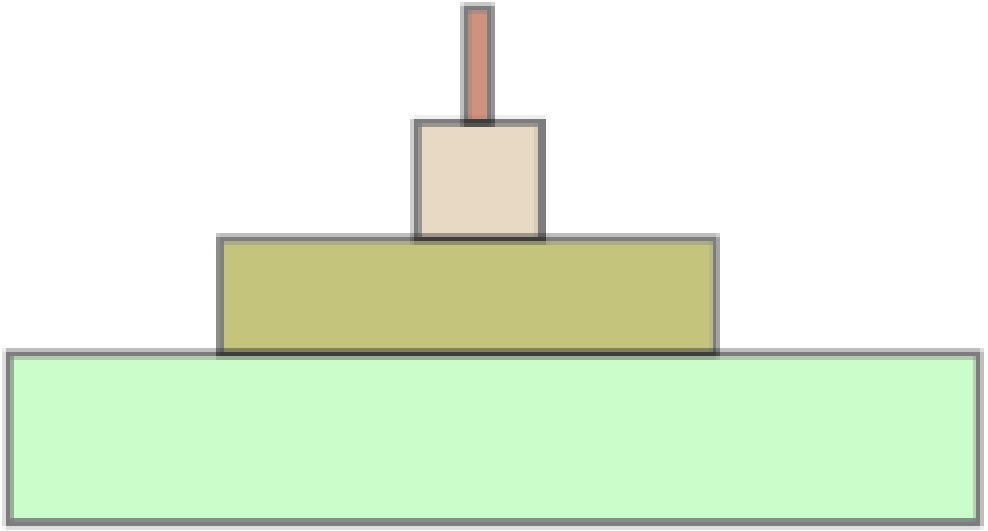


Communities and Ecosystems

Ecology

the study of relationships between living organisms and between organisms and their environment

Population

A group of organisms of the same species living in the same area at the same time

Ecosystem

A community and its abiotic environment
non-living

Community

A group of populations living and interacting with each other in an area

Habitat

The environment in which a species normally lives
(the location of a living organism)

Species

A group of organisms that can interbreed to produce fertile offspring

Feeding Methods

Autotrophy
self-feeding

Organisms which produce their own food from organic molecules

Producers

Photoautotrophy
photosynthesis

Green plants, phytoplankton and algae

Chemoautotrophy
chemosynthesis

Deep-sea chemosynthetic bacteria

Heterotrophy
other source-feeding

Organisms which derive energy from other living organisms

Consumers
ingest organic matter which is living or recently killed

Primary
eat producers

herbivores

Secondary
eat other consumers

carnivores, omnivores

Decomposers
derive energy from non-living organic matter

Detritivores
ingests non-living organic matter

earthworms, woodlice

Saprotrophs
lives in or on non-living organic matter, *secreting digetive enzymes into it* and absorbing digestive products

bacteria and fungi

Detritivore

ingests non-living organic matter

ingest first, then digest

One of Darwin's great (and final) works was a long-term study of how earthworms produce soil through their feeding, published 1881.

"The formation of vegetable mould, through the action of worms."

Read it online here: http://darwin-online.org.uk/EditorialIntroductions/Freeman_VegetableMouldandWorms.html

woodlouse
(Armadillidium vulgare)

Image: 'slater'
www.flickr.com/photos/11821713@N00/3385260971

earthworm
(Eisenia fetida)

Image: 'Regenwurm / Earthworm'
www.flickr.com/photos/8888696@N06/3332190255

Giant Gippsland Earthworm:

http://www.youtube.com/watch?v=DZig6EL5B6A

Saprotrophs

live in or on non-living organic matter, *secreting digetive enzymes into it* and absorbing digestive products

Digest first, then absorb

Saprotrophic bacteria and fungi recycle nutrients.

Secret life of fungi:

http://www.youtube.com/watch?v=Az9SbsK0j1M

Fly agaric mushroom *(Amanita muscaria)*

Consumers ingest organic matter which is living or recently killed

Food chains show the flow of energy through the trophic levels of a feeding relationship.

Trophic level: *feeding position of an organism in a food chain.*

consumers (heterotrophs)

Tertiary consumer

Final stage = top carnivore

eaten by

energy

Secondary consumer

carnivore/ omnivore (predators)

eaten by

energy

Primary consumer

herbivore

eaten by

energy

producer (autotroph)

Producer

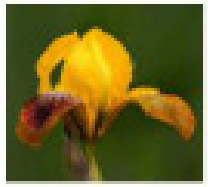
Woodland

sparrowhawk

great tit

moth caterpillar

yellow iris



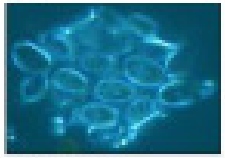
Arctic

seal

cod

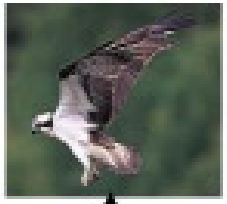
krill, amphipods

diatoms, phytoplankton

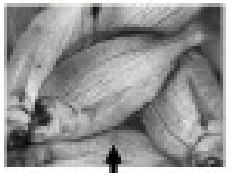


Freshwater

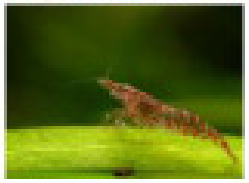
osprey



bream



freshwater shrimp



(all images from flickrcc)

Food webs show all of the feeding relationships within a habitat

Read this article and generate a food web:

ehp ENVIRONMENTAL HEALTH PERSPECTIVES

"The State of the Oceans, Part 2: Delving Deeper into the Sea's Bounty," *EHP Student Edition*, January 2005: A472–A481.

http://ehp.niehs.nih.gov/members/2004/112-8/focus.html

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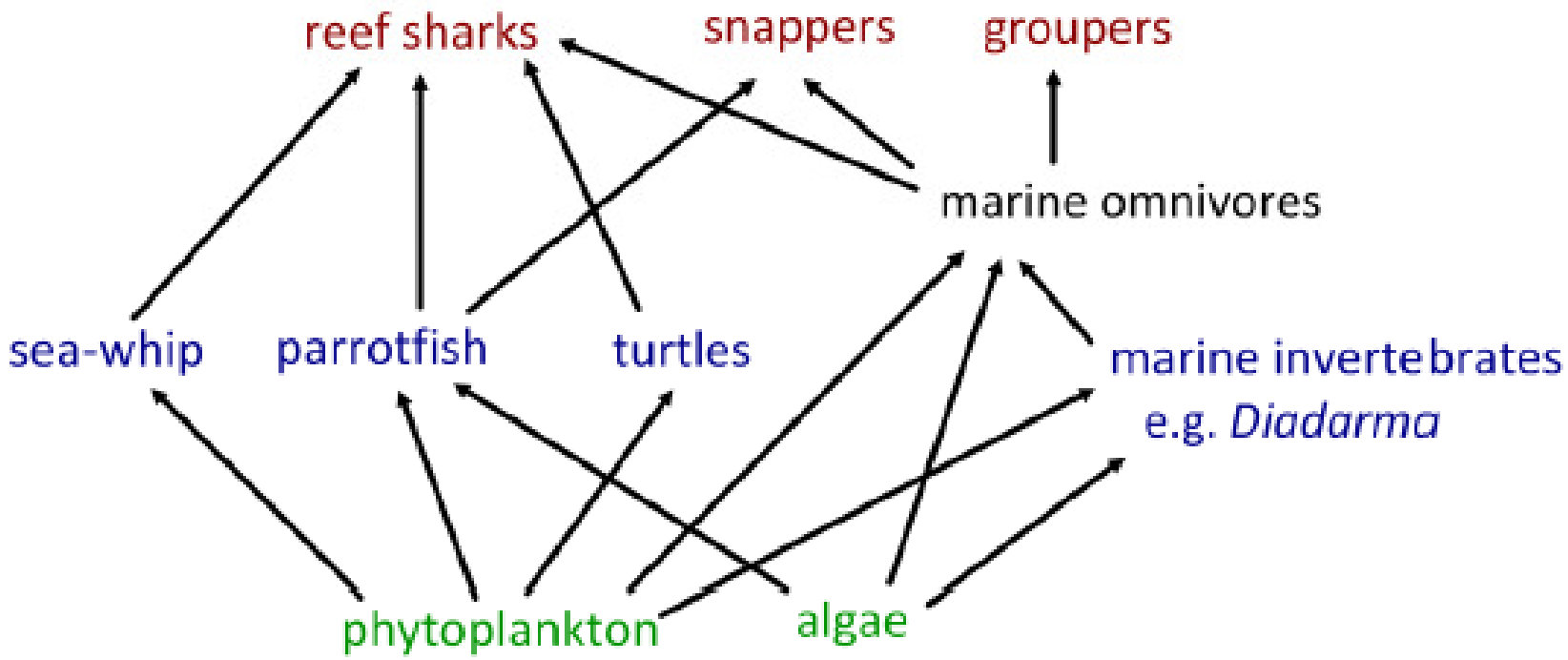
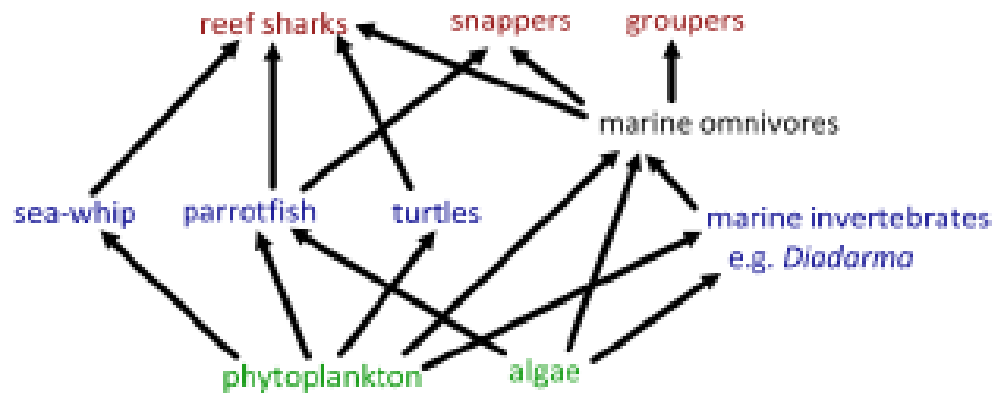


Food webs show all of the feeding relationships within a habitat

Food webs contain many food chains.



Can you pick out:

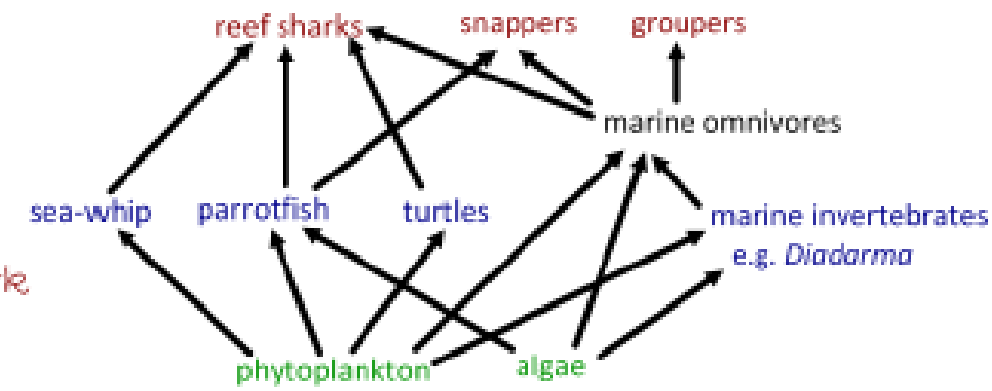
1. A three-step food chain?

2. A four-step food chain?

Some organisms can fit into more than one trophic level.
Give two examples from this food web.

Food webs show all of the feeding relationships within a habitat

Food webs contain many food chains.



Can you pick out:

1. A three-step food chain?

phytoplankton → sea whip → reef shark

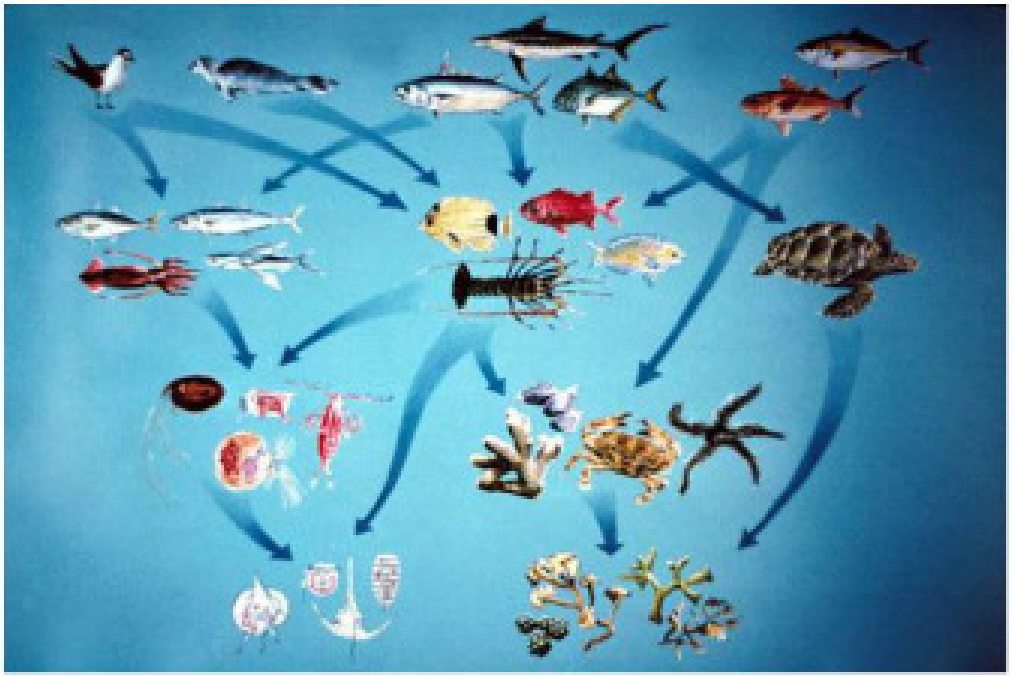
2. A four-step food chain?

algae → Diadarma → marine omnivores → groupers

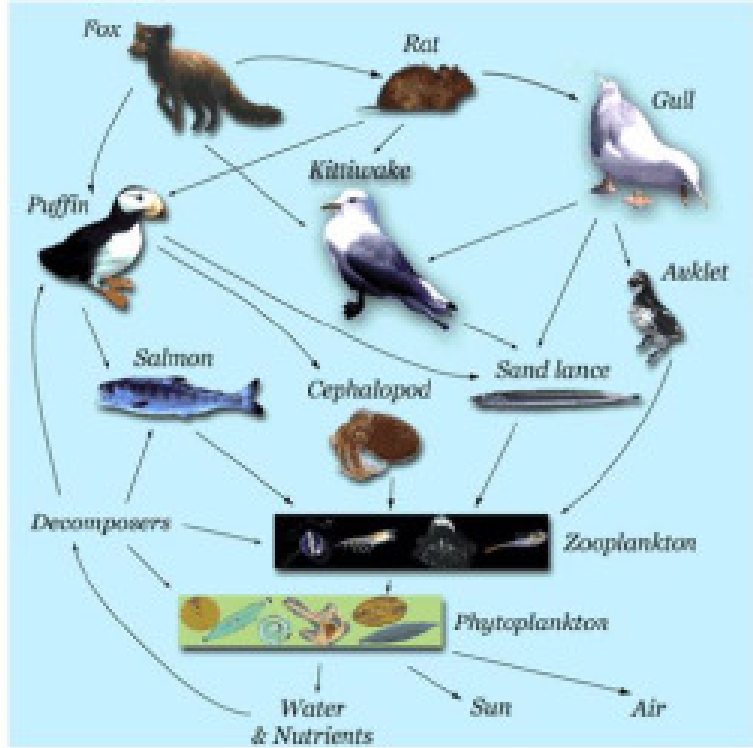
Some organisms can fit into more than one trophic level.
Give two examples from this food web.

- Snappers and reef sharks can be either secondary or tertiary consumers, depending on their food source.

What's wrong with these food webs?



http://celebrating200years.noaa.gov/breakthroughs/ecopath/food_web_600.jpg



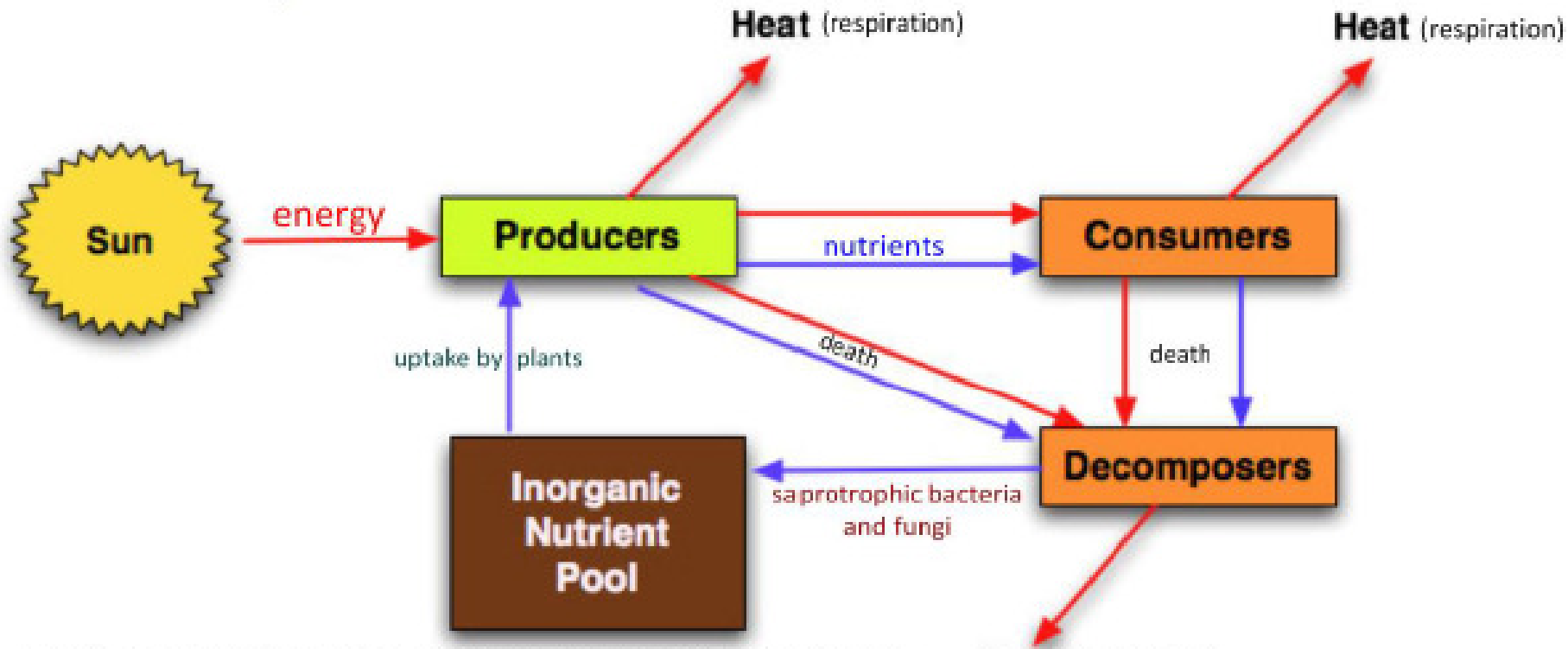
http://www.absc.usgs.gov/research/seabird_foragefish/marinehabitat/home.html

Are the foxes *really* being eaten by the puffins?

Sunlight is the initial energy source for almost all communities*.

Energy flows through the food chain, being lost at each stage due to respiration.

Nutrients are recycled.



http://www.sciencebitz.com/wp-content/uploads/2007/06/energy-flow.jpg

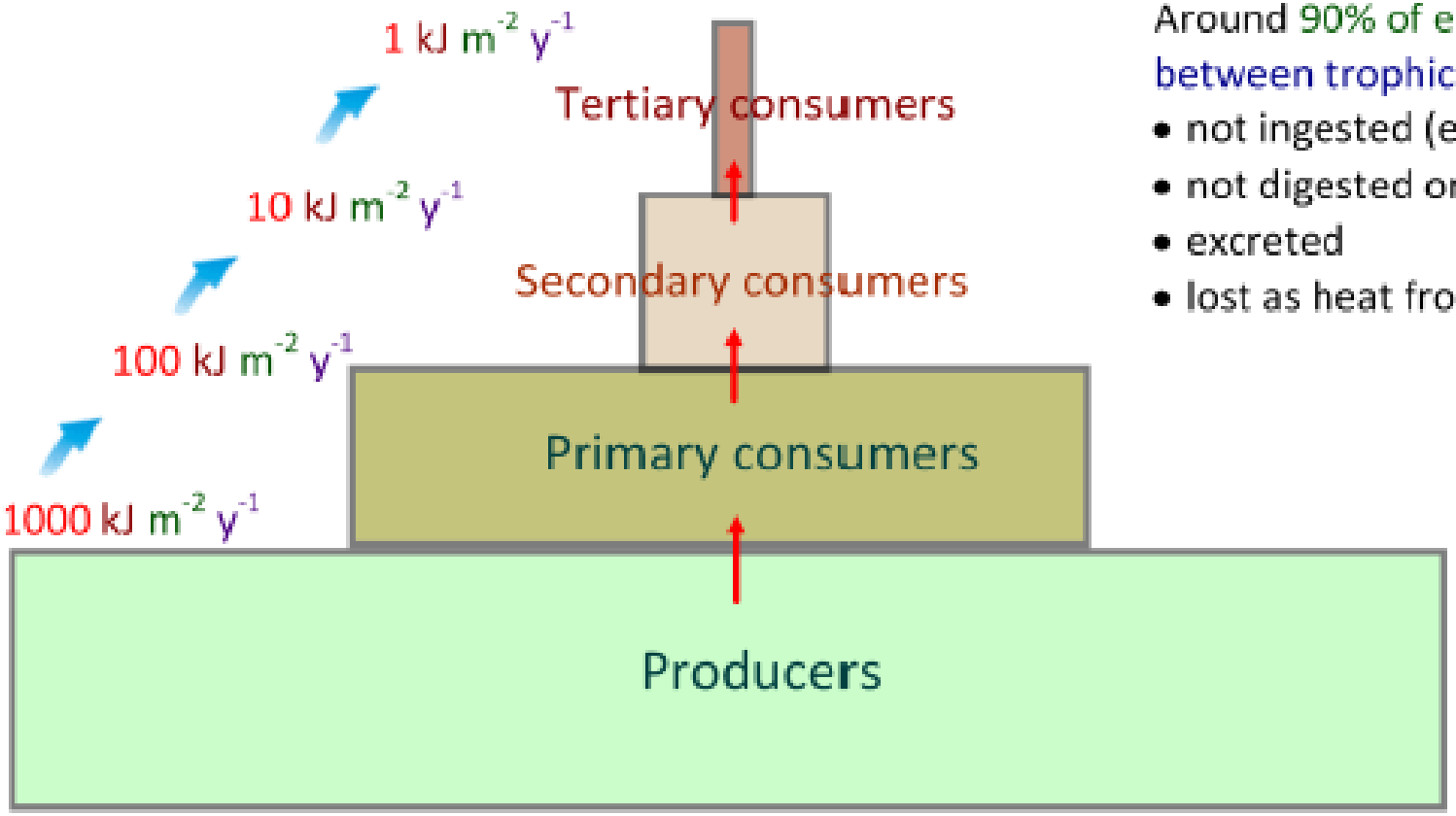
* To what extent to deep-sea communities based on chemoautotrophy rely on sunlight?

Pyramids of energy

show the flow of energy between trophic levels

Measured in units of energy per unit area per unit time: $kJ\ m^{-2}\ y^{-1}$

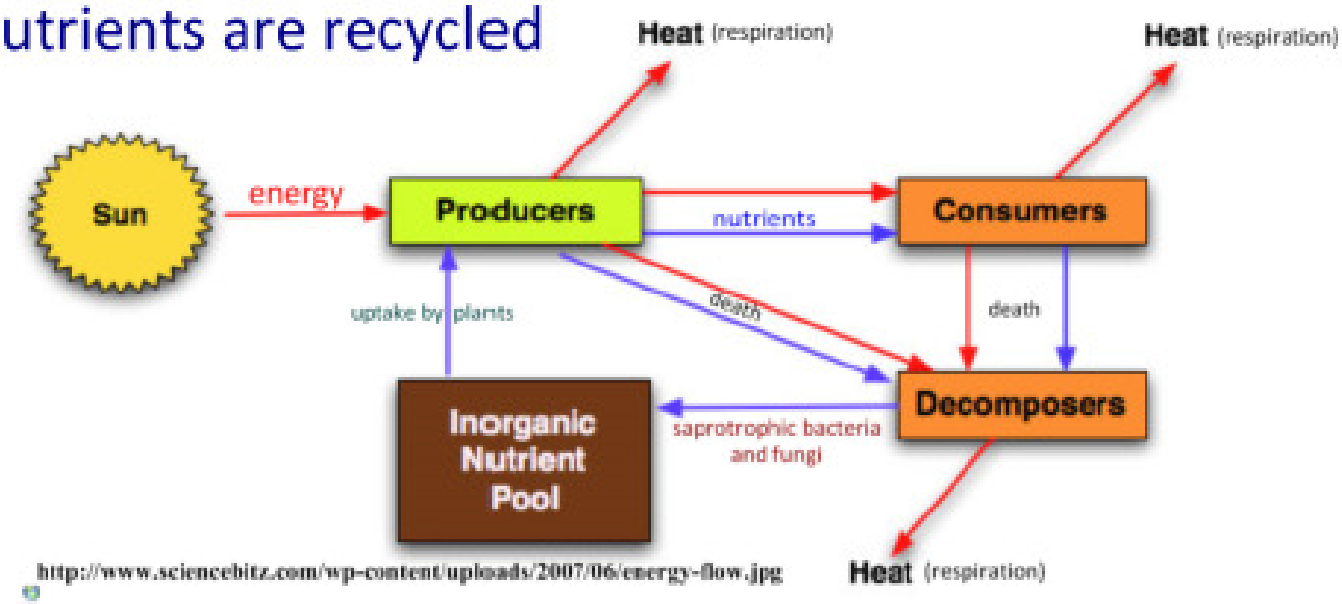
Transfer of energy is never 100% efficient.



Around 90% of energy is lost between trophic levels:

- not ingested (eaten)
- not digested or assimilated
- excreted
- lost as heat from respiration

Energy flows, nutrients are recycled



http://www.sciencebitz.com/wp-content/uploads/2007/06/energy-flow.jpg

Energy:

- energy enters from sunlight
- autotrophs capture sunlight
- energy flows through the trophic levels / stages in food chain
- energy transfer is (approximately) 10 % from one level to the next
- energy loss due to material not consumed assimilated / egested / excreted
- energy passes to decomposers / detritivores / saprotrophs in dead organic matter
- heat energy is lost through cell respiration

Nutrients:

- nutrient cycles within ecosystem / nutrients are recycled
- nutrients from weathering of rocks enter ecosystem
- nutrients recycled from decomposition of dead organisms
- nutrients move through (food chain) by digestion of other organisms
- nutrients absorbed by producers / plants / roots
- nutrients lost by leaching / sedimentation (*e.g.* shells sinking to sea bed)

Nutrient Recycling: The Carbon Cycle