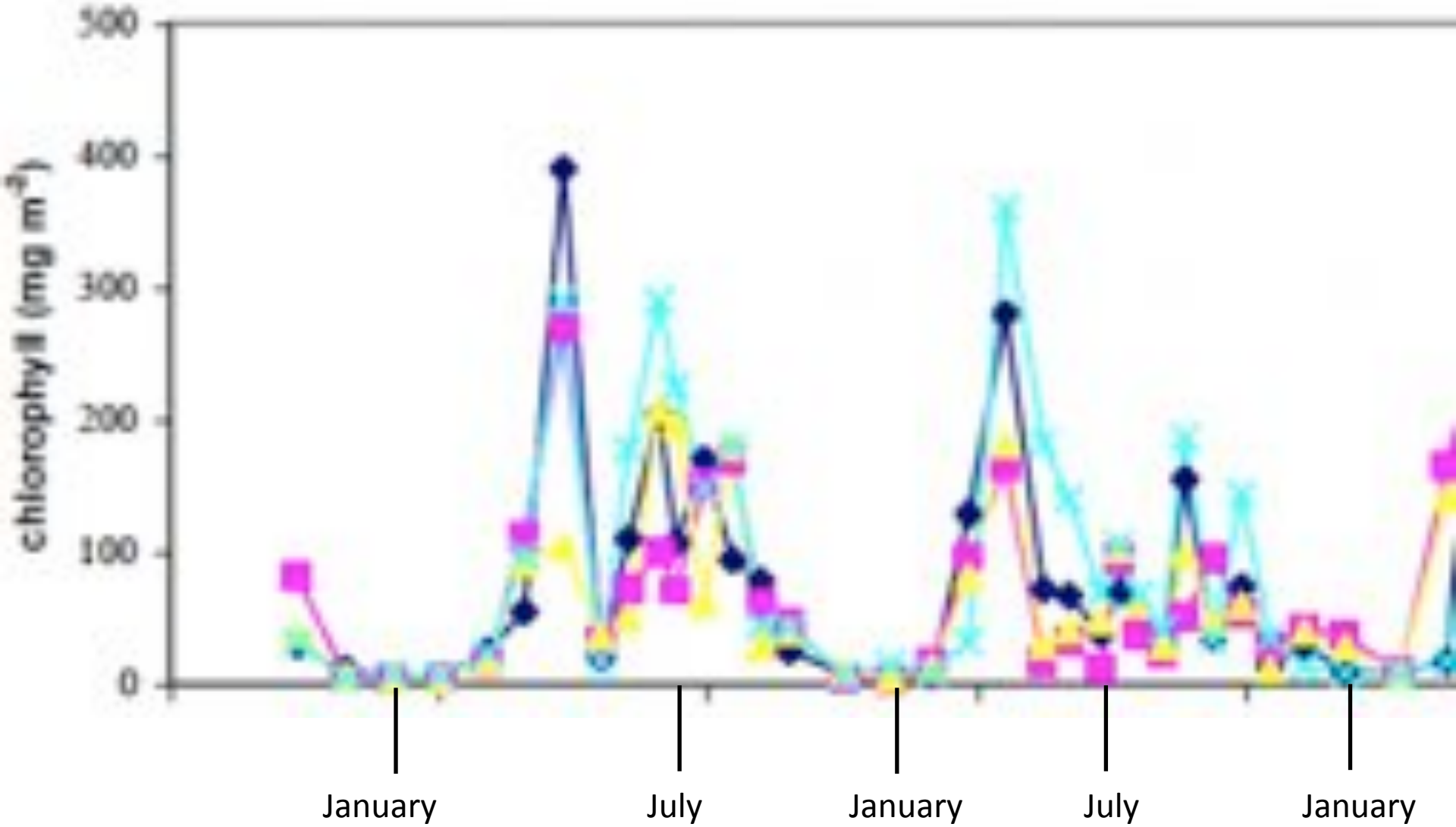


# Puget Sound – Greenness



The World is Green

# The World is Green

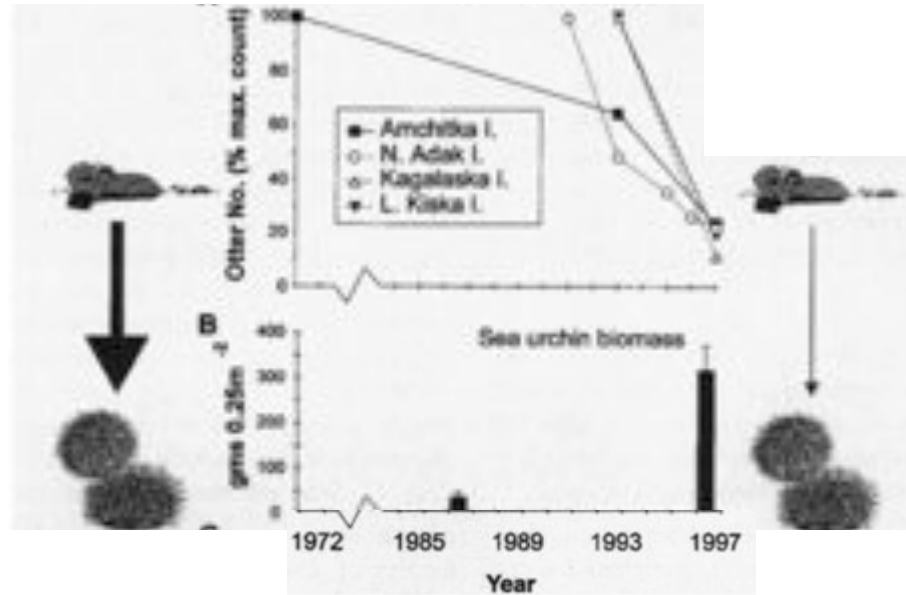
Top-Down food web control

- The world is green because herbivore populations are kept in check by predators

# Otters



# Otters eat urchins

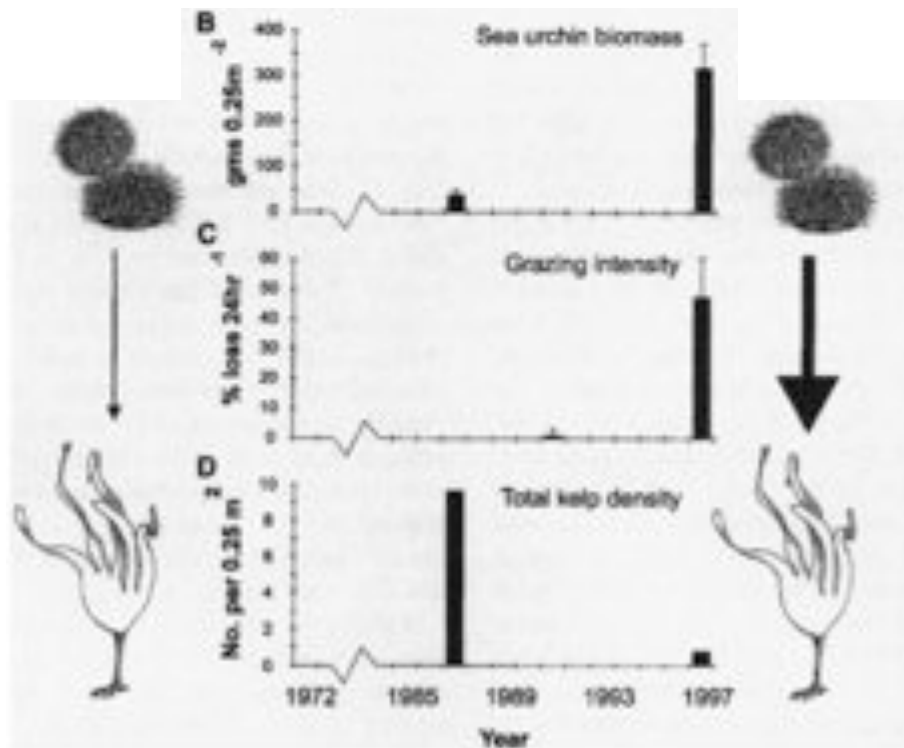




# Urchins



# Urchins eat Kelp



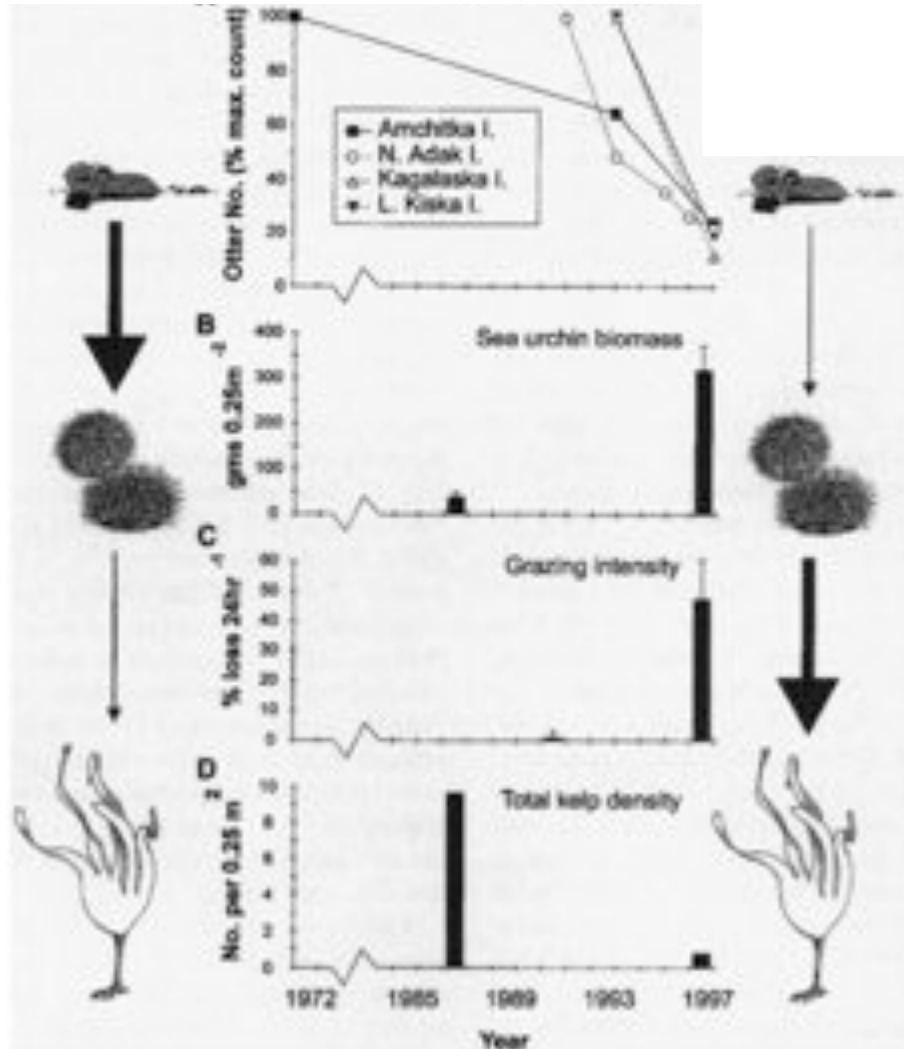
# Otters, urchins and kelp





# Otters eat urchins eat kelp

“trophic cascade”



# Kelp Forest



# Urchin Barrens



Besides urchin food...





# Tatoosh Island



Bob Paine  
Prof. Emeritus, UW

# Tatoosh Island



Lichen

Barnacles, small mussels

Barnacles, LARGE MUSSELS

Algae, mobile grazers, gooseneck barnacles

Anemones, STARS, gooseneck barnacles



# *Mytilus californianus*





# *Pisaster ochraceus*



# Crowbar





# With *Pisaster*



# -*Pisaster*



“A keystone species is...

...one whose impact on its community or ecosystem is large, and disproportionately large relative to its abundance.”

Marine examples:

Otters, *Pisaster*, tropical sea stars, tropical urchins, carnivorous snails, baleen whales, damselfishes



Top-down control is...