Chapter 6 in an Urchin shell

The Acorn Connection

- Points
  - All parts of the community are dependent on non-living parts
  - Living members effect non-living aspects
  - Life is connected in complex ways - everything effects everything

The Acorn Connection

- Points
  - Relationships in ecosystems are dynamic
  - Human management of ecosystems involve trade-offs

Ecosystem

- Ecosystem = community + non-living environment
  - community = all the living things in an area

Three Characteristics of

- 1: structure of living and non-living things
- 2: processes (including energy and chemical cycling)
- 3: Change (including succession)

Yellowstone hot springs

- Simplest ecosystem
  - First trophic level - producers - photosynthesis [bacteria and algae]
  - Second trophic level - herbivores - primary consumers [flys and larvae]
  - Third trophic level - carnivores - secondary consumers [insects, bird]

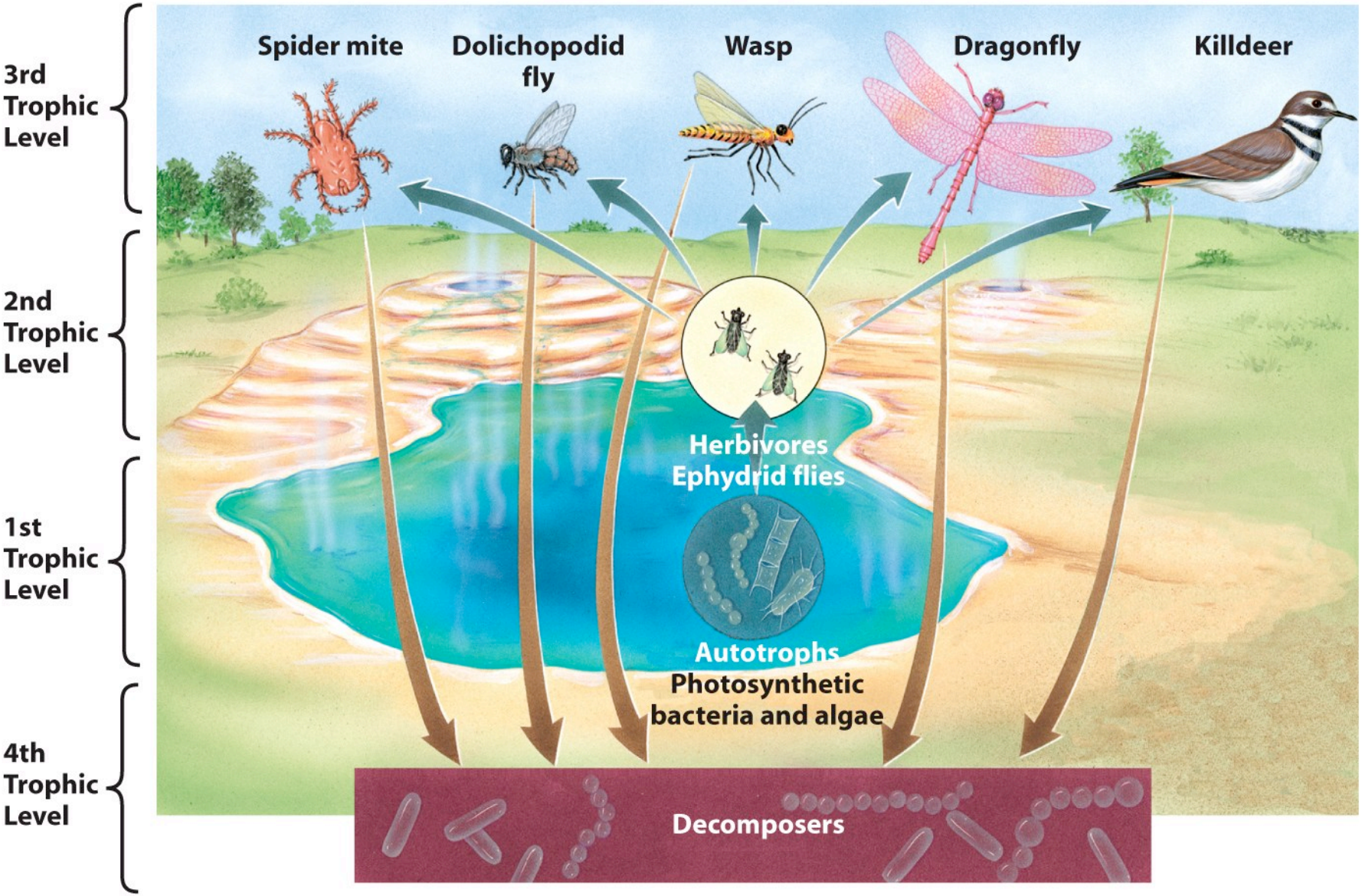


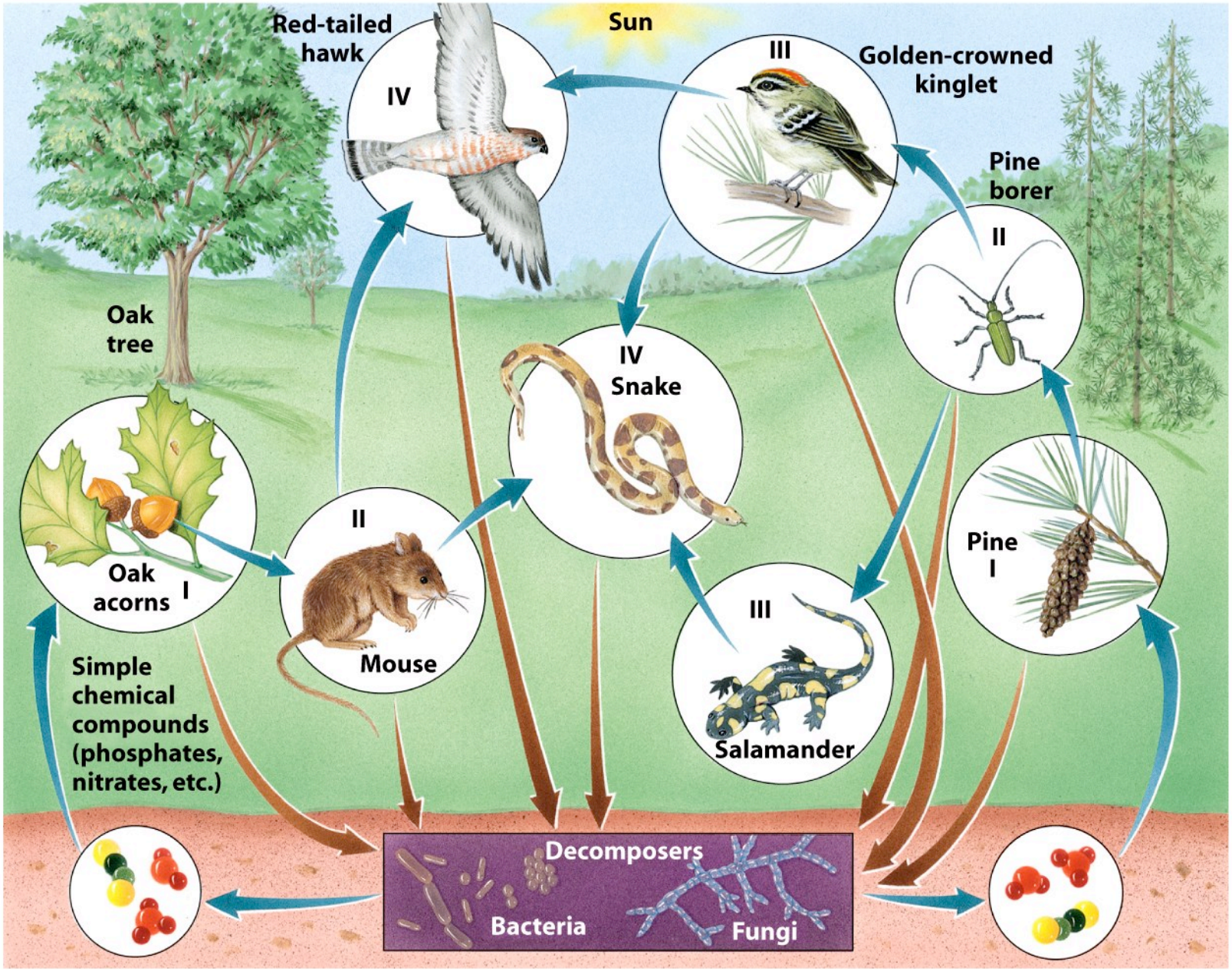
Figure 6-4 Botkin - Env. Sci. 6/e

Yellowstone hot springs

- Fourth trophic level - in this case, decomposers - [bacteria]
- Decomposers work at all levels
- RULE: when an organism is at multiple levels we assign it the highest one it operates at

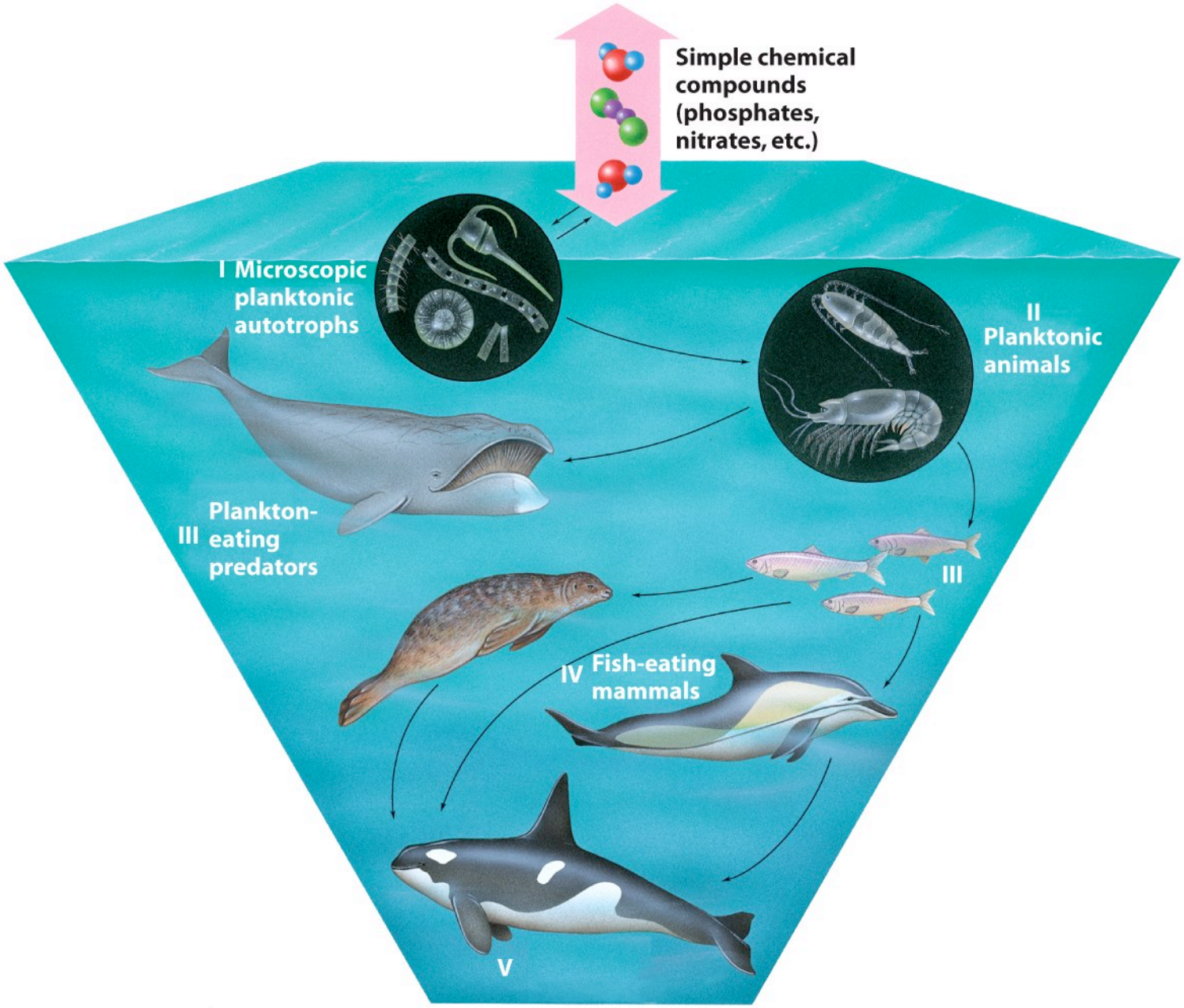
Yellowstone hot springs

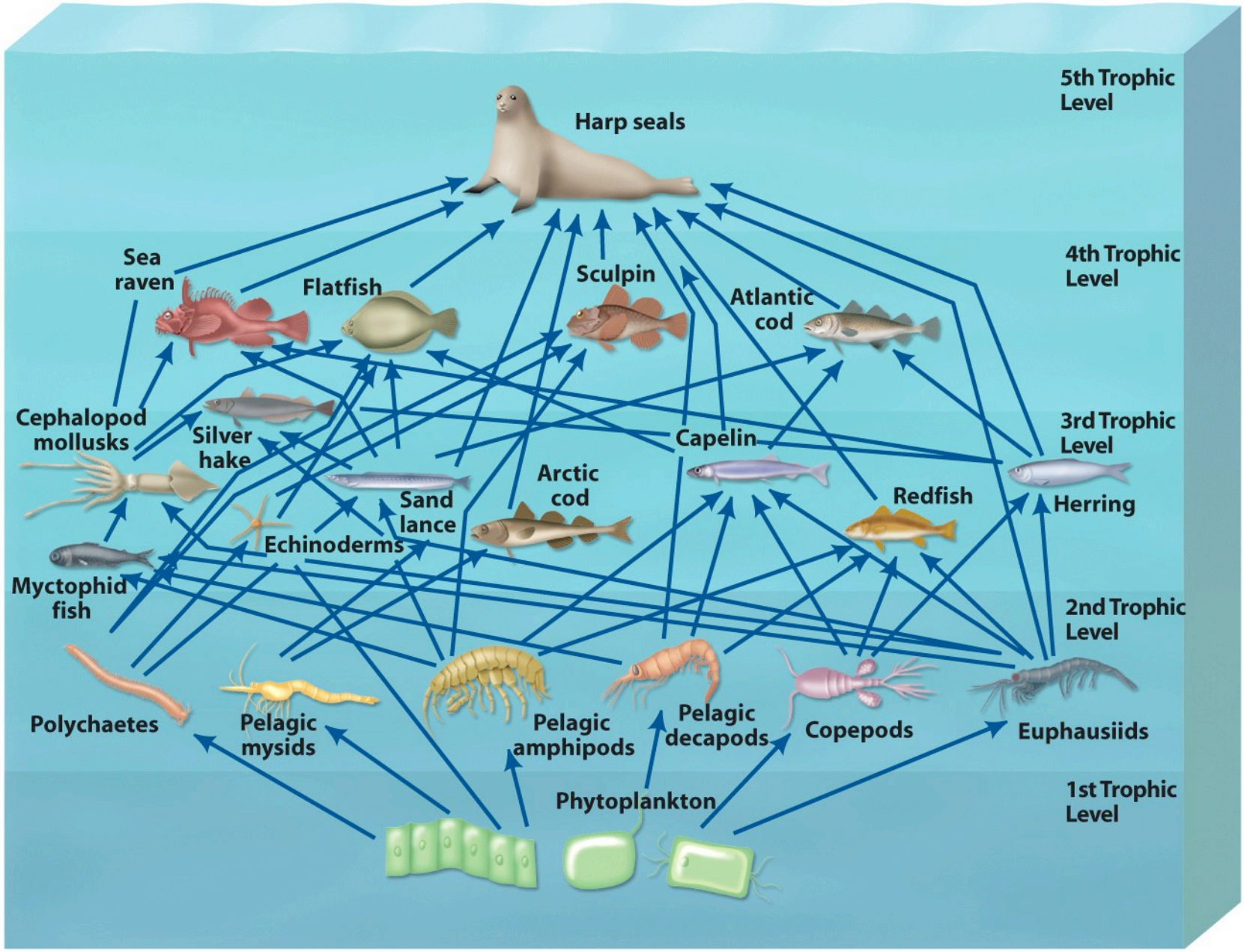
- Maintained by two factors
  - 1: sunlight
  - 2: inflow of water with chemical elements
- Includes a total of about 20 species!! (even though it is very simple)


Red-tailed hawk
IV
Sun
III
Golden-crowned kinglet
Pine borer
II
Oak tree
IV
Snake
Oak acorns
I
II
Mouse
III
Salamander
Pine
I
Simple chemical compounds (phosphates, nitrates, etc.)
Decomposers
Bacteria
Fungi

Terminology reminder

- Phytoplankton - tiny photosynthetic organisms in aquatic ecosystems - first trophic level
- Zooplankton - tiny animals in aquatic ecosystems, such as krill - second trophic level


Simple chemical compounds (phosphates, nitrates, etc.)
I Microscopic planktonic autotrophs
II Planktonic animals
III Plankton-eating predators
III
IV Fish-eating mammals
V

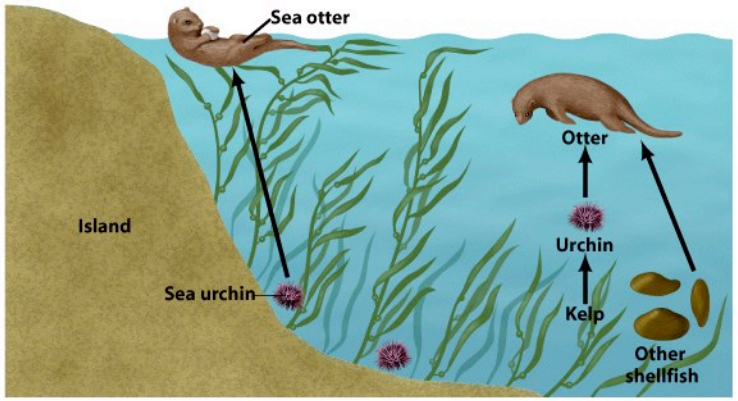

5th Trophic Level
Harp seals
4th Trophic Level
Sea raven
Flatfish
Sculpin
Atlantic cod
3rd Trophic Level
Cephalopod mollusks
Silver hake
Capelin
Arctic cod
Sand lance
Redfish
Herring
Echinoderms
Myctophid fish
2nd Trophic Level
Polychaetes
Pelagic mysids
Pelagic amphipods
Pelagic decapods
Copepods
Euphausiids
1st Trophic Level
Phytoplankton

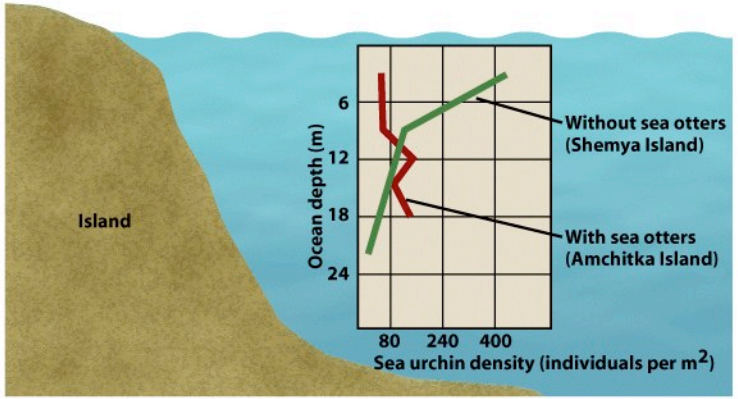
The Community Effect

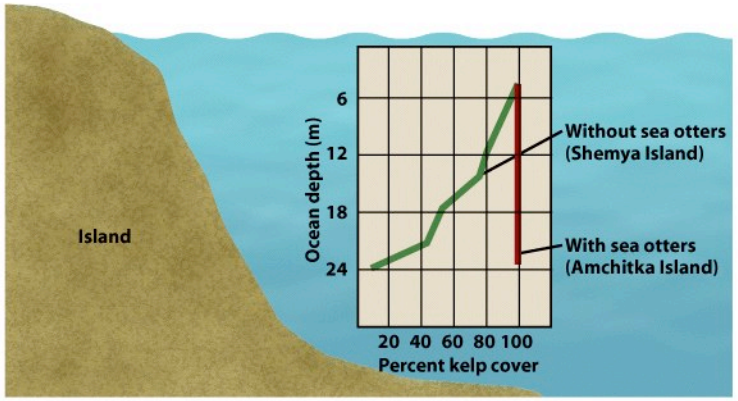
- Indirect effects of one species on another due to the law of environmental unity
  - Whales eating krill is not a community effect. Dolphins having less food because whales eat krill is a community effect.

Sea Otters 1

- Study of otters has been available, because the history of hunting has meant they are more common in some areas than others
- Food chain
  - Kelp ---> Urchin ---> Otter


Sea otter
Otter
Island
Urchin
Sea urchin
Kelp
Other shellfish


Island
Ocean depth (m)
6
12
18
24
Without sea otters (Shemya Island)
With sea otters (Amchitka Island)
80 240 400
Sea urchin density (individuals per m2)


Island
Ocean depth (m)
6
12
18
24
Without sea otters (Shemya Island)
With sea otters (Amchitka Island)
20 40 60 80 100
Percent kelp cover

Sea Otters 2

- Where there are few otters there are many urchins and the kelp get killed
- Where there are many otters there are few urchins and kelp thrives
- Kelp serves as habitat to many species, therefore otters indirectly effect diversity

What is an ecosystem?

- If understanding ecosystems is important to management, then we have to define ecosystems.
  - Well defined - edge of lake
  - Gradual - from desert to forest
  - Vague - grassland to savannah in Africa
  - Common - watershed

How Do You Know When You Have Found an Ecosystem?

- Vary greatly in structural complexity.
- The watershed is a common, practical delineation.
- Common to all ecosystems is energy flow and cycling of chemical elements.

Ecosystem Management

- Ecosystem management is the key to conservation of life on Earth.
- If ecosystems cease to function we must supplement with our own actions.
- Must consider chemical cycling, energy flow, community-level interactions, and natural changes.

Three kinds of Ecosystems

- Natural
- Artificial - a pond as part of a waste treatment plant
- Managed - agriculture and wildlife preserves
- Sometimes, such as in zoos, individuals are separated from their ecosystems