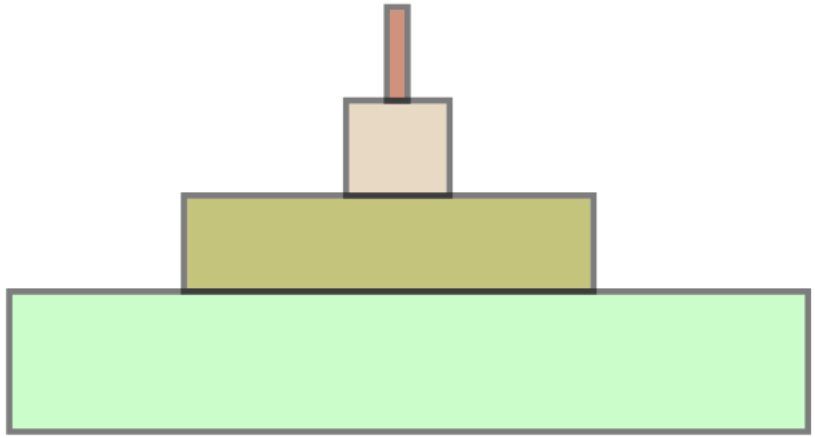


# Communities and Ecosystems

Stephen Taylor
Bandung International School

# 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/8880696@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)

producer (autotroph)

**Tertiary consumer**

Final stage = top carnivore

eaten by

energy

**Secondary consumer**

carnivore/ omnivore (predators)

eaten by

energy

**Primary consumer**

herbivore

eaten by

energy

**Producer**

## Woodland

sparrowhawk

great tit

moth caterpillar

yellow iris

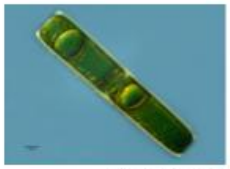
## Arctic

seal

cod

krill, amphipods

diatoms, phytoplankton

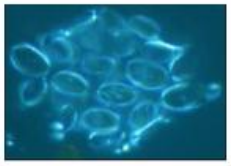


## Freshwater

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:


"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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ehp ENVIRONMENTAL HEALTH PERSPECTIVES

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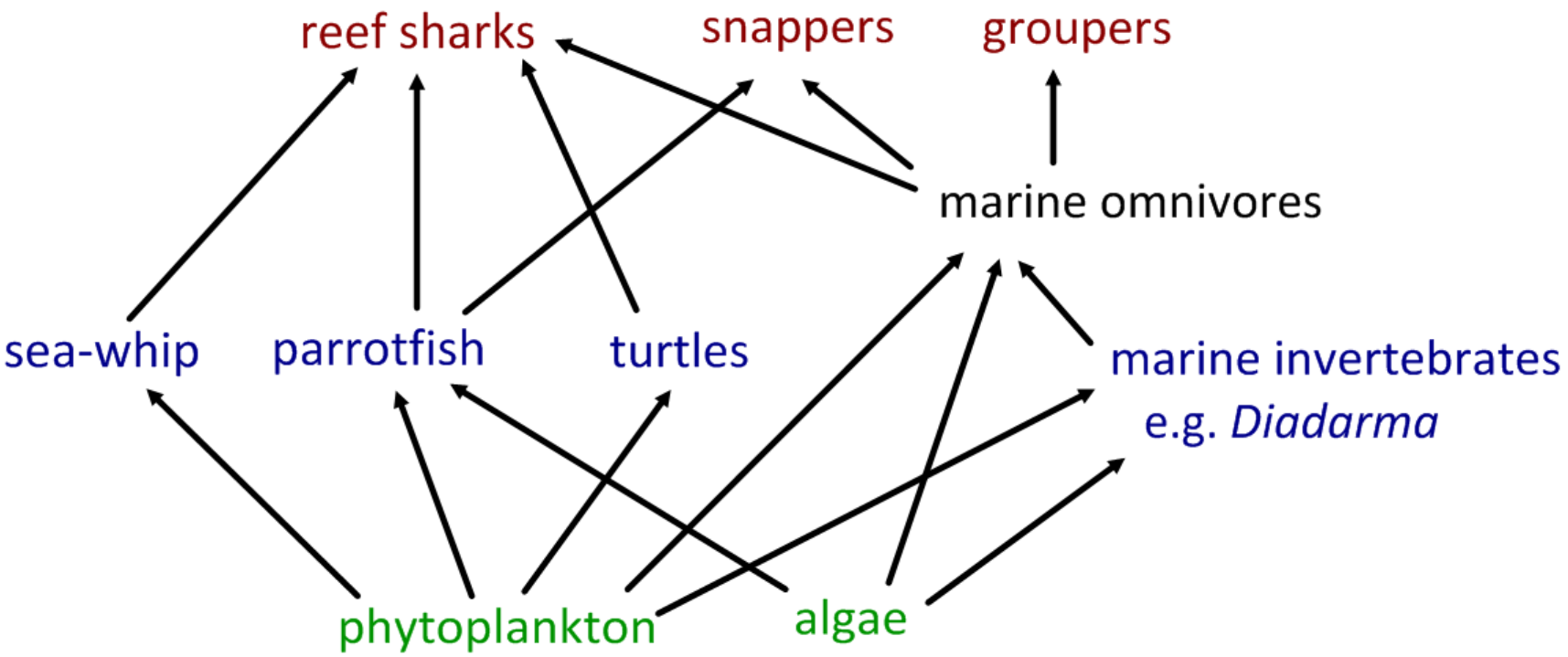
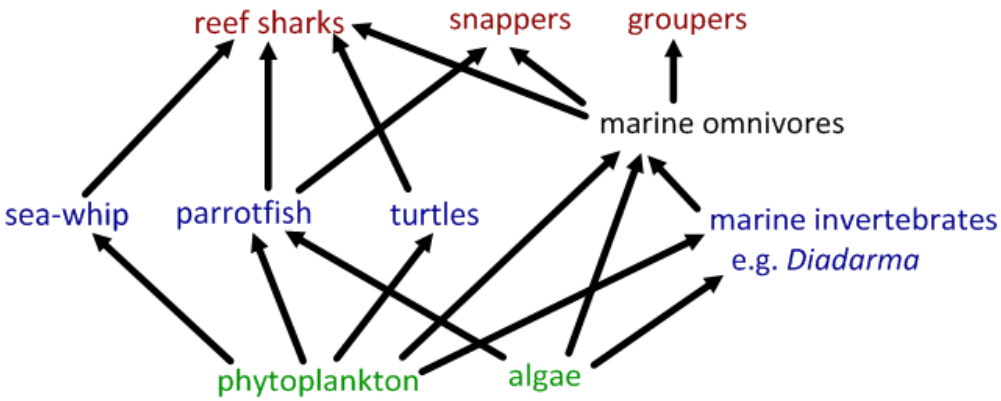


# Food webs show all of the feeding relationships within a habitat

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

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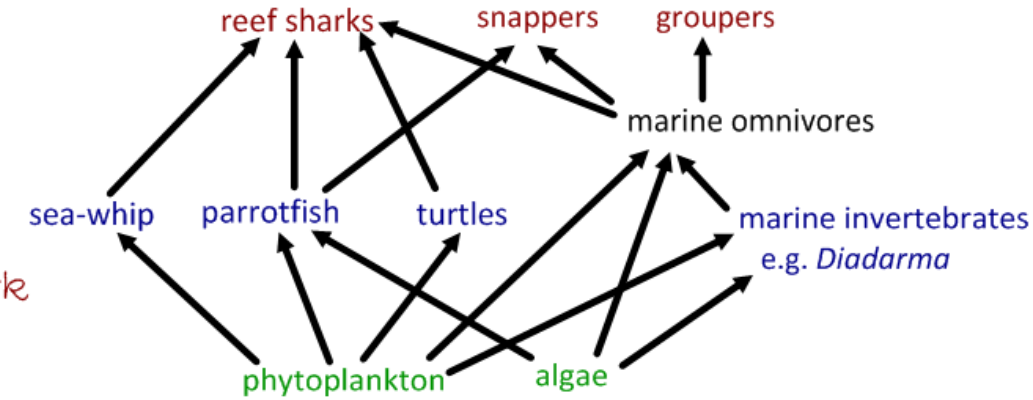



Can you pick out:

1. A three-step food chain?

phytoplankton → sea whip → reef shark

2. A four-step food chain?

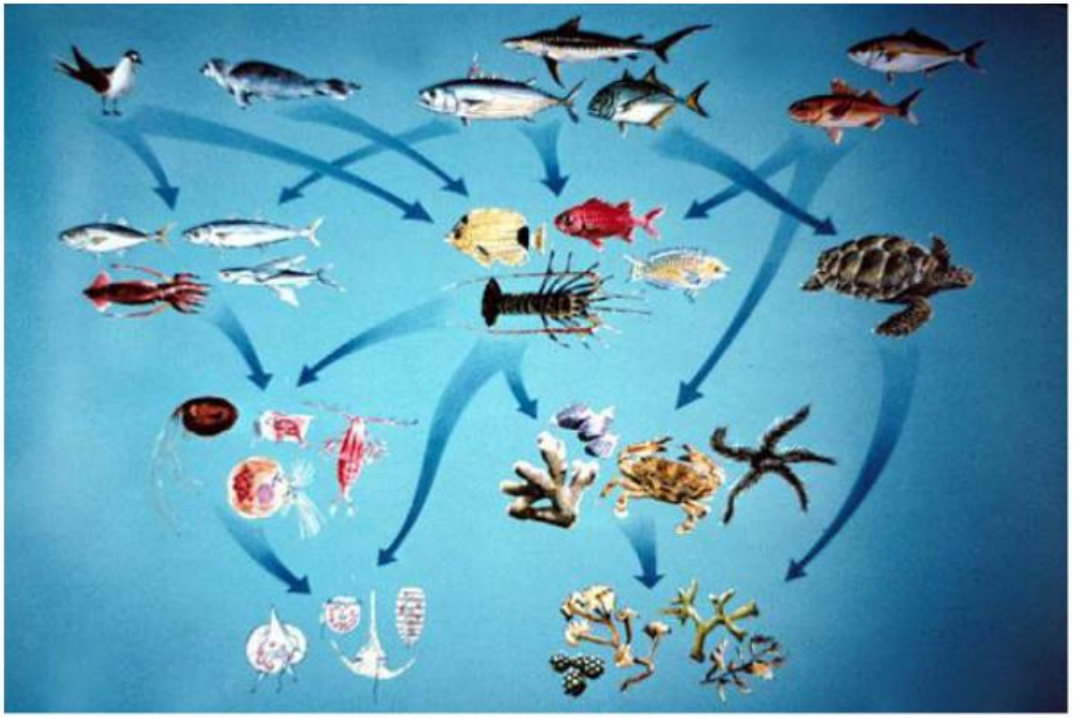
algae → Diadarma → marine omnivores → groupers

Some organisms can fit into more than one trophic level.

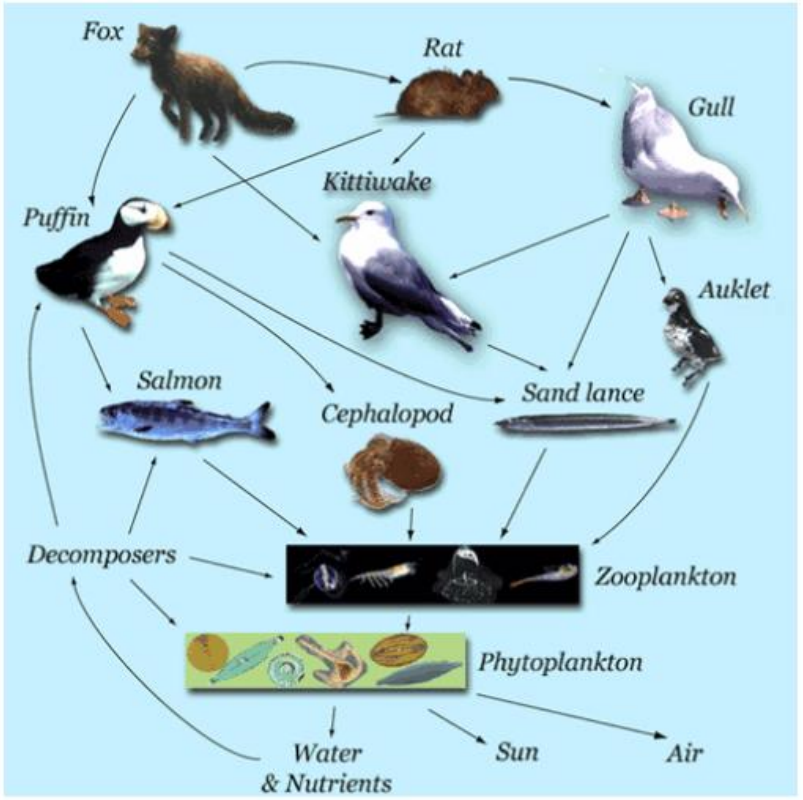
Give two examples from this food web.

- 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



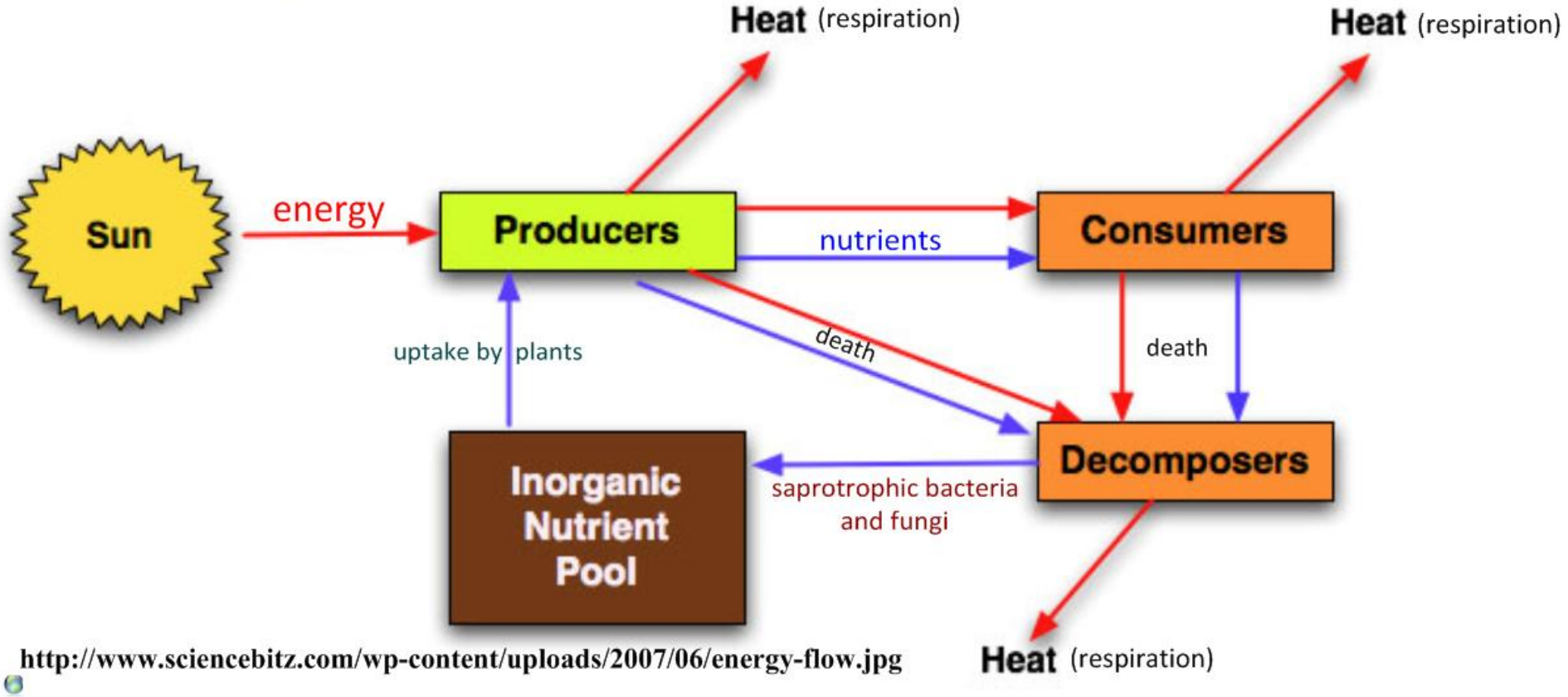

http://www.absc.usgs.gov/research/seabird_foragefish/marinehabitat/home.html

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

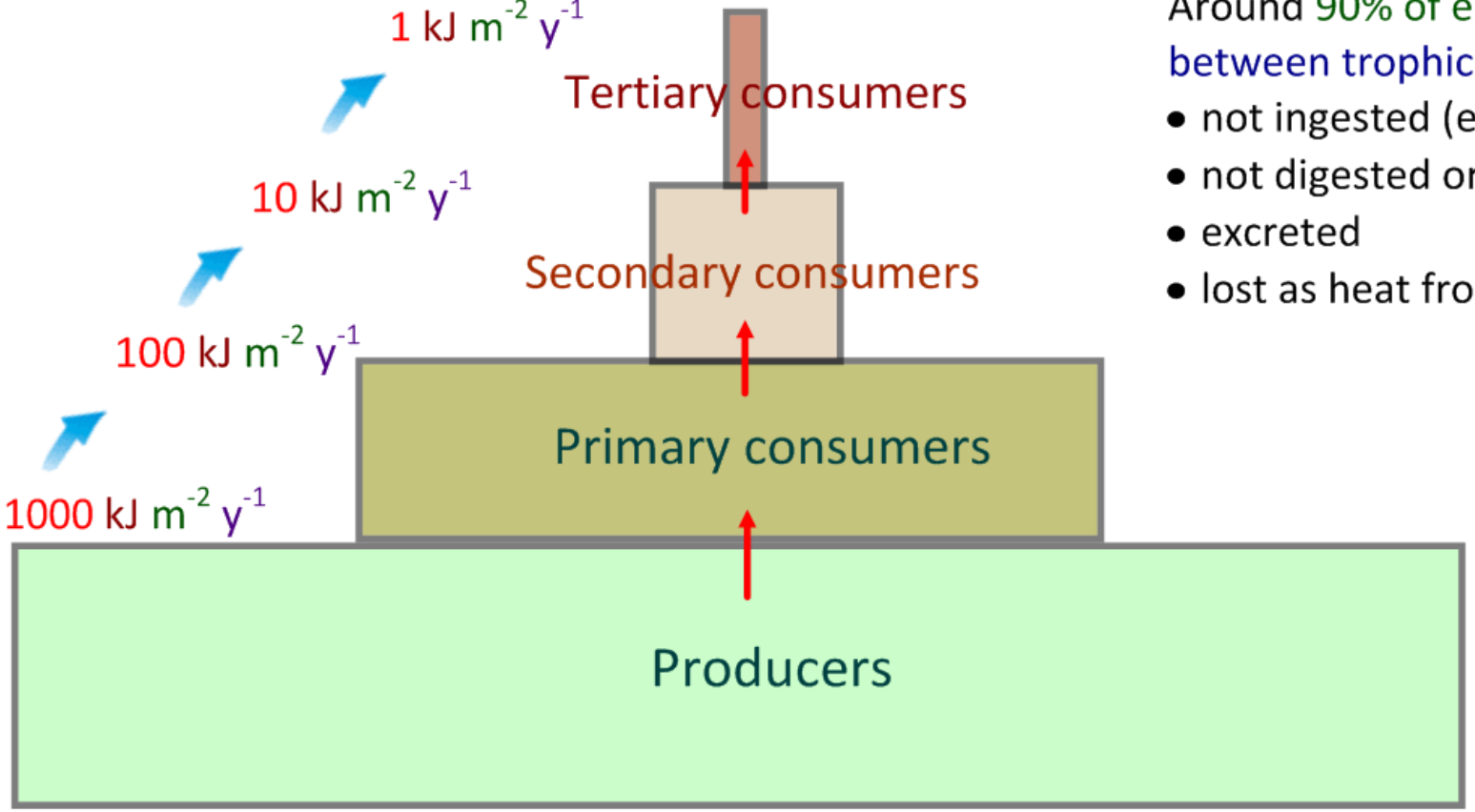
* To what extent to deep-sea communities based on chemoautotrophy rely on sunlight?

# Pyramids of energy

show the flow of energy between trophic levels

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

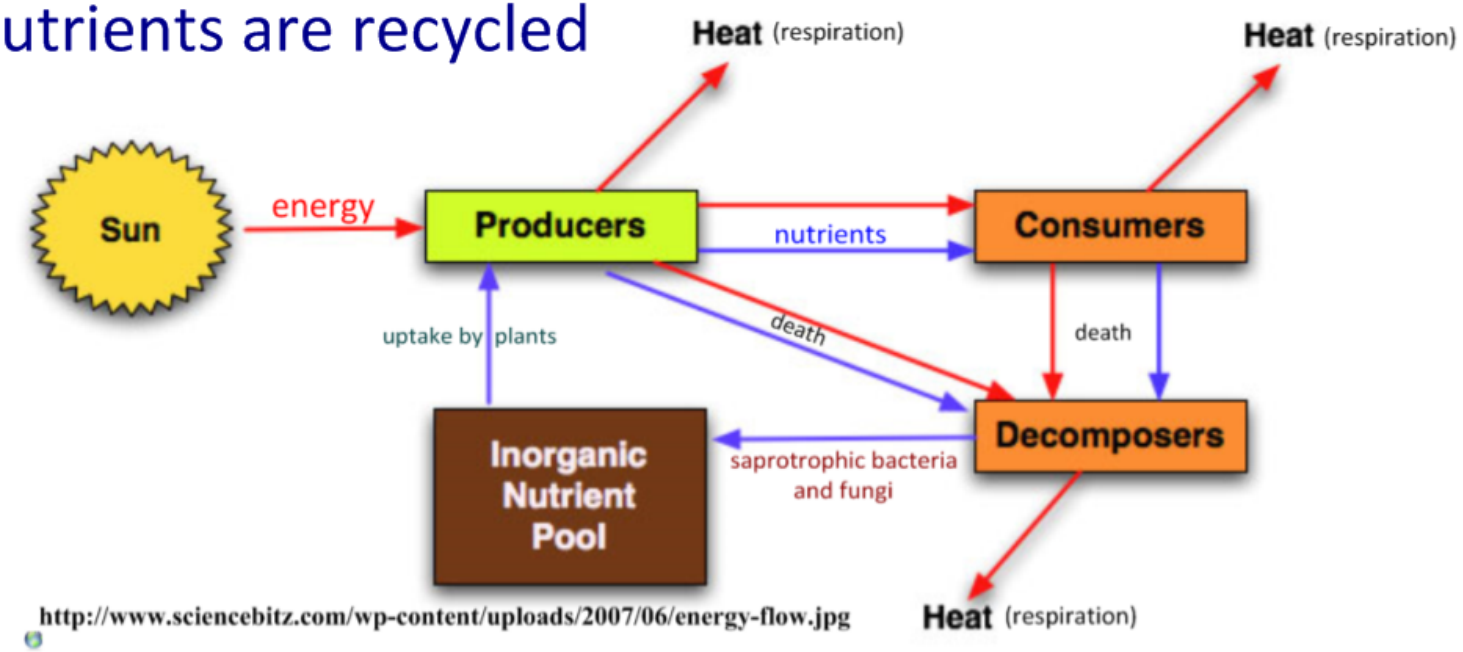
Transfer of energy is never 100% efficient.




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

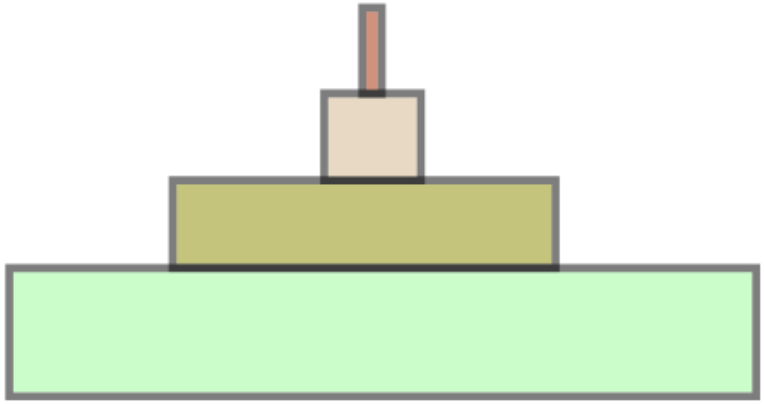



## Energy:

- 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)



For more IB Biology resources:

http://sciencevideos.wordpress.com