Announcements

1. Homework due Wed.
2. Extra credit due next Friday – if you want it back by final exam.
3. Extra credit opportunity next Friday at noon, SL 110:

   Tasha Johnson - Sex with Aliens: The effects of a showy invasive plant on pollination of a rare endemic wildflower
4. Mutualisms lecture – posted, with notes.
   - Focus on questions outlined at the beginning of powerpoint and in the study guide.

Processes affecting diversity - I

READING:
Chap. 16 - Species Abundance and Diversity
Chap. 17 – Community structure

Processes affecting diversity

A. Equilibrium
   1. Habitat heterogeneity/niche differentiation
   2. Intermediate stress hypothesis
   3. Food webs and trophic interactions: keystone species

B. Non-equilibrium
   1. Intermediate disturbance hypothesis
   2. Temporal variability

C. Ecosystem implications of food webs
   Chap. 18 – 2° production (4th: 424-9; 5th: 411-17)

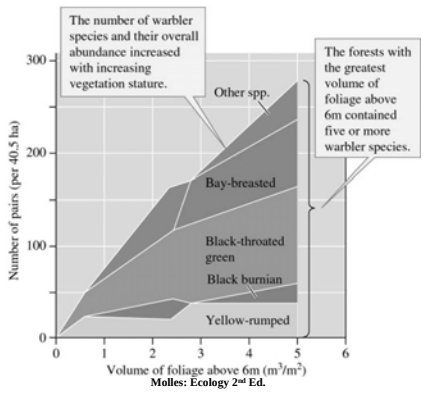
D. Island biogeography (Chap. 22)
   1. Effects of island size and distance
   2. The balance between immigration and extinction

E. The latitudinal species gradient
   1. The patterns
   2. The hypotheses

Causes of diversity variation?

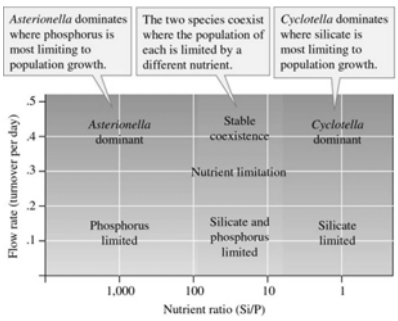
1. Environmental Complexity

- In general, species diversity increases with environmental complexity or heterogeneity.



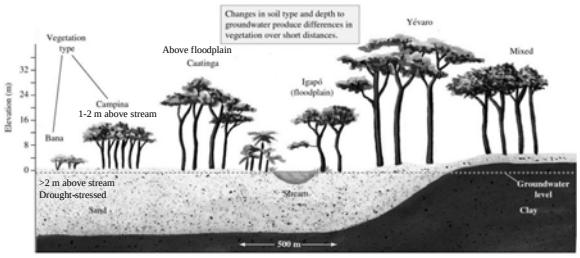
16.9

Diversity of Algae



16.11

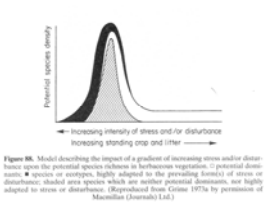
Environmental Heterogeneity and Diversity of Plants (tropical forests)

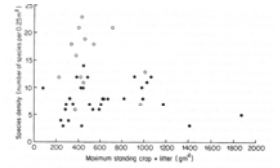


16.14

2. Intermediate stress hypothesis

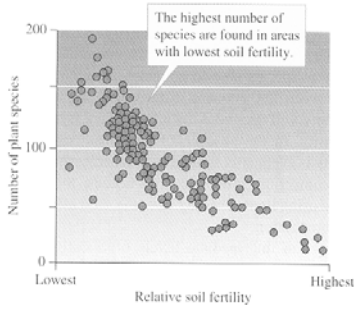
Grime predicts a "humped-back" distribution of species richness across a gradient of productivity (degree of resource availability stress)





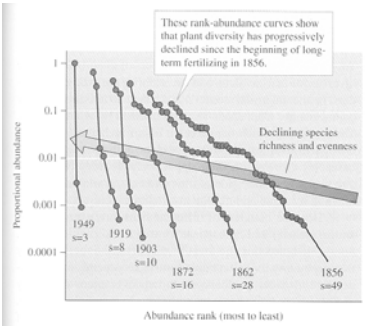
Grime 2001, pp. 263-266

Highest species richness generally found in areas with low nutrient availability



16.15

Addition of nutrients leads to decline in species richness and evenness in Rothamsted, England



16.16

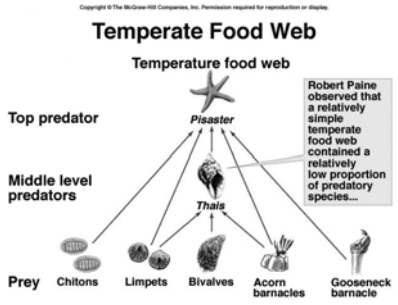
Serpentine grasslands

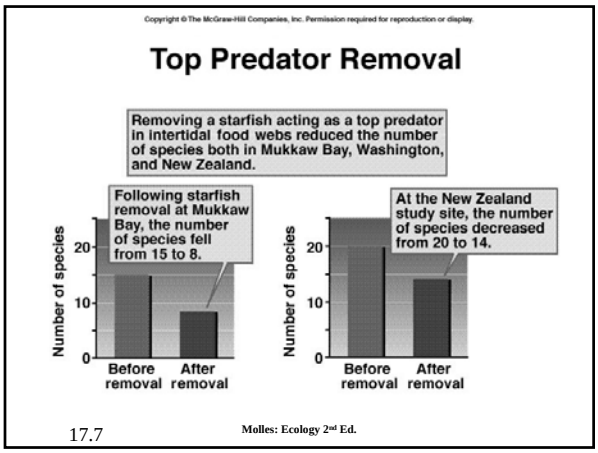
Serpentine soils: low nutrients + high heavy metals + low Ca:Mg = tough for plants!

But, high diversity because of low dominance by exotic grasses.

3. Food webs and trophic interactions

Keystone species





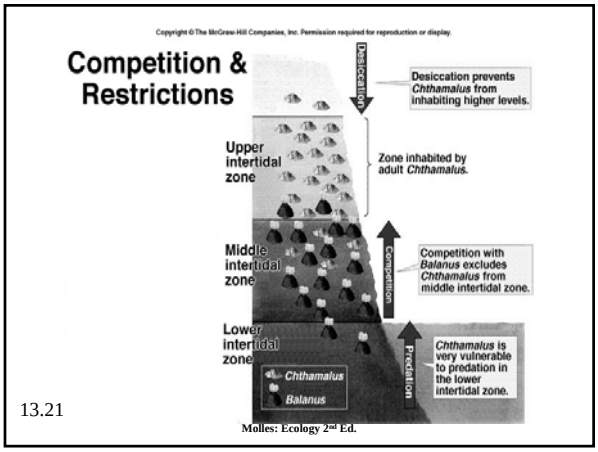
17.7

Molles: Ecology 2nd Ed.

Effects on community composition

- Keystone predators

13.21



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Molles: Ecology 2nd Ed.

Keystones species

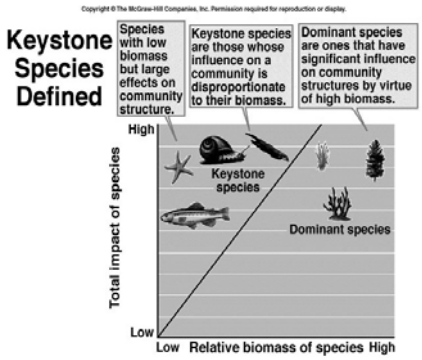


Fig.17.16

Molles: Ecology 2nd Ed.

Keystones species

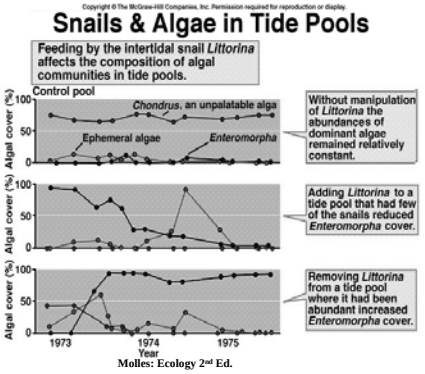


Fig.17.8

Molles: Ecology 2nd Ed.

Keystones: dependence on environment

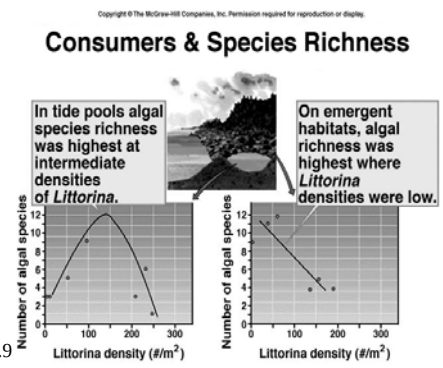


Fig.17.9

Not all top predators increase diversity

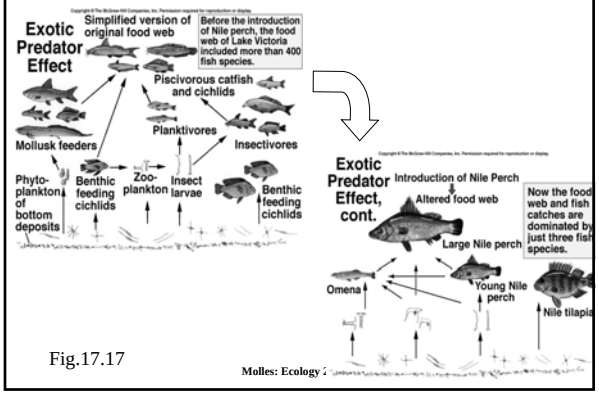


Fig.17.17

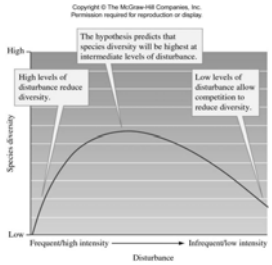
Keystones: factors that increase diversity

1. Selective predation
2. Preferred prey is the competitive dominant

B. Non-equilibrium processes

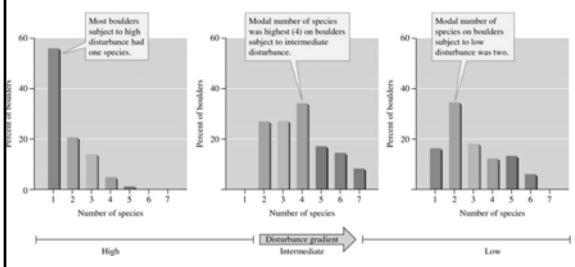
1. Intermediate disturbance hypothesis

- *Connell* proposed disturbance is a prevalent feature that significantly influences community diversity.
  - Proposed both high and low levels of disturbance would reduce diversity.



Disturbance and Diversity

- *Sousa* defined disturbance:
  - Discrete, punctuated, killing, displacement, or damaging of one or more individuals that directly or indirectly creates an opportunity for new individuals to be established.
  - Two major characteristics:
    - Frequency
    - Intensity

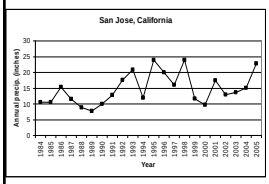


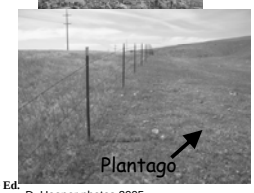
16.18

- Large boulders require more force to move.
  - Boulders supporting greatest diversity of species were those subject to intermediate levels of disturbance.

2. Temporal heterogeneity

- For example, coexistence of competing species in grasslands because environmental conditions (rainfall amount and timing) varies greatly from year to year.
- Variable conditions mean that the best competitor varies from year-to-year as well.





D. Hooper photos 2005

Summary

- Species diversity is affected by both equilibrium and non-equilibrium processes.
  - Equilibrium: complex environments, degree of environmental stress, trophic interactions.
  - Non-equilibrium: levels of disturbance, temporal variability.