

Class 34 -- Marine Ecosystems

MATTER AND ENERGY TRANSFER IN MARINE ECOSYSTEMS

Ecosystems (Producers, Consumers, Decomposers)

Food chains and food webs

Efficiency of energy flow (Biomass pyramid)

Food required for two separate needs:

1. Matter (for growth and reproduction)
2. Energy (for metabolic processes)

Ecosystem: Community of plants and animals ... interactions between organisms and environment permit matter and energy transfer.

Producers, Consumers, Decomposers:

- Primary Producers: . Phytoplankton (autotrophs)
- Consumers: . heterotrophs
- Primary consumers: herbivores
- Secondary and higher-level consumers (carnivores, predators)
- Decomposers: . bacteria (and fungi) ...Completes the cycle

"Trophic relationships" describe what an organism eats, and who eats it

Energy and matter pathways in a simple food chain

trophic levels:

4 top predator

3 carnivore

2 herbivore

1 autotroph

Example: Simple food chain of herring in a coastal area:

trophic levels:

3 herring

2 herbivorous zooplankton

1 phytoplankton

Energy and matter pathways in a more complex food WEB

Food webs are more accurate descriptive of marine trophic relations.

e.g., Adult herring -- feeds on more than one level

Food webs more stable than simple food chains

-- greater variety of food organisms.

ENERGY TRANSFER BETWEEN TROPHIC LEVELS

Matter (C, H, O, nutrients) cycled:

Producers, consumers and decomposers (then back to the producers)

Examples: Cycles of P and N

Energy flows **in one direction**:

Sun --> producers --> consumers --> decomposers--> Heat

Energy utilization is not very efficient

- 1% of available solar energy is used by phytoplankton to make organic matter
- Most of this stored energy (70-90%) is used up by them
- Remainder (10-30%) is available to consumers at next highest trophic level
 - This percentage is the transfer efficiency
- Most of the energy in food eaten by consumers (70-90%) is used up by them
- ...etc. on up the food chain/web

Biomass at each trophic level: How much is passed up from the next lowest level?

--> Biomass Pyramid

- Lowest trophic level: high biomass; many small producers
- Highest trophic level: low biomass; few, large animals

Transfer efficiencies:

- Anchovy in coastal upwellings- 20%
- Tuna in open ocean- 10%

Implications for harvesting marine food resources:

Size of harvest is greater when the trophic level harvested is lower and the transfer efficiency is high.