

第二次期中考

16 May 2005 (Monday)

10:30-12:00

Community Structure

Molles, ch 17

Chapter Concepts

- Food webs
- Keystone species
 - Keystone predator
 - Exotic predators
 - Mutualistic keystone sp
 - Human role

Chapter Concepts

-- Food webs

- A food web summarizes the feeding relations of a community.
 - Earliest: Elton (1927), simple food webs, Bear Island, high Arctic, impoverished faunas

Ex. Fig 17.3

Food Web Complexity

- Complexity of FW incr dramatically for more diverse communities
- Can simplify food webs in various ways:
 - Only included common species.
 - Top-predator sink.

(FW consists all items consumed by the prey of the top predator, and so on down to the base of the FW)

- Excluded weakest trophic links.

Chapter Concepts

-- Keystone species

- The feeding activities of a few keystone species may control the community structure.
 - Keystone predator
 - Exotic predator
 - Keystone mutualist
 - Human as keystone sp

Keystone Species

- If keystone species reduce likelihood of competitive exclusion, their activities would increase the number of species that could coexist in communities.

Keystone predator

- Ex. Paine (1966, 1969)
Intertidal zone, Washington, 49°N
 - K. predator= starfish
- Ex. Lubchenco 1978,
 - K. predator= snail
- Ex. Power 1990, fish, river, California
 - K. predator= fish

Paine found

- as # species in intertidal FW increased, proportion of predators in FW incr.
 - Total sp: 13→45 (3.5倍)
 - Predator sp: 2→11 (5.5倍)
- higher predator %→predation pressure
→ promoting higher diversity.

Experiments:

- Removal of *starfish (top predator)*
 - decline in diversity
 - At Washington, temperate,
area: 8mX2m, 2yr, 15 → 8 sp.
 - At New Zealand, subtropical,
9 month, 20 → 14 sp

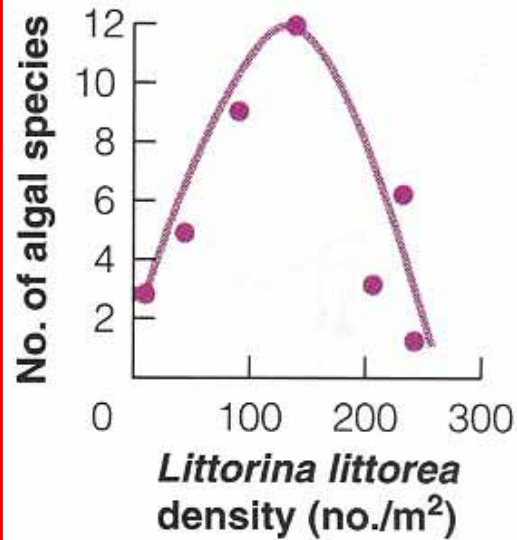
Consumer Effects on Local Diversity

- *Lubchenko* proposed to resolve the effect of herbivores on plant diversity, you need to know:
 - (1) Herbivore food preference.
 - (2) Competition between plant species.
 - (3) Variance of (2) across environment.

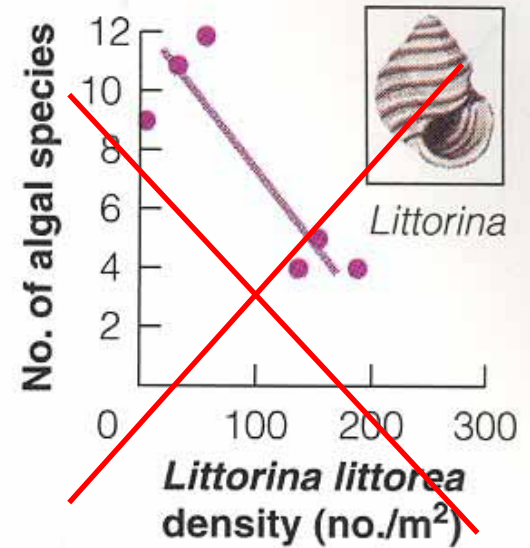
In tidal pools...

- Under normal conditions:
 - green algae (*Enteromorpha*) out-competes red algae (*Chondrus*)
 - *Snail* (*Littornia*) prefers green algae
 - Green crabs (*Carcinus maenus*) prey on snails.
 - Crabs are controlled by Seagulls.
- In the absence of snails: red algae is competitively displaced.
- When snails are present.....

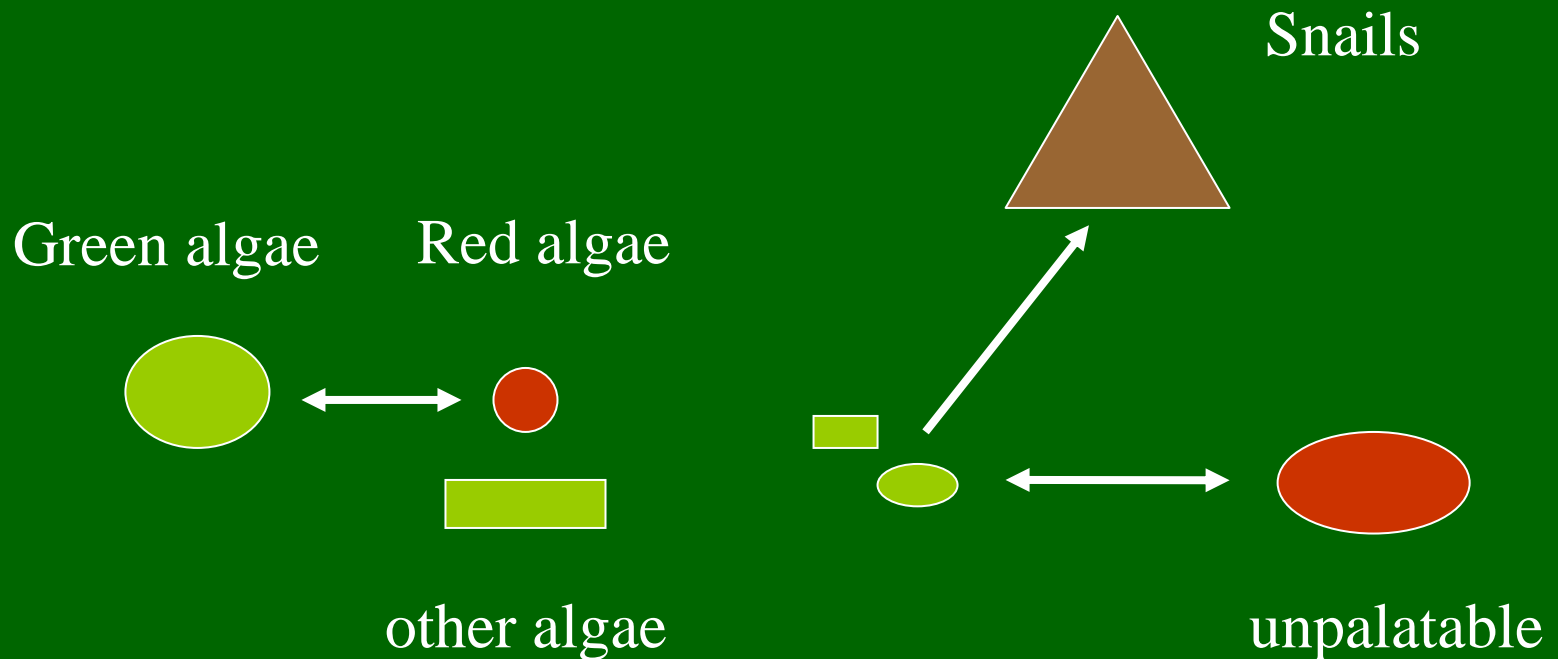
Tidal pools



(a) Tide pools



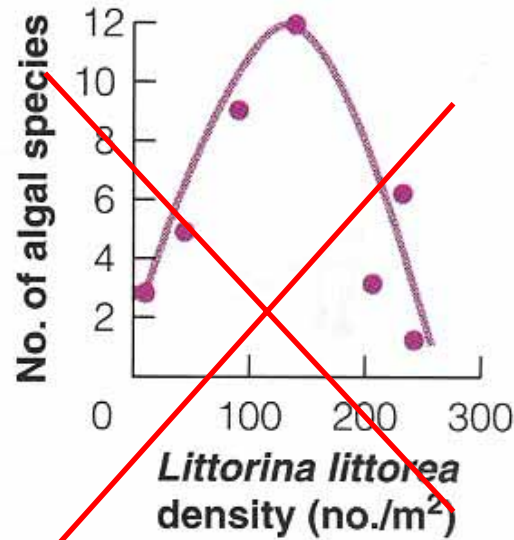
(b) Emergent substrates



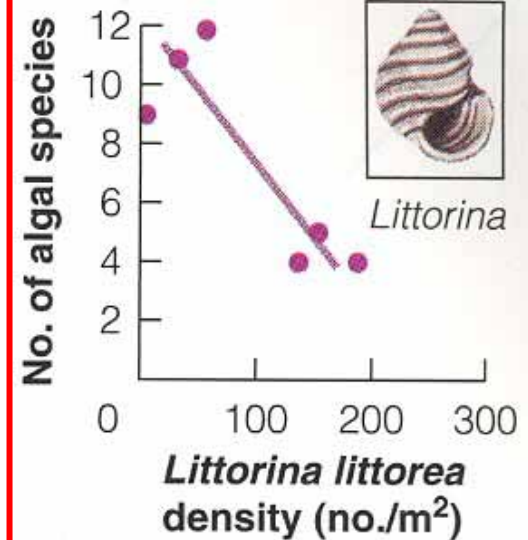
On emergent habitats,

- Algae flora is diff, (bec rock surfaces not submerged in tide pools during low tide)
- Brown algae are dominant (*Fucus* & *Ascophyllum*)
- Snails eat competitively inferior species of algae (ephemeral, tender green algae)

Emergent substrata



(a) Tide pools



(b) Emergent substrates

Brown algae

Fucus, Ascophyllum

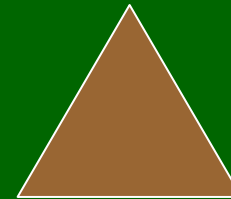


Red algae

Green algae
(ephemeral)



unpalatable



Snails



Fish as River Keystone Species

Power, California,

- Predatory fish:
 - roach (*Hesperoleucas symmetricus*)
 - steelhead trout (*Oncorhynchus mykiss*)
- Fish incr → dec algal densities.
- Thus fish act as Keystone Species.

- Exp: Power 1990, Eel River, California
- Q: whether 2 top predators significantly influence web structure?
- Manipulate the passage of large fish, by 3 mm mesh net, 12 of 6m²-area

fig 17.12

Keystone Species: Summation

Power 1996:

- Keystone species are those that exert strong effects on their community structure, despite low biomass.
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Chapter Concepts

-- exotic predators

- Exotic predators can collapse and simplify food web structure.
 - Exotic species have dramatic impacts on communities because they were outside the evolutionary experience of local prey populations.

Exotic Predators

EX. Lake Victoria, E Africa (69,000 km², <>60m) depth, original 400 fish sp,

- <>1954, Nile perch (*Lates nilotica*) exotic fish predator were introduced
- 1980s, found: Fish fauna reduced, <> 10 sp
3 dominate sp:
 - Nile perch (introd),
 - Nile tilapia (introd),
 - omena (native sp)

Exotic Predators

- *Kaufman* 1992, pointed out changes in Lake Victoria fish community coincide with other ecosystem changes.
 - Dissolved oxygen concentrations significantly decreased. → massive fish kills 1987
 - Cultural eutrophication (human pop incr).

Chapter Concepts

-- Mutualistic Keystone species

- Ex. A cleaner wrasse (*Labroides dimidiatus*) fish, Queensland, Australia, can remove and eat 1200 parasites from client fishes per day (Grutter 1999)

- Bshary 2003, Mohammed Nat Park, Egypt
- Comparative studies on Reef fish diversity, 46 patches (29 natural settings), for 4 month,

→ 24 % diff, fig 17.18

Chapter Concepts

-- Human as Keystone species

- EX. Redford 1992, tropical rain forest, Amazon
 - Human effect on animals?
 - Subsistence hunting led to
 - 60million animals deaths per year
 - Concentrate on larger birds and mammals
 - 18% sp composition = 75% biomass
- fig 17.21

“The big things that run the world”

- John Terborgh 1988
- Ex. Barro Colorado Island, Panama,
no large predators
(pumas, jaguars)
 - medium-sized mam sp
 - > 10 folds than # sp at other area
 - deer?

- Redford warned: “We must not let a forest full of trees fool us into believing all is well.”
- Tropical rain forest conservation must also include the large, and potentially keystone animals which are vulnerable to hunting by humans.

END!