be found
 - Filamentous and numerous haptera hold in sand or mud
- Some with calcium carbonate (mostly reds and some greens)
 - Encrusting red algae important to binding coral reefs (in warm waters) together and may create reefs of their own
 - Greens may contribute to sand

Reproductive Cycle

- Asexual or vegetative reproduction - fragmented pieces continue to grow and reproduce

- Sexual reproduction typically involves life cycle of two forms - sporophyte and gametophyte
 - Substantial variability among different seaweeds
 - Sporophyte (diploid) creates spores through meiosis
 - Spores germinate forming gametophyte (haploid)
 - Gametophyte produces gametes which fuse (zygote) and germinate to form sporophyte

Sample Reproductive Cycles (graphic)

More Reproductive Cycle

- In Ulva, both forms appear the same
- In Codium, the gametophyte stages is absent
- In Laminaria, the gametophytes are small and sexually separated and dimorphic
- Green algae spores have 4 flagella, brown - 2, and red - none
- Growth is by mitotic cell division and differentiation of tissue
 - Along with differentiation is specialization of growth tissue - meristematic tissue

Economic Uses

- Edible varieties
- Derivatives - primarily phycocolloids
 - Algin - largely from kelp
 - Used as food additive (stabilizer and emulsifier for dairy products like ice cream, cheese and toppings)
 - Used as thickener and emulsifier for variety of other products...shampoo, plastics, pesticides
 - Agar - from certain red algae
 - Used in canning of meats e.g. ham
 - Used in some pharmaceuticals
 - Bacterial growth medium

Phylum Magnoliophyta

- Marine flowering plants or angiosperms
- Secondary adaptation (return to marine environment)
- Have leaves, stems, roots, and conductile tissue, dominant sporophyte phase
- Typically are seagrasses, 50% of which are found in tropics or subtropics
 - Most have rhizomes - important for anchoring, storage for starch and vegetative reproduction
 - Sexual reproduction (flowering) with formation of current transported pollen, attachment to stigma, and formation of seeds

Rhizomes of Seagrasses (graphic)

More Phylum Magnoliophyta

- “Meadows” frequently found and result from both sexual and asexual reproduction
- Not true grasses

- Hawaii's forms are marine or estuarine and usually found in soft sediments (silt or sand) - a few found attached directly to rock
- Mangroves - border terrestrial and marine environments
 - Form thickets or mangals limited to subtropics and tropics
 - Prop roots reach down through intertidal waters with remaining portion of plant above water level

Even More Magnoliophyta

- Controversy about effect of securing and accumulating sediments
- Red mangrove (Rhizophora) typical in Hawaii
 - Seeds germinate while still hanging from branches causing bottom to be heavier
 - When dropped, seeds float (distribute) and roots secure in another location
- Both seagrasses and mangroves form communities of organisms

Mangrove Seed Distribution (graphic)