SNC 1D

Ecology: Sustainable Ecosystems

Topic	Learning Goals – By the end of the lesson I will be able to…	Yes	Meh	No
Ecosystems	· Distinguish between Biotic & Abiotic factors · State the relationship between these factors that allows for a healthy ecosystem to function			
Biodiversity	· Explain the importance of biodiversity to an ecosystem and to humans · Understand the importance of biodiversity to sustainability			
Relationships	· Explain the relationship between the parts of the biosphere · Show how feeding relationships are established in an ecosystem			
Nutrient Cycles	· Describe the complementary processes of cellular respiration& photosynthesis; and describe how human activities can disrupt			
Energy	· Describe the flow of energy in ecosystems · Outline the main principle of the 10% rule and why it is important to food chains			
Populations	· Describe limiting factors and their effects on carrying capacity			
Assessing Ecosystems	· Evaluate the health level of an ecosystem by examining factors such as pH, oxygen/carbon levels, etc.			
Human Impacts	· Identify and assess the effects of human activities on ecosystems (Eg. Bioaccumulation, Introduction of Invasive Species, Overfishing, Pesticides, Acid Rain)			
STSE	· Identify an environmental issue and government based initiatives that are meant to remediate the environmental problem.			

VIDEO - Planet Earth: Pole to Pole

1. Every part of planet Earth is touched by the _____.
2. In which month does the sun hit the Arctic? _____.
3. The mother Polar Bear goes _____ months without food?
4. Caribou herds can travel up to _____ miles during their journey.
5. What produces so much Oxygen that it changes the atmosphere? _____
6. The world's rarest cat is the _____ Leopard, found in Russia.
7. The rainforest covers only _____% of the Earth but contains more than _____ of its plants and animals.
8. The Blue Bird of Paradise does a sort of _____ for their mate, the more bizarre, the better.
9. In South Africa, the waves turn up cold water and nutrients. When the sun hits the nutrients, the process of _____ occurs, greatly increasing the amount of life present.
10. How does the sun create a "monster"? _____.
11. Water then condenses into _____.
12. Without water, there is _____.
13. Deserts cover 1/3 of the land and every year, they _____.
14. Which is the first land mammal shown to reach the African wetlands? _____.
15. Which animals never seem to get their "sea legs"? _____.
16. Hunting Dogs use _____ & _____ to catch Impala.
17. The Dogs average 1 kill per _____.
18. Which animals are shown frolicking and swimming in the water? _____.
19. In a minimum of six sentences, describe interesting facts you learned about an animal, a biome and an environmental adaptation.

LESSON 1: Ecosystems

Ecology is the scientific study of how organisms interact with each other as well as the environment around them

The goal of ecology is to understand the principles of an environment and to predict their responses to change.

An **_____**is an environment where living things interact with each other and their surroundings. An ecosystem includes both the living (**_____**) and the non-living (**_____**) things in the environment. The more biotic factors in the ecosystem, the more biodiversity it has. To keep an ecosystem healthy, we need to maintain the diversity of life, or **_____.**

Biospheres

Much like everything ecological, biomes combine to make a **BIOSPHERE** - our home Earth. This means that a biosphere contains all parts of the planet including air, water, land and life.
The biosphere can be broken into 3 main physical components:

Atmosphere	
Lithosphere	
Hydrosphere	

Biomes

The biosphere consists of many biomes (and therefore ecosystems) that interact. Imagine a river running through a forest. The river is a single ecosystem, and the forest another. Yet, animals in the forest need the river water to live, thus making them interconnected.

A _____ is a _____ that consists of many _____.
Each biome is defined by the common biotic and abiotic factors of the ecosystems within it. In Canada, there are 5 major land based biomes and 2 aquatic biomes.

Land ***Aquatic***

When a biome has lots of biodiversity, it is made up of many communities that contain a variety of species populations.

Homework: Parts of an Ecosystem

a) Using the diagram below, list 10 biotic and 10 abiotic factors that you can identify.

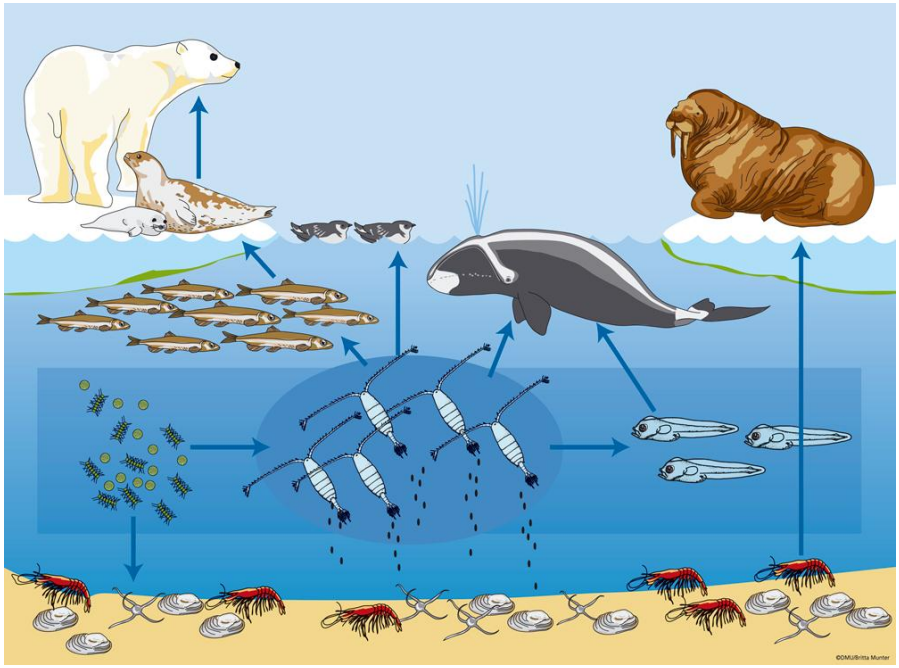
illustration by Jeff Grader / property of Delta Education

b) Explain how the biodiversity of a football field is different from that of a forest.

c) How is a natural ecosystem different from an artificial one. List 5 differences.

d) Can ecosystems be different in size? Explain why.

e) How is a biome different from an ecosystem?



Biodiversity & Human Health

Greater Diversity	Plants	Animals

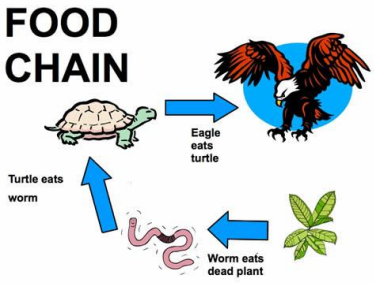
So what does this mean?

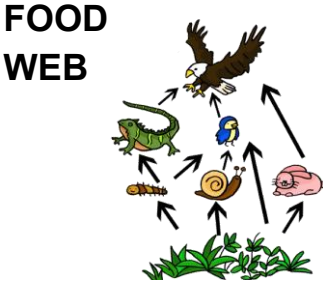
Lesson 3: Ecological Relationships

Predation	*Commensalism*	*Parasitism*	*Mutualism*

Producers/Consumers & Decomposers (Detrivores)

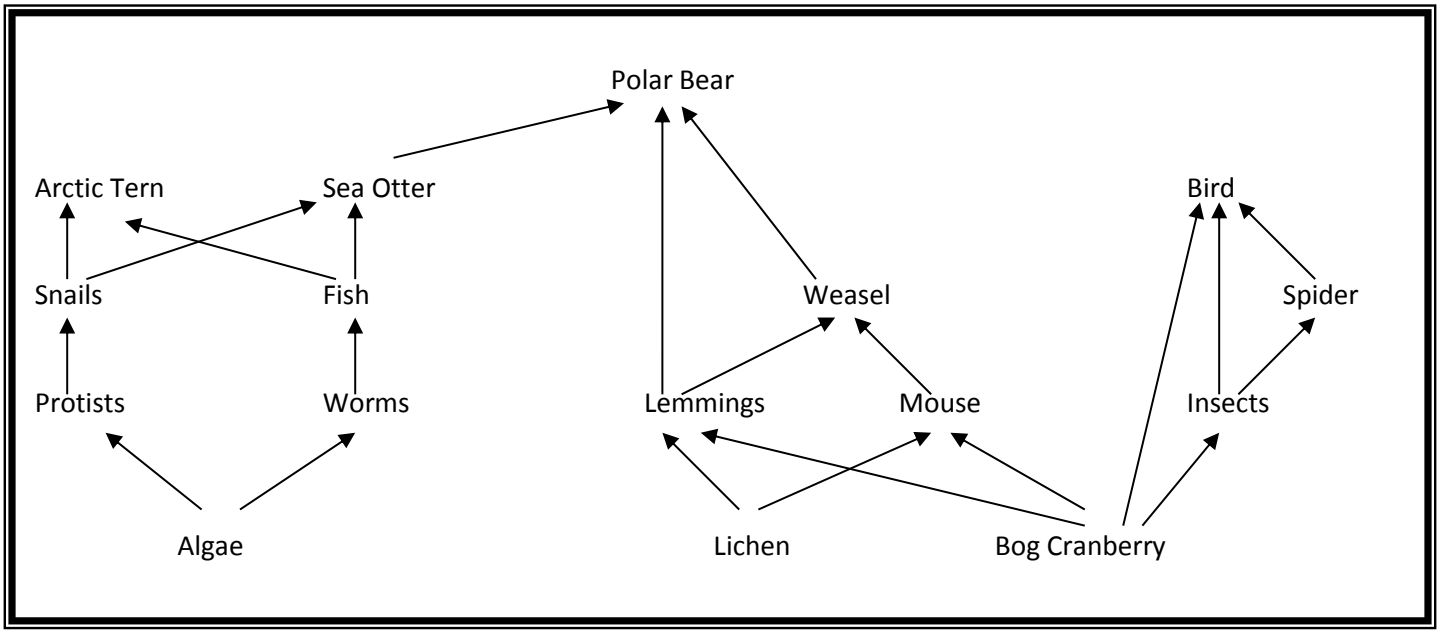
Food Chains & Food Webs





Worksheet: Ecological Relationships

1. Referring to the arctic food web below, answer the following questions;



a) Name three producers in the ecosystem: _____, _____ & _____
b) Where do the algae obtain their energy? _____
c) Which organism(s) eat snails? _____
d) Name one omnivore. _____ What does it eat? _____
e) What do weasels eat? _____
f) What do polar bears eat? _____
g) What type of consumer is the polar bear? _____
h) Name four herbivores: _____
i) Which two animals consume the most organisms? _____ & _____
j) Which animal is the tertiary consumer? _____
k) Starting with **bog cranberry**, write three complete food chains.

2. Classify each of the following biotic interactions as predation, competition, mutualism, commensalism or parasitism.

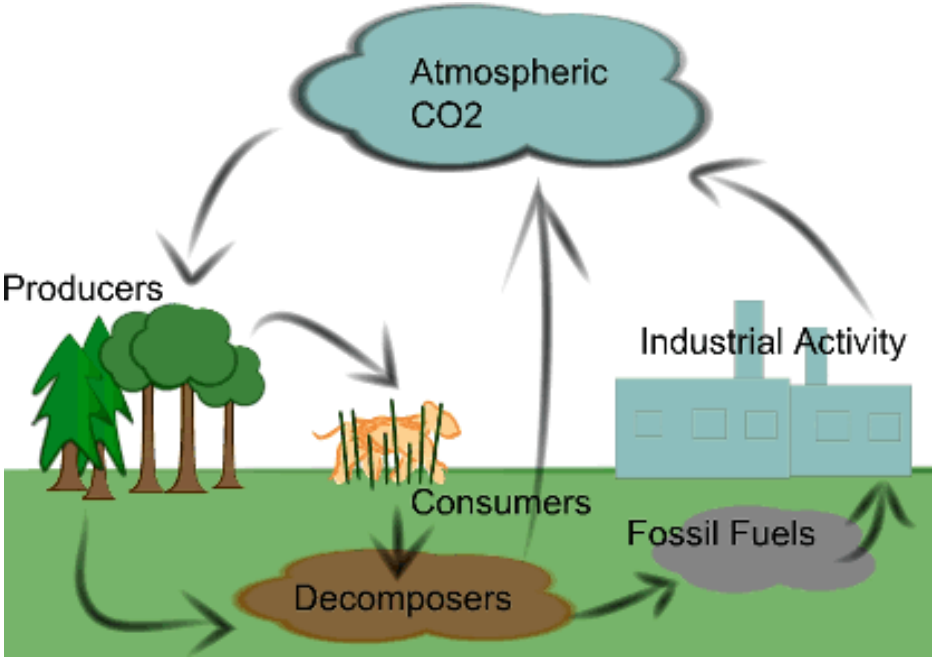
a) The African crocodile and the blackbird plover depend on each other for survival. The tiny bird helps the crocodile by removing tiny morsels of food from in between the crocodile's teeth while the bird gets a tasty meal.

b) Hornbills remain close to the Guenon monkeys of the Upper African Congo region. When the monkeys climb trees in search of juicy fruits, they cause moths, beetles and other insects to fall to the ground. These falling insects are a tasty feast for the hornbills.

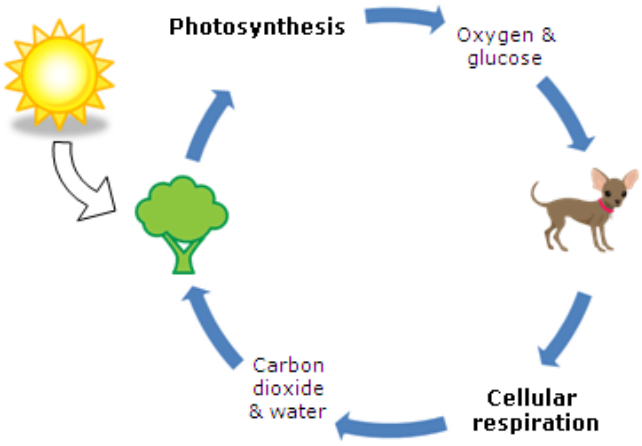
c) Small ticks live in the fur of many forest mammals. They survive by feeding on the blood of the animals that they have infected.

d) The viceroy butterfly uses mimicry to look like the monarch butterfly in hopes that it will avoid being eaten by a black starling.

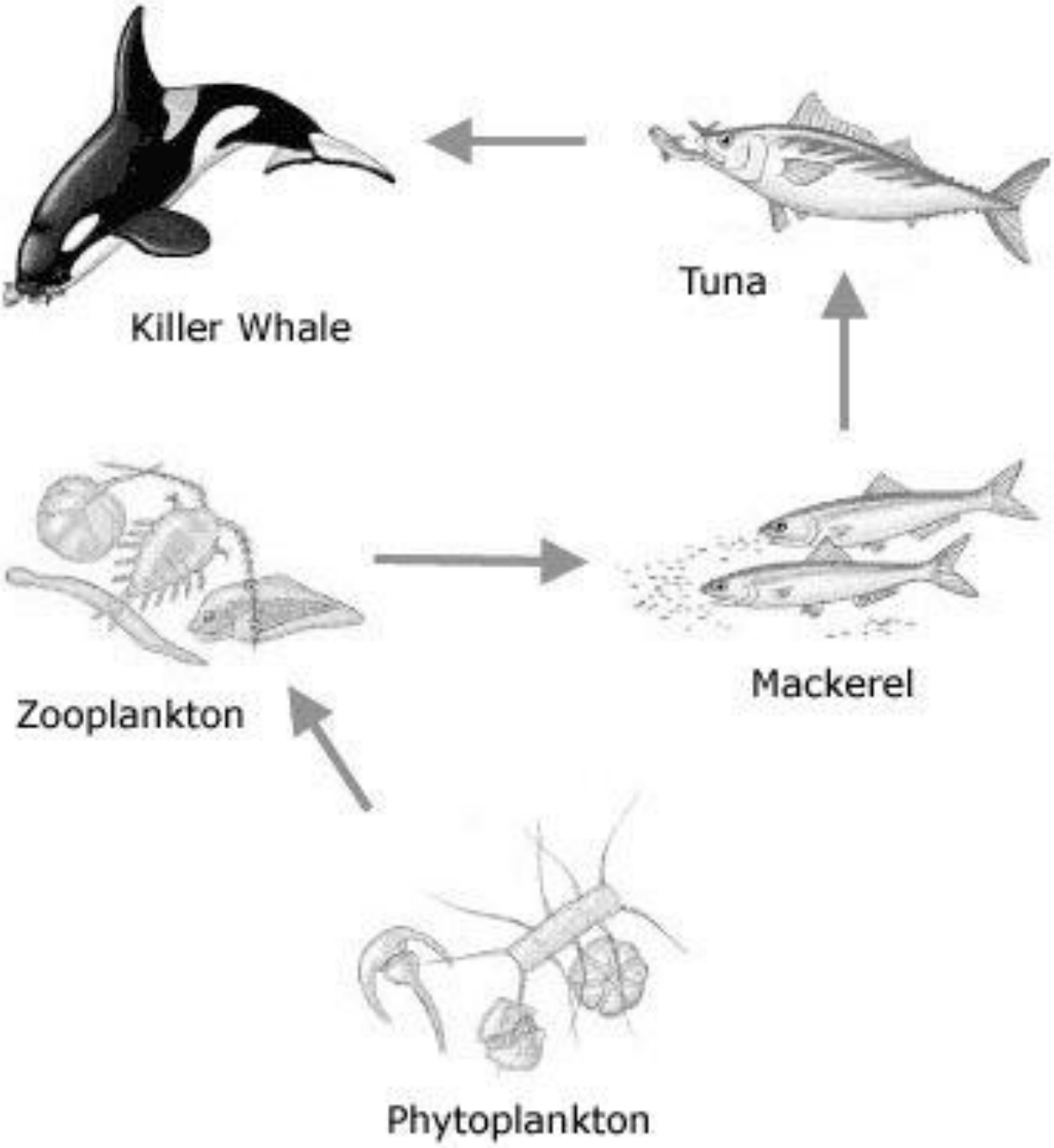
The CARBON CYCLE



The Importance of Cellular Respiration & Photosynthesis



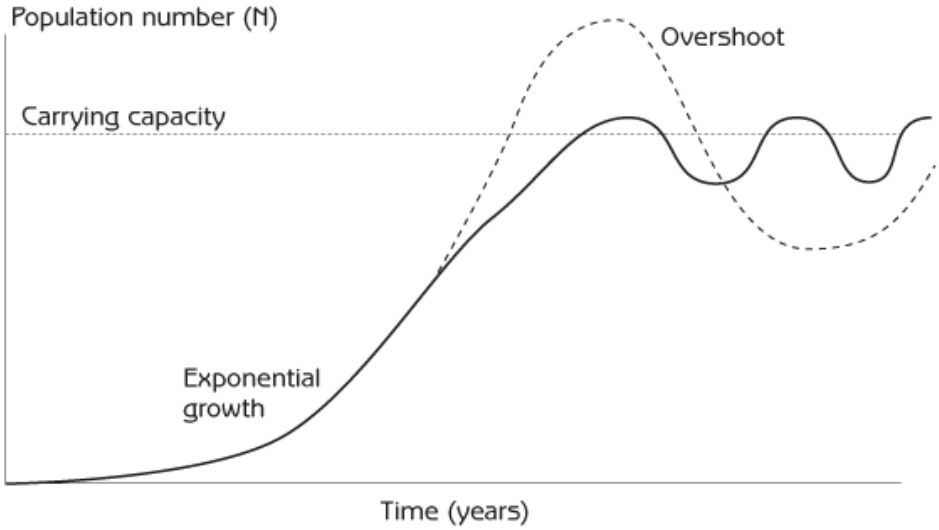
Human Impacts


Killer Whale
Tuna
Zooplankton
Mackerel
Phytoplankton

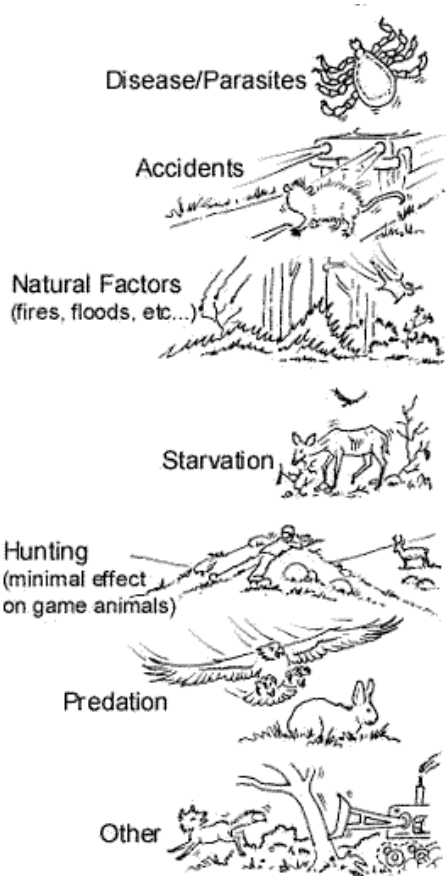
Lesson 6: Populations

Populations are constantly changing in an ecosystem due to their dependence on each other and the world around them. As a whole, populations are a fluid system constantly changing - cycling up and down in numbers as various factors affect them.

Characteristics of a Population

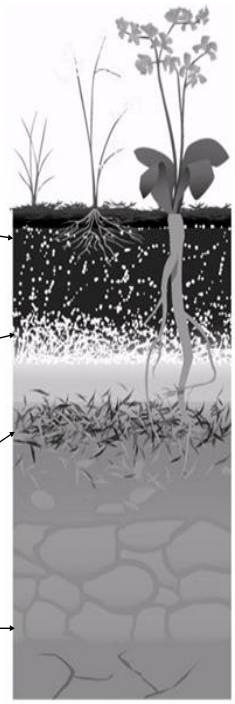


Limiting Factors



Lesson 7: Assessing Ecosystems

Soil



Litter –

Topsoil –

Subsoil –

Bedrock –

Loam Soil	
Clay Soil	
Sandy Soil	

Low pH	
Neutral pH	
High pH	

Humans can negatively impact soil quality by:

1. _____
2. _____

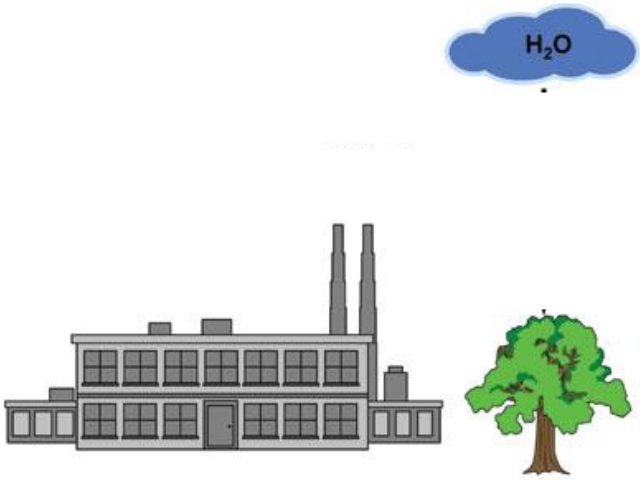
Water

Chemical	**Physical**	**Biological**

Humans can negatively impact water quality by:

1. _____
2. _____
3. _____

Acid Rain



Invasive Species

An alien species is any species that has spread beyond its natural range into new locations as a result of human activity. An invasive alien species moves into a new habitat and takes over. They can cause harm to the environment, the economy or even human health. Some can arrive accidentally and some can arrive intentionally.

Phases of Invasion

Effects on the environment/ecosystems

Competition		
Predation		
Disease		
Parasitism		

The War Against Invasive Species

Physical Control	
Biological Control	
Chemical Control	

Pesticides

A PEST is an organism that people _____. Pesticides are chemicals designed to kill pests.

Why Use?

1. Approximately 30% of Canada's annual crop can be lost to pests, which means a staggering cost to consumers.

2. To prevent the spread of diseases such as malaria in areas can affect millions of people.

Pesticide Types

a) First-Generation Pesticides – _____

b) Second-Generation Pesticides – _____

Bioaccumulation (Bioamplification/Biomagnification)

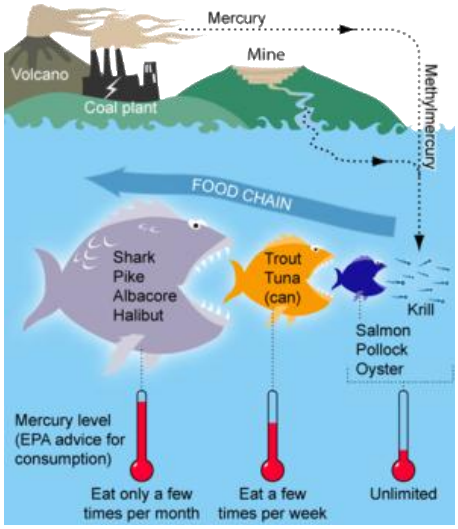
Pesticides containing chlorine such as DDT (dichlorodiphenyltrichloroethane) are _____ _____. Therefore, they _____ in urine or sweat causing them to _____ of various bodies.

Although there is only a small amount of the toxin in each prey that is eaten, as the food chain continues _____ and _____ of the higher order predators. These higher concentrations are now at a poisonous level, thus causing the top consumers to die.

Bioaccumulation = _____

Modern Chemical Pesticides

Newer pesticides are _____. Animals can remove them from their bodies. They are broken down in the soil (must be applied often) and operate like nerve gas that _____ for predators. These can still be a problem as they can harm animals that the _____and still can cause _____ in these organisms.



Endangered Species

Conservation of organisms begins when their population declines over time and the species is at risk. Levels of danger can be classified as:

_____ – no longer exists in certain areas

_____ – a species that faces extinction/extirpation

Conservation of ecosystems occurs in two ways: _____ occurs when species are being conserved in their natural habitat whereas _____ conserves species by removing them from natural habitats.

SNC1D BIOLOGY: TOXIC CONTAMINATION IN THE BAY OF QUINTE

The worst contaminants in the Bay of Quinte are mercury and PCBs (poly chlorinated biphenyls). These toxins tend to store in the fat tissues and magnify as they cycle up the food chain. The concentration is measured in parts per million (ppm). A **bioaccumulation factor** is used to compare the organisms within a food chain/web.

$$\text{Bioaccumulation factor} = \frac{\text{Toxin concentration in animal}}{\text{Toxin concentration in water}}$$

Note: Water has a PCB concentration of 0.0005 ppm and a Mercury concentration of 0.000003 ppm.

Questions

{6} 1. Determine the bioaccumulation factor for each species from the data given and record the factors in the table below. Round your answers to 2 significant digits. (See "sculpin" example below.)

Sculpin

PCB Bioaccumulation Factor
= PCB concentration in animal / PCB Concentration in water
= 1.7 ÷ 0.0005
= 3400 ☜ two significant digits

Mercury Bioaccumulation Factor
= Mercy concentration in animal / Mercury Concentration in water
= 0.07 ÷ 0.000003
= 23333
≐ 23000 ☜ two significant digits

{2} 2. Rank the species in the table below from lowest ① to highest ⑦ according to each bioaccumulation factor recorded.

Species	Concentration (ppm)		Bioaccumulation Factor		Ranking	
	PCB	Mercury	PCB	Mercury	PCB	Mercury
sculpin	1.7	0.07	3400	23000		
mysis	0.09	0.013				
herring gull (eggs)	60	0.54				
smelt	1.8	0.09				
phtyoplankton	0.01	0.004				
lake trout	5.6	0.17				
pontoporeia	0.32	0.014				

{5} 3. Use the back of this sheet to create the simple food web for the predator-prey relationships given to the right (hint: phytoplankton is the producer). Include both bioaccumulation factors in a set of brackets (PCB/Mercury) below the organism's name in the food web.

Predator	Prey
herring gull	lake trout, smelt, sculpin
lake trout	smelt, sculpin
smelt	mysis, pontoporeia
sculpin	mysis, pontoporeia
mysis	phytoplankton
pontoporeia	phytoplankton

{8} 4. Use your food web to answer the following questions:

(a) # of producer(s) ____ (e) # of herbivore(s) ____

(b) # of consumer(s) ____ (f) # of omnivore(s) ____

(c) # of food chain(s) ____ (g) # of carnivore(s) ____

(d) highest trophic level ____ (h) top carnivore is _____

{2} 5. How is bioaccumulation related to position in a food chain?

{2} 6. Why do gull eggs have the highest level of contaminants in the Bay of Quinte?

Human Impacts on Aquatic Environments

Positive	Negative

Human Impacts on Terrestrial Environments

Positive	Negative

How do we change for Sustainability?

Lesson 9: Environment Canada Initiatives

Initiative	*What is it?*
Great Lakes Program	
St. Lawrence Action Plan	
Atlantic Ecosystem	
Georgia Basin	
Western Boreal Conservation	
Northern Ecosystem Initiative	
Northern Rivers Ecosystem	
Fraser River Action Plan	

VIDEO – Planet Earth: Saving Species

1. What does Wilderness do for us?

2. What was the thing that shocked the crew the most?

3. Why is “sustainable development” contradicting?

4. How many mammals and amphibians are on the endangered species list?

5. Contrast the views of the filmmakers and scientists.

6. Why are amphibians more susceptible to extinction than other species?

7. All the frogs in which country will soon be gone?

8. What is killing all the frogs?

9. What are some reasons for poaching bush meat?

10. What are some of the animals killed for bush meat?

11. What are some of the issues facing the following animals?

    a) Ethiopian Ibex
    b) Snow leopard
    c) River dolphins
    d) Polar bears
    e) Walruses
    f) Saiga antelope
    g) Tigers

12. What are the main environmental problems driving extinction?

13. How is this cycle of extinction different from what we have seen before?

14. What are the different ideas of what must be done to halt these extinctions?

Lab: The Effect of Humans on Soil & Aquatic Ecosystems

Question:

How does human activity impact ecosystems? (aquatic or terrestrial)

Design:

a) With a partner, choose which ecosystem (aquatic or terrestrial) you are going to investigate.
b) Create a hypothesis that will predict and explain the effect that humans will have on your system. See your teacher for approval.
c) Design an experiment that will help you to explore answers to the question, and validate the truth to your hypothesis. Be sure to consider which variables you will control and which you will measure. See your teacher for approval.
d) Create a data table in which you can record your measurements or observations.
e) Start your experiment.

Lab Report

Background: (full sentences)

1) Describe the importance of ecosystems & how abiotic/biotic factors are interconnected.
2) Explain how humans can disrupt these relationships (farming, residential, recreation, etc)
3) Outline how (altered) nutrient cycles can cause problems for an ecosystem.

Purpose – as a statement
Hypothesis – if. . . then statement
Materials – point form list
Procedure – numbered list
Observations – data charts

Analysis/Discussion:

1) Analyze your data. Use appropriate graphs or diagrams to illustrate your findings. Did your results support your hypothesis? Why or why not?
2) Based on your observations, how would this change the a food web that would normally be living in this ecosystem? How would this change the biodiversity?
3) Using your observations and research, what conclusions can your draw about the health and sustainability of an ecosystem when exposed to fertilizer.
4) Outline any errors that may have occurred during the experiment. How did these change your results? What should have been done to prevent these from happening?

Conclusion – full sentences