Name ______________________________ APES

Depth Profile and Compensation Point Exercise

The productivity of an aquatic ecosystem is the rate at which sunlight is stored by plants in the form of organic molecules to the following equation:

$$6CO_2 + 6H_2O + \text{energy}_{\text{sun}} \longrightarrow C_6H_{12}O_6\ _{\text{(organic molecule)}} + 6O_2$$

Because of respiration, some of the organic molecules made by photosynthesis are "burned" to supply energy according to this equation:

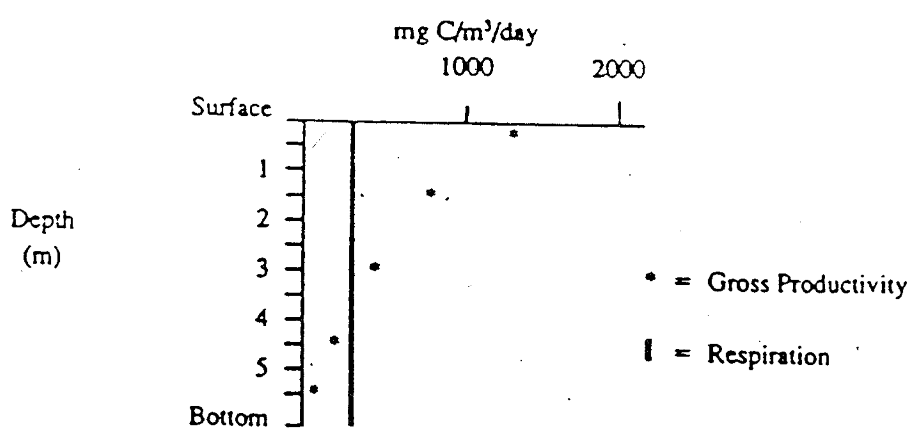
$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{energy}_{\text{chemical}}$$

Net Primary Productivity is the amount of energy stored in organic molecules after respiration loss is factored in:

NPP = **GPP** (Gross Primary Productivity) - **RL** (Respiration Loss)

A depth profile shows how the productivity of a lake varies with depth. Typically, productivity is plotted as gross productivity expressed as milligrams of organic carbon ($C_6H_{12}O_6$) produced per cubic meter of water per day.

Respiration Loss is also plotted as mg C/m^3/day. The following is a typical depth profile:



In this exercise you will compare Tiger Paw Lake to Bulldog Pond. These two bodies of water are comparable in terms of overall size, depth, state of eutrophication, and species. The only major difference is turbidity, the amount of suspended particles in the water column.

The following two data charts show how the gross productivity, expressed as ml O_2 / liter / hour, varies with depth. In the spaces provided calculate gross productivity as milligrams (mg) carbon (C) / cubic meter / day using the following conversion units:

$$1 \text{ ml } O_2 = 0.536 \text{ mg C} \qquad \text{and} \qquad 1 \text{ m}^3 = 1000 \text{ liters}$$

	DEPTH (meters)	GROSS PRODUCTIVITY ml O_2 / liter / hour	GROSS PRODUCTIVITY mg C / m^3 / day
Tiger Paw	0.0	0.15	
	0.5	0.15	
	1.5	0.13	
	2.5	0.10	
	4.0	0.06	
Bulldog	0.0	0.16	
	1.5	0.15	
	4.0	0.14	
	7.0	0.10	
	11.0	0.07	

After you have made the conversions, construct a depth profile for each lake, using the sample on the first page as a guide.

The respiration loss for both lakes is.0 9 ml O_2 / liter / hour. (.09)

This should also be plotted on your graphs.

After you have made your depth profiles, **ANSWER THE FOLLOWING QUESTIONS:**

1. Calculate the Net Primary Productivity in each lake at the depth of 1.5 meters:

NPP Tiger Paw   NPP Bulldog

2. Find the compensation point for each lake. This is the depth where Gross Productivity equals Respiration Loss. At this depth, therefore, NPP will be zero.

Compensation Point Tiger Paw   Compensation Point Bulldog

3. Which lake has greater turbidity? Explain your answer.

4. Which lake is more productive? Explain your answer.

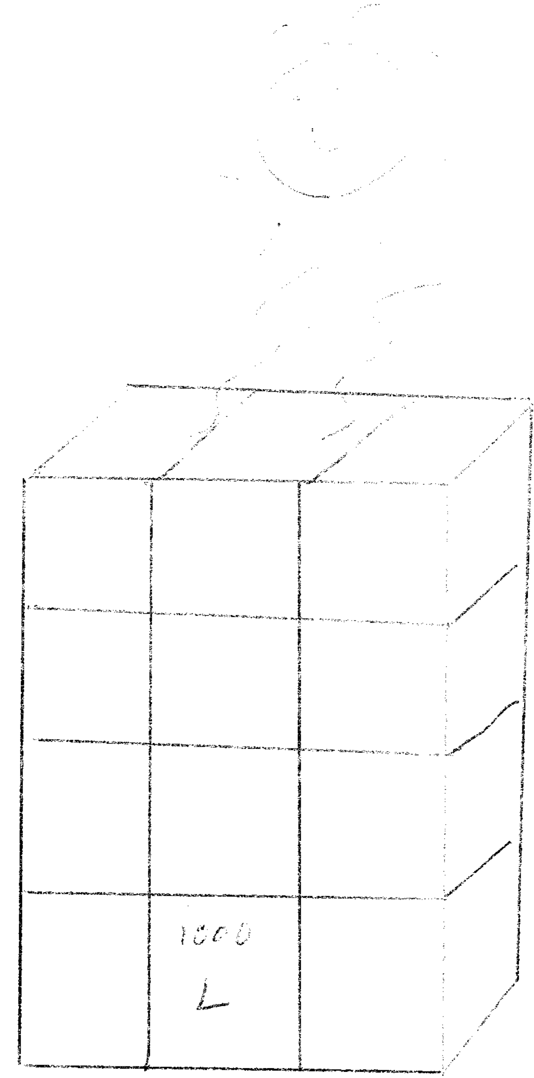
5. Describe the effect of turbidity on productivity in a lake, citing support from your graph and calculations.

Tiger Paw Lake

Bulldog Pond

Gross Productivity
is expressed as

$ml\ O_2$ / liter / hour



Conversion Units

$1\ ml\ O_2 = 0.536\ mg\ C$

$1\ m^3 = 1000\ L$

If $ml\ O_2$ / liter / hour = 0.15 then:

$$0.15\ ml\ O_2/\text{liter}/\text{hour} \times \frac{0.536\ mg\,C}{1\ ml\ O_2} = 0.0804\ mgC/\text{liter}/\text{hour}$$

$$0.0804\ mgC/\text{liter}/\text{hour} \times \frac{1000\ L}{1\ m^3} = 80.4\ mgC/m^3/\text{hour}$$

$$80.4\ mgC/m^3/\text{hour} \times \frac{24\ \text{hours}}{1\ \text{day}} = 1929.6\ mgC/m^3/\text{day}$$