

Name \_\_\_\_\_ Date \_\_\_\_\_

## Ch. 10 An Intro To Ecology

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### Basic Principles That Apply To All Habitats

**habitat**- the natural environment where an organism lives

has characteristics that determine which organisms live there and which do not

2 types of characteristics: 1. Abiotic Characteristics- nonliving characteristics of a habitat

physical features: type of bottom  
temperature of water  
amount of penetrating sunlight  
density  
turbidity  
water depth  
wind patterns  
wave action  
surface currents  
tidal patterns  
pressure  
stability - stratification-  
thermocline  
overturn

chemical features: saline concentration  
dissolve oxygen  
dissolved carbon dioxide  
dissolved nitrogen  
pH  
calcium carbonate  
alkalinity  
hardness  
sulfur dioxide  
solutes presents  
metals present  
toxins present

2. Biotic Characteristics- living characteristics of a habitat

types of organisms present  
number of organisms present  
what stage of life cycle of organisms present  
amount of biomass production (productivity)  
reproductive rate  
competition among organisms  
metabolic rate  
behavior  
growth rate  
carrying capacity

**ecology**- the study of the interactions among organisms and their environment

organisms adapt to environment thru changes in behavior, metabolism, pattern of growth, ect

**natural selection** -the production of more offspring by the best adapted individuals in a population

**evolutionary adaptations**-the genetic adaptation of a population to its environment thru evolution

**biotic**- a living component of environment

**abiotic**- the nonliving component of an environment

## **How Populations Grow**

**populations**- a group of individuals of the same species that live together

**community**- all the different populations of organisms that live in the same place

organisms in a community are dependent upon each other

**population explosion**- unrestrained population growth occurring under favorable conditions

organisms producing more offspring that is takes to replace themselves

population explosion growth graph produces a J-shaped curve fig. 10.2

changes in the environment can slow or destroy a population

changes can be large or small, seasonal or sudden

changes can be abiotic factors

changes can be biotic factors

1. slow repro. if habitat becomes too crowded
2. organisms fight among selves or cannibalism
3. if large population...natural enemies are attracted to habitat
4. diseases spread easier in large populations
5. large populations pollute area with their own waste
6. large populations use up their resources

**resources**- things organisms need to live and reproduce

nutrients  
 physical characteristics.....light, temp, benthos thickness  
 chemical characteristics.....level of nitrate, DO  
 other organisms  
 living space

decrease or removal of any resource can slow or prevent growth and reproduction

**nutrients** raw materials other than carbon dioxide and water that are needed by primary producers for primary production

**carrying capacity**- the maximum population size that can be sustained by the available resources in a given environment

**limiting factor**- an essential resource whose short supply limits the growth of a population

**self-regulating population**- a population with a growth rate that is dependent on its own numbers

self-regulation acts only when the population is large

as population becomes more crowded, its growth rate goes down

*Populations are capable of explosive growth. Population growth is usually limited, however, by either the nonliving environment or by the activities of the organisms themselves.*

Natural Selection: nature favors the members of a population that are best suited to the environment

population as a whole is a little better adapted each generation pop evolves

**evolution**- a change in the genetic makeup of a species, usually as a result of natural selection favoring some individual characteristics over others

## **Species Interactions**

4

competition  
predation  
symbiosis

**competition**- the interaction that results when a resource is in short supply and one organism uses the resource at expense of another

**intraspecific competition**- competition among members of same species

**interspecific competition**- competition among members of different species

**competitive exclusion**- the elimination of one species by another as a result to competition

*Competition between species results when both species have the same limiting resource. In competitive exclusion, one species wins the competition and eliminates the other from the community.*

there may be shifting balance between competing species (neither is excluded)

competitively superior species may be prevented from excluding other species

conditions may shift that favor the inferior competitive species and hinder the superior one

conditions: abiotic or biotic (other species) characteristics

avoiding exclusion: share limiting resource

each species specializing on just part of the resource

each species live in different place even though eat same food

each species feed at different times on same food

**resource partitioning**- sharing of resources by specialization

enables species to live together

specialization: each species gives up some of the resource

pro: species can use resource better by being a specialist  
may reduce competition

con: fewer resources may decrease population size  
if the resource dwindles then too specialized to use another resource

\*specie find balance between specialization and generalization.....species will be successful

**ecological niche**- the full range of ecological characteristics for a species  
 eg. feeding habits (what it eats)  
 specific habitat (where it lives)  
 reproductive strategies (when & how it reproduces)  
 behavior

*The role a species plays in the community is called its ecological niche. The niche includes feeding habits, habitat, and all the other aspects of the species' lifestyle*

## **Species Interactions**

competition  
 predation  
 symbiosis

**predation**- act of one organism eating another

**predator**-organism that does the eating

**prey**- organism that gets eaten

**carnivore**- animal that eats other animals

**herbivory**- act of an organism eating algae or plants

**herbivore**- organism that eats plants or algae

there is a balance between predator and prey  
 predator depends on prey  
 if prey #'s decrease effects predator (predator eats too much or if increase predator #'s)

natural selection favors the best predators : faster, better detector

natural selection favors prey that can defend itself or get away

**inducible defenses**- defense mechanisms that an organism uses only in response to predators

**coevolution**-process in which one species evolves in response to another

## **Species Interactions**

6

competition  
predation  
symbiosis

**symbiosis**-a close relationship between 2 species

3 types: commensalism  
mutualism  
parasitism

**commensal**- symbiotic relationship in which one species benefits without affecting the other -host

**mutualism** - symbiotic relationship in which both partners benefit

**parasitism** - symbiotic relationship in which one partner (parasite) derives benefit from the other (host)

**host**- the larger partner in a symbiotic relationship

**symbiont**- smaller partner in the symbiotic relationship

**cleaning associations**- a symbiotic association in which a smaller partner regularly removes parasites from a larger fish

both partners can survive without the other

eg> shrimp, small cleaner fish, ect

**zooxanthellae** - dinoflagellates that live within the tissues of reef corals and other marine animals

*In symbiosis, numbers of different species live in close association. Symbiosis includes parasitism in which the symbiont harms the host, commensalism, in which the host is not affected, and mutualism, in which both partners benefit.*

## The Flow of Energy and Materials

7

all living things use energy to make and maintain the complex chemicals necessary for life

**autotrophs**- organisms that can use energy (usually solar E) to make organic matter

get E from non-living environment to make their own food

**heterotrophs**- organisms that cannot make their own food and must eat the organic matter produced by autotrophs

both organic mat. and energy stored in animal eaten are passed onto to heterotroph

the flow of energy & matter thru an ecosystem can be followed by observing trophic relationships

Trophic Structure and Levels                      fig. 10.12 and 10.12

**trophic**- each of the steps in a food chain

**primary producers**- an organism that carries out primary production

usually ecosystem is named for the major primary producer

**consumers**- a heterotroph

**primary consumer**-(first level consumer) a consumer that feeds directly on a primary producer

**secondary consumer**-(second level consumer) a consumer that feeds on a primary consumer

**tertiary consumer**- (third level consumer) a consumer that feeds on a secondary consumer

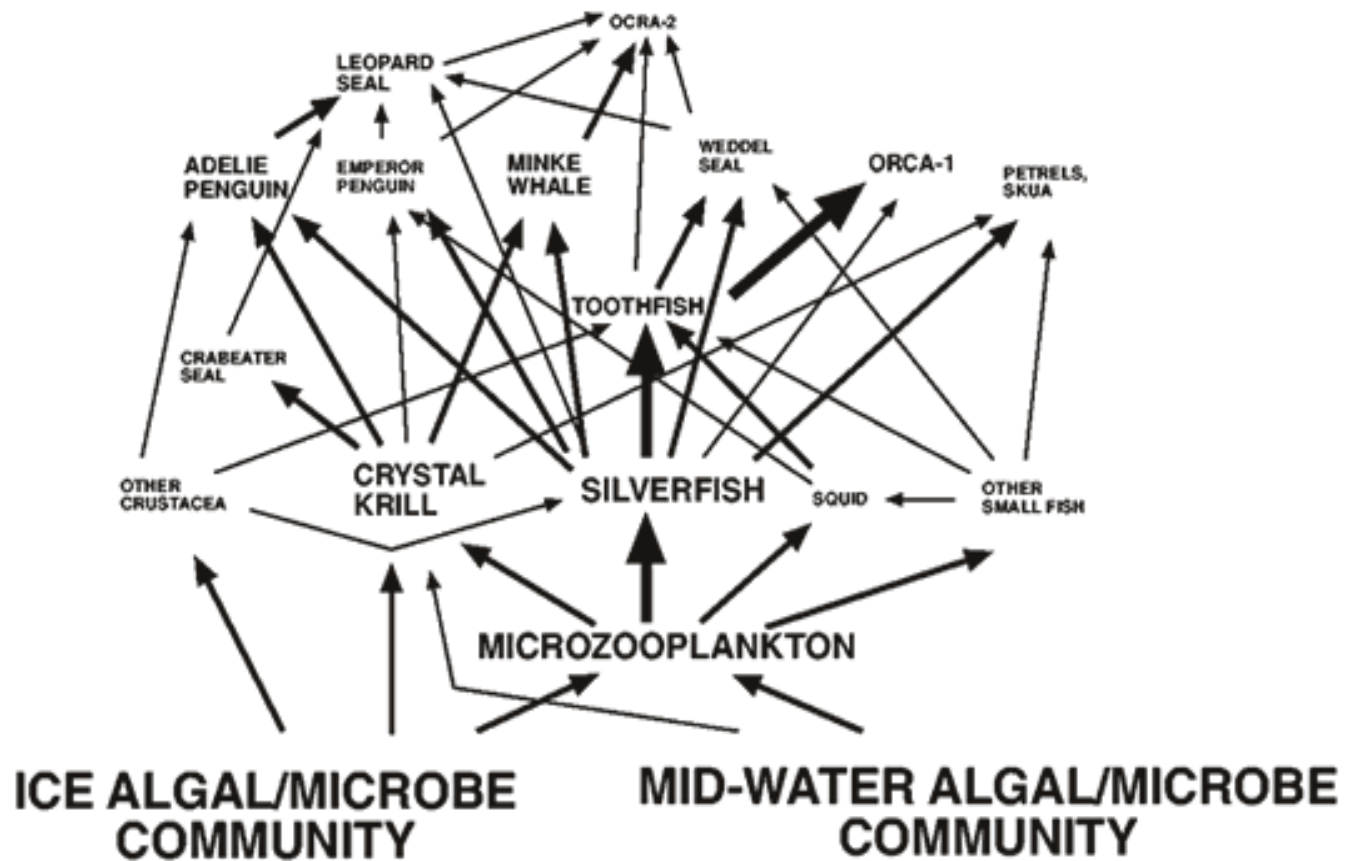
**top predator**- (final consumer) organism that is at the end of a food

**food chain**- the steps of transfer of energy from primary production thru consumers

**trophic level**- each of the steps in a food chain

**food web**- all the interconnecting feeding relationships in a community

predators usually feed on prey from different trophic levels



**pyramid of energy**- the decrease in energy that is observed in each higher level of a food chain

most of energy consumed in a level is used up by activities of organism  
therefore, as move up to higher trophic levels...the amount of energy passed on decreases

between 5%-20% of energy in one trophic level is passed on to the next

the average amount of energy passed on to next trophic level is 10%  
therefore, 90% of energy is lost in each step of the food chain

because there is less energy available at each level.....there are also fewer ind. organisms

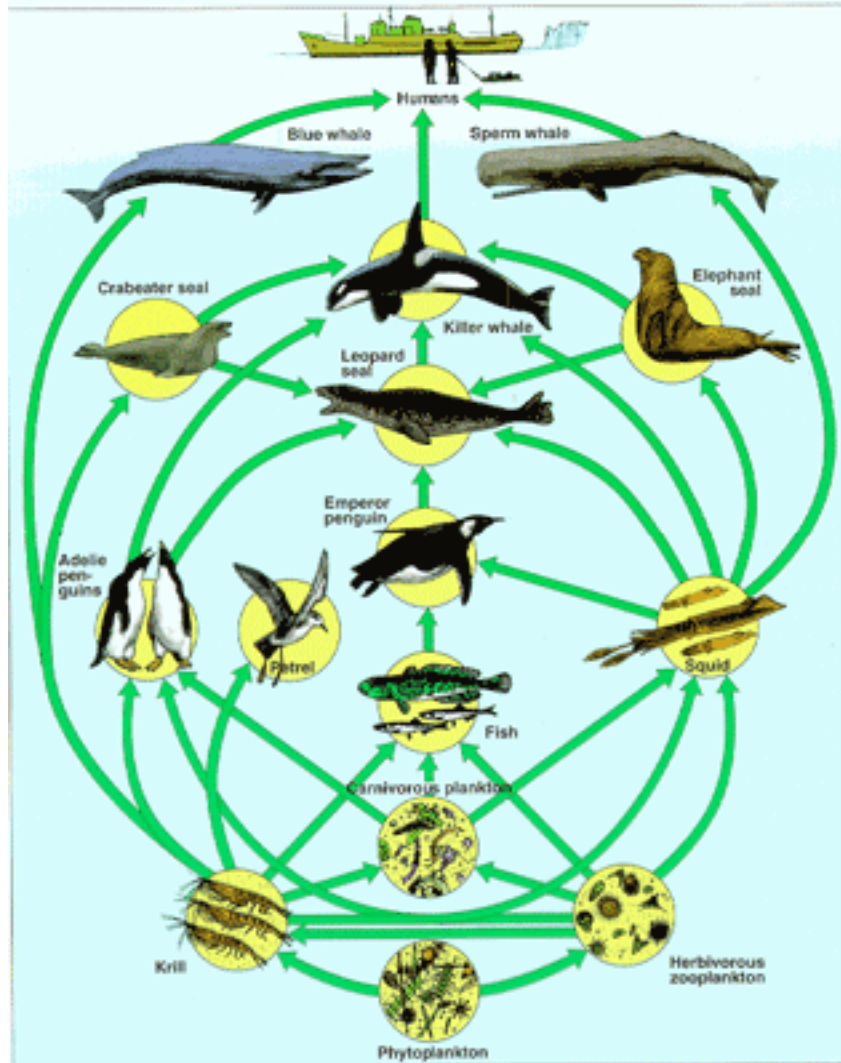
**pyramid of numbers**- the decrease in numbers of individuals that are observed in each higher level of a food chain

can be expressed as **biomass**-total mass of living organisms produced by orgs at ea. level

**pyramid of biomass**- the decrease of biomass that is observed in each higher level of a food chain

to support a given biomass of 1° consumers, 1° producers must make about 10 times as much living tissue

*Only about 10% of energy or organic matter in one trophic level is passed to the next higher level*



at each step of food web some organic matter is lost rather than being eaten by higher consumers

excreted as waste, spilled during feeding, or leaks out of cells through diffusion

some organic material dissolves into the water

**dissolved organic matter (DOM)**- organic matter that is dissolved in H<sub>2</sub>O rather than being in particles

some non-living organic material is in solid form eg. decaying seaweeds, leaves, dead bodies

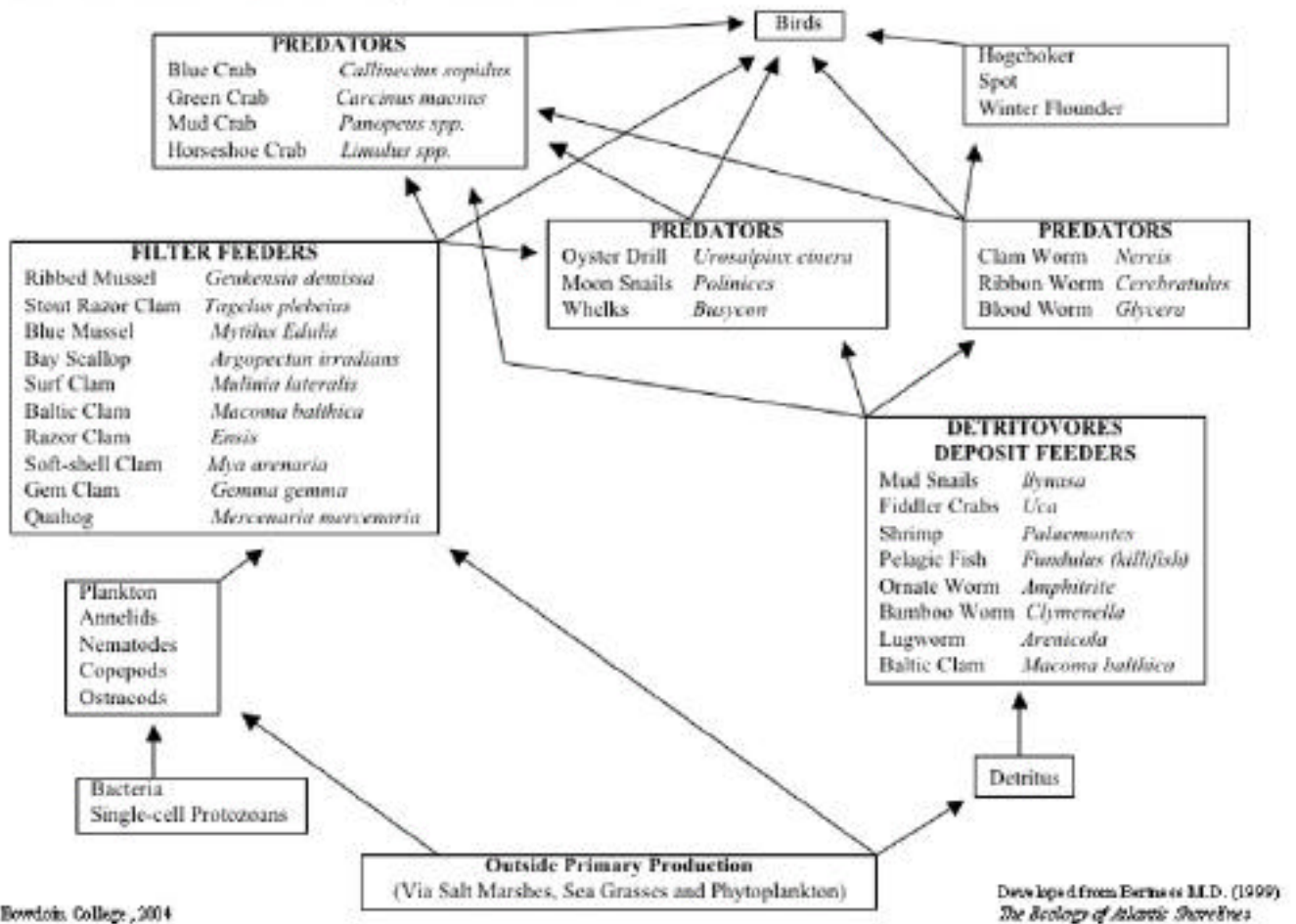
**detritus**- particles of dead organic matter many orgs feed on detritus

the lost non-living organic matter is not lost to ecosystem...it is broken down by decomposers into its original components: CO<sub>2</sub>, H<sub>2</sub>O, & nutrients

**decomposers**-organisms that break down dead organic matter into smaller molecules

**nutrient regeneration**- the release of nutrients from organic matter by decomposers

## Soft-Sediment Habitats: Proposed Interactions



## Measuring Primary Productivity

**productivity**- the rate of primary production

expressed as amount of carbon fixed under a square meter of sea surface per day or year

gC/ m<sup>2</sup>/ day

includes production of phytoplankton in the water column and producers that live on the bottom

determine amt of raw materials used up in photosynthesis or the amt of end products given off

**productivity** refers to amt of new organic mat. being created and **standing stock** refers to how much phytoplankton is already in the water

**standing stock**- the total amount of phytoplankton in the water

det. by measuring amt of chlorophyll, use remote sensing from satellites

**standing crop**- the total amount of phytoplankton in the water

## Ecological Zonation of the Marine Environment

Marine biologists categorize communities according to where & how the organisms live

**benthic organisms**- or **benthos** organisms that live on or buried in the bottom

**sessile**- benthic organisms attached to one place

**pelagic**- organisms that live up in the water column away from the bottom

pelagic divided into 2 categories

**plankton**- organisms that swim weakly in water column

**phytoplankton**- autotrophic plankton

**zooplankton**- heterotrophic plankton

**nekton**- organisms that can swim well enough to oppose the currents

mostly vertebrates: mainly fishes & marine mammals  
few invertebrates: squid

zonation according to depth and continental shelf

**intertidal zone**- the area between the highest and lowest tide

**littoral zone**- the area between the highest and lowest tide

**subtidal zone**- the bottom above the continental shelf

fig 10.20

**sublittoral zone**- the bottom above the continental shelf

away from the continental shelf the benthic environment is subdivided by depth

1. **bathyal zone**- the bottom between the shelf break and a depth of approximately 4,000m
2. **abyssal zone**- the bottom from a depth of approximately 4,000m to 6,000m
3. **hadal zone**- the bottom below 6,000m

the pelagic environment is divided with reference to continental shelf

1. **neritic zone**- the pelagic environment above the continental shelf
2. **oceanic zone**- the pelagic environment beyond the shelf break

**shelf break**- the increase in steepness that marks the outer edge of the continental shelf

pelagic environment can be divided vertically into depth zones according to amount of light

1. **epilagic zone**- the pelagic environment from the surface to a depth of 100 to 200m

shallowest, plenty of light for photosynthesis, lots of productivity  
nearly all neritic waters lie in the epipelagic

2. **mesopelagic zone**- the pelagic environment from a depth of approximately 100m to 200m

area below epilagic, not enough light to support photosynthesis, enough light to see

no sunlight penetrates to the deepest parts.....deep sea

**bathypelagic zone**- the pelagic environment from a depth of 1,000m to 4,000m

**abyssopelagic zone**- the pelagic environment from a depth of 4,000m to 6,000m

**hadopelagic zone**- the pelagic environment below 6,000m