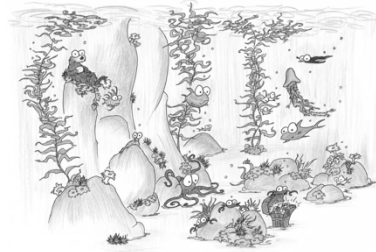


6. Kelps, Mangroves & Photosynthetic Habitats

- Photosynthetic Habitats
- Kelps
 - Anatomy
 - Community
 - Ecosystem
- Mangroves
 - Anatomy
 - Community
 - Ecosystem
- Other photosynthetic habitats
 - Seagrasses

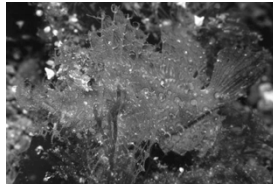
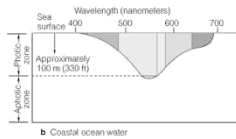
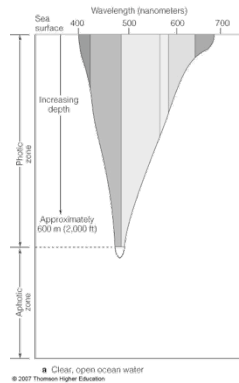


Dr Rhian G. Waller
23rd April 2010
Reading:

Photosynthetic Habitats

- Primary Producing Habitats
 - Need direct sunlight to survive
 - Coastal oceans
 - Clear water
- Major Habitat forming:-
 - Sea Weeds (kelps)
 - Kelps
 - Mangrove Trees
 - Terrestrial trees
 - Sea Grass Beds
 - Eelgrass

Algae

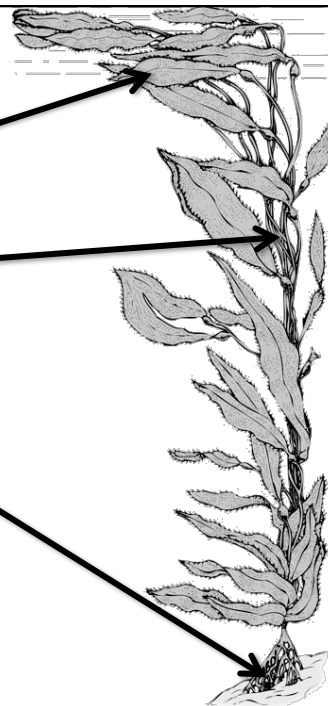
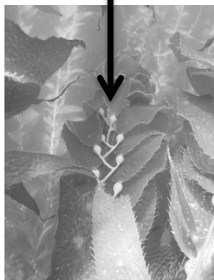


- Photosynthesizing
- Pigments for specific wavelengths
- Red algae can be found deepest

Seaweed Group	Pigments	Storage Products	Light used
Green Algae	Chlorophyll a, b	Starch	Red, blue
Brown Algae	Chlorophyll a, c, fucoxanthin	Laminarin, Mannitol	Red, blue
Red Algae	Chlorophyll a, d, phycoerythrin, phycocyanin	Floridan starch	Green

Kelps

- Brown Algae
- Anatomy
 - Thallus
 - Blade
 - Stipe
 - Holdfast
 - Pneumatocysts



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Kelps

- 300+ species of Kelp
 - Not all create forests
 - Some species grow 30cm per day
- Different species of kelp make up the habitat
 - Community succession
 - Taller = more light
 - Shorter = survive storms
- Environmental Requirements
 - Nutrient rich waters
 - Upwelling zones
 - ~ <20°C
 - Arctic & Antarctic
 - Clear water
 - 5 – 15m depth

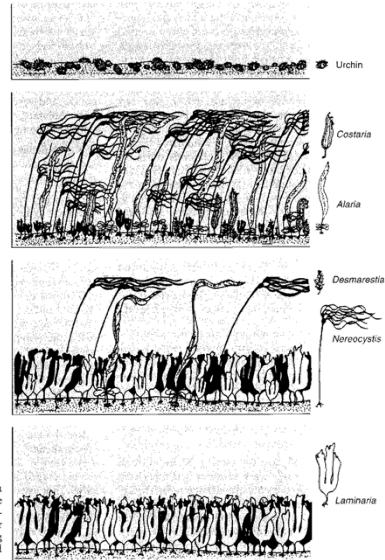


Fig. 15.9 Succession in an Alaskan kelp forest. Eventually (bottom) the kelp *Laminaria groenlandica* dominates the forest and prevents taller species from reinvading, by shading out juveniles. (Courtesy of David Duggins.)

Levinton, 1995

Kelp Communities

- Kelps create ecosystems & sustain specific communities
- **Pelagic**
 - Rockfish, Perch
 - Nursery habitats
 - Feeding
 - Sea Otters
- **Benthic**
 - Holdfast Communities
 - Brittle stars, snails
 - Canopy Communities
 - Urchins, abalone, seastars



Kelp Communities

- Urchins are an important part of the kelp habitat



Sea Urchin Barrens

- Urchins usually feed on “drift algae”
- Storms strip bottom of kelps
- Urchins feed on new kelp recruits
 - “Roving”
- Can take a year to redevelop kelp beds
- Once kelp developed, urchins stop “roving”

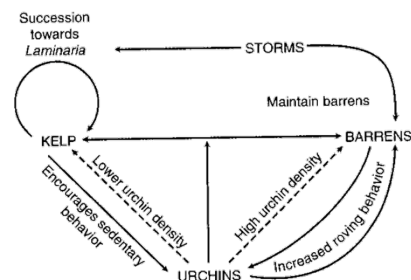
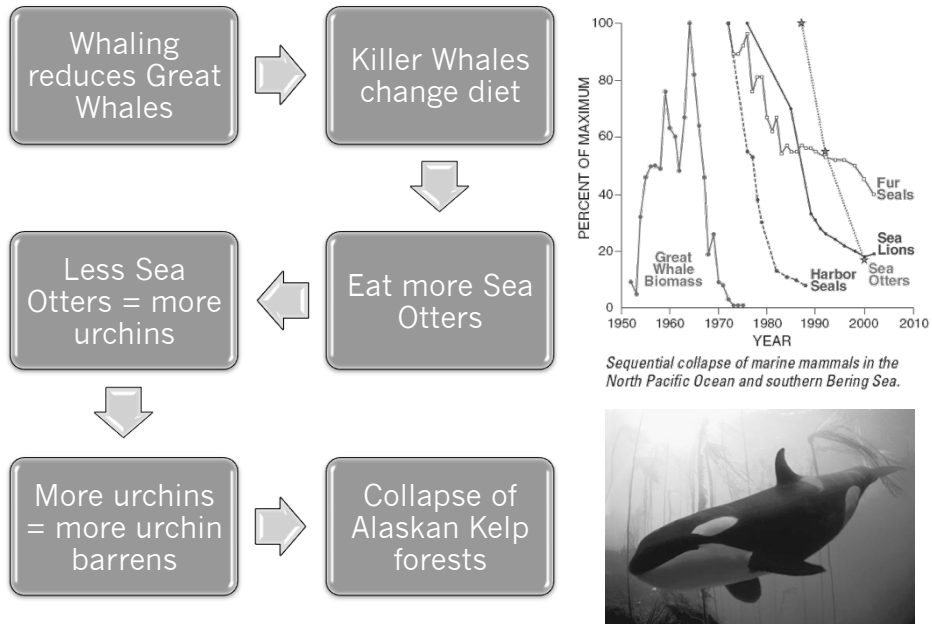


Fig. 15.8 The interactions between urchin population density, urchin behavior, and storms, as they affect the character of a kelp forest.

Levinton, 1995

Killer Whales & Kelp?



Kelps

- Fishery for kelp
 - Alginate
 - Thickener
 - Ice cream, jelly
 - Fertilizer
 - Iodine
 - Fuel
 - Diet pills!
 - Appetite suppression,

Nutrition per 100g (raw)	
Energy	43 kcal
Carbohydrates	9.6g
Sugars	0.6g
Fiber	1.3g
Fat	0.6g
Protein	1.7g
Vit. B9 (Folate)	180ug (45%)
Iron	2.8mg (22%)
Magnesium	121mg (33%)

Mangroves

- Terrestrial Trees
 - ~50 species “true mangroves”
 - Live on coastlines
 - Tropics & subtropics
- Help to prevent coastal erosion
 - Stabilize soils
- Invasive...
 - Buoyant seeds
 - Water dispersal
 - Seeds can photosynthesize
 - Travel long distances



Mangroves

- Mangrove roots dissipate wave energy
 - Roots slow flow
 - Protection from storm surges
- Trap sediment
 - Sediment comes in on high tides
 - Only fine particles leave on ebb
 - Sink for heavy (trace) metals
- Leads to highly saline, anoxic environment

Mangroves

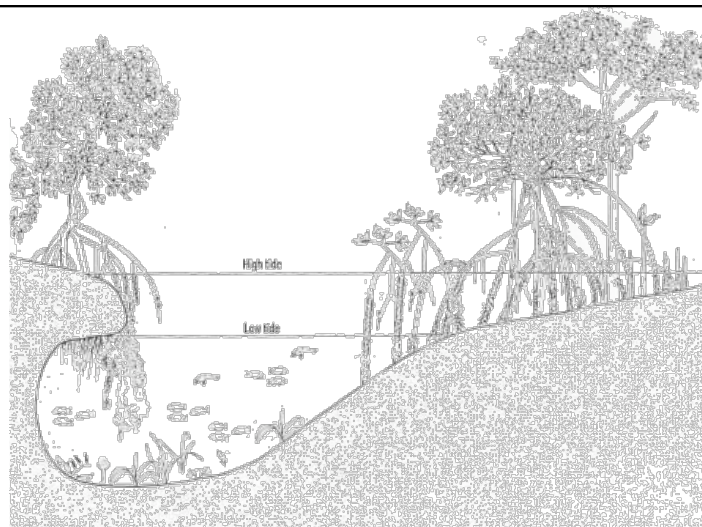
- **Salinity Adaptation**

- Highly impermeable roots
 - Fine filters exclude sodium
- Control stomata & leaf orientation
 - Limits evaporation



- **Anoxia**

- Prop Roots
 - Pores within the bark
- Pneumatophores
 - “Snorkels”
- Large channels in plant
 - Transport oxygen quickly

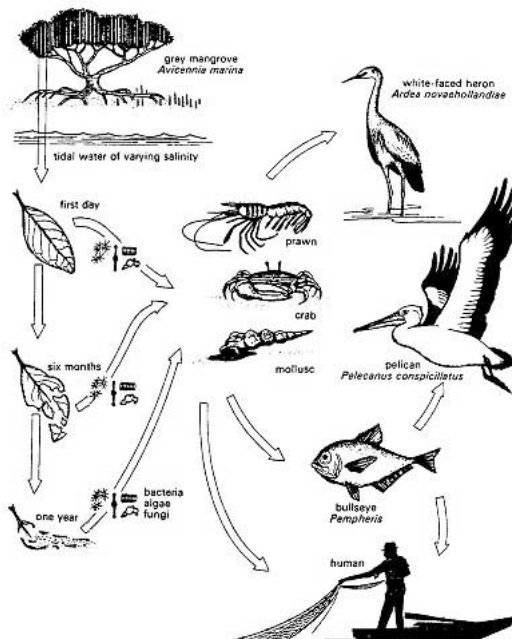


- **Nutrient Uptake**

- Sediments inside mangroves are anoxic
 - Anaerobic bacteria
 - Produce sulphides, methane, phosphates
 - “Mangrove Smell”
- Roots are able to absorb gases from atmosphere, rather than water

Mangrove Communities

- Root system creates habitat
- **Underwater in sediments**
 - Mud lobsters, shrimp
- **Underwater on roots**
 - Algae, barnacles, oysters
- **Tidal Zone**
 - Mangrove crabs
 - Leaf waste feeds benthos
- **On land**
 - Coastal birds, fish
 - Kangaroos!



Mangrove Food Web

- Primary Producers
 - Mangroves
- Consumers
 - Inverts
 - Fish
 - Birds
- Decomposers
 - Bacteria
 - Algae
 - Fungi

Threatened Mangroves

- *“Mangroves more threatened than rainforests”*
 - 200,000 km² coastline
 - Found in 120 countries
- 1-2% per year being removed
 - Urbanization
 - Aquaculture
 - Coastal Landfill
- Leads to –
 - Loss of Biodiversity
 - Coastal Erosion
 - Atmospheric CO₂ sink lost
 - Economic value lost
 - Fishing, tourism, etc.

Threatened Mangroves

- **Florida Keys**
 - Red, Black & White Mangroves
- 23,500 acres removed (2001)
 - Dredging and filling in of coastline for waterfront property
 - Cropping to allow better views of water
- Problem?
 - Hurricane protection!
- State Regulations
 - \$10K fine for removing mangroves

Mangroves as a threat!

- Invasive species!
 - Seed pods good at long distance dispersal
 - Ideal for instant growth
- Established on all Hawaiian Islands
 - Red & Oriental Mangrove
 - No natural predators to slow growth
- Replaced native marshlands
 - Decline in native birds
 - Increase in predators - mongoose
- Mangrove removal projects



Other Photosynthetic Habitats

- **Sea Grass Beds**
 - Not seaweeds
 - Flowering plants
 - Often grow in “meadows”
- **Eelgrass**
- Sand and mud bottom
 - Anchor into sediments
- Form habitats
 - Shelter & feeding grounds
 - Fish, turtles, dugongs
 - Molluscs, worms, nematodes



Eelgrass

- 12 species
 - Zostera
- Sandy substrates
 - Particularly estuaries
- Stabilize sediments
 - Traps flow
 - Increases habitat for infaunal animals
- Used to be used for food



Conclusions

- Primary Producing Habitats
 - Coastal zones
- Kelp Forests
 - Features, threats
- Mangroves
 - Features, threats
- Food webs complex interaction – benthic, pelagic and terrestrial all together