Lagoon Metabolism

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JKC Bridges Program 2013 –UC Santa Barbara
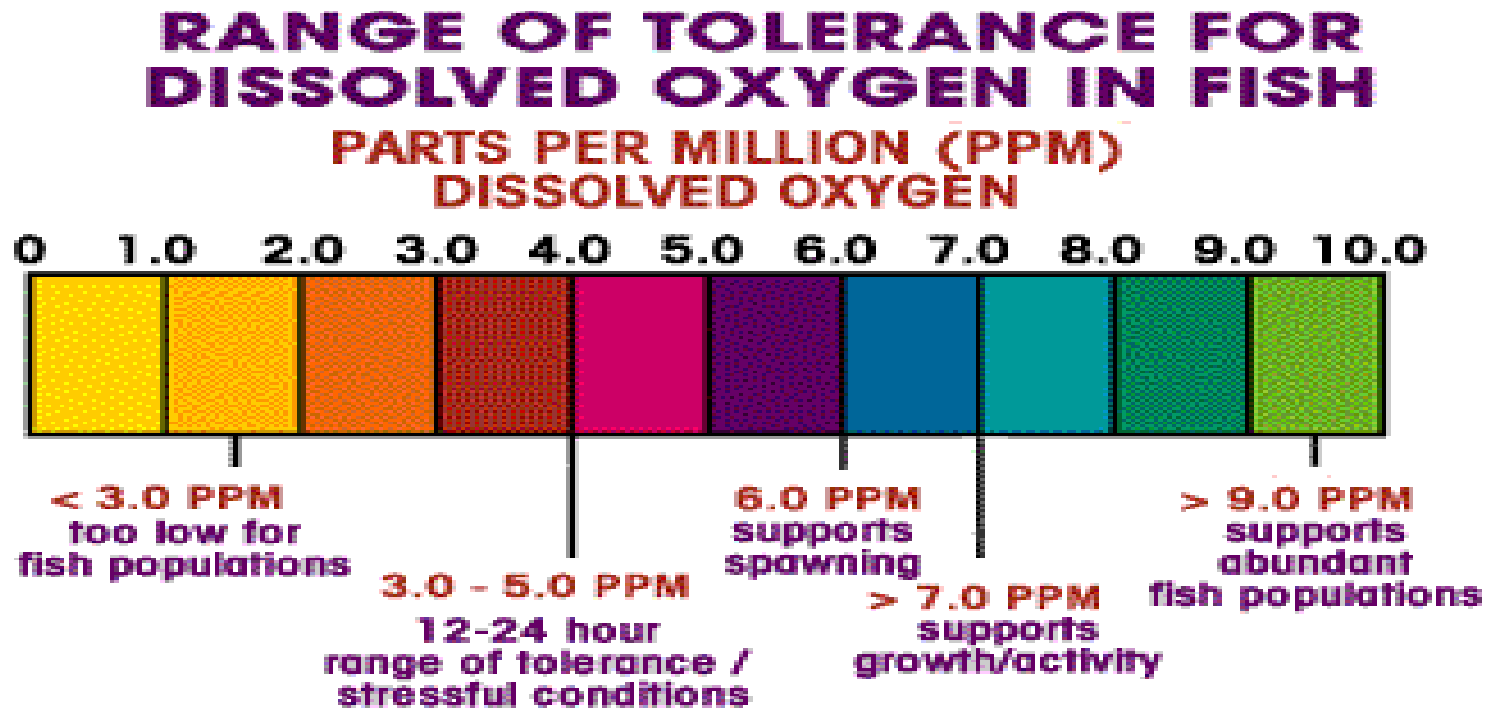
Lagoon History

- Naturally formed in 37 acres of area.

- Unique mixture of both salt and fresh water.
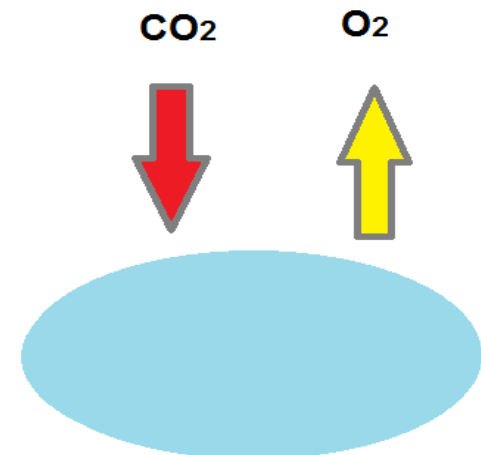
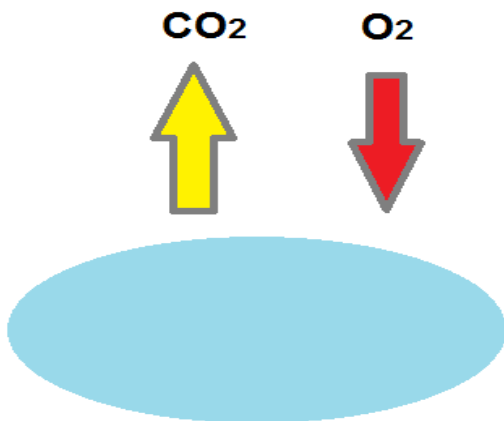# Dissolved Oxygen in Bodies of Water

- Identify whether the lagoon can sustain aquatic organisms.

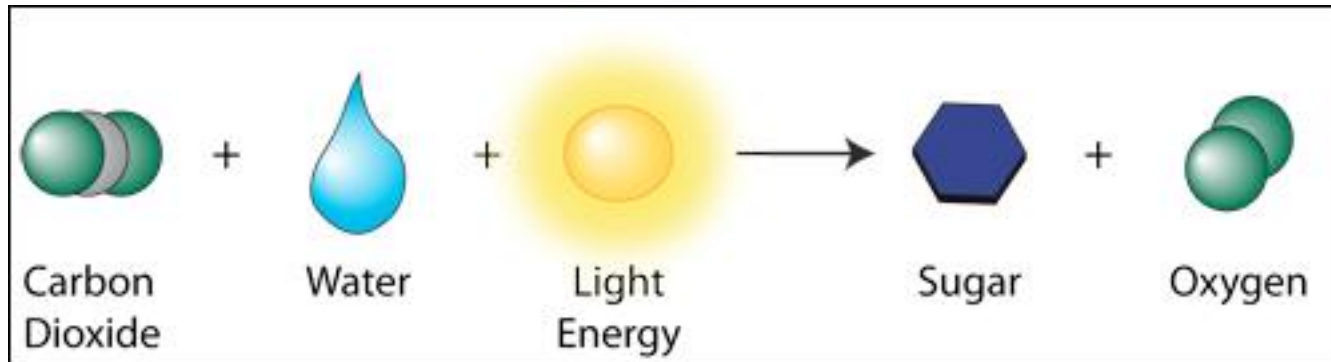- Acts as indicator of pollution in the environment.

Project Goals

RANGE OF TOLERANCE FOR DISSOLVED OXYGEN IN FISH

PARTS PER MILLION (PPM) DISSOLVED OXYGEN

0   1.0   2.0   3.0   4.0   5.0   6.0   7.0   8.0   9.0   10.0

< 3.0 PPM
too low for
fish populations

3.0 – 5.0 PPM
12-24 hour
range of tolerance /
stressful conditions

6.0 PPM
supports
spawning

> 7.0 PPM
supports
growth/activity

> 9.0 PPM
supports
abundant
fish populations

- Determine whether the lagoon is heterotrophic or autotrophic.

Heterotrophic vs. Autotrophic

Mississippi River Delta

CO_2 ↑ O_2 ↓

CO_2 ↓ O_2 ↑

Photosynthesis

Carbon Dioxide + Water + Light Energy → Sugar + Oxygen

Cellular Respiration

Oxygen + Sugar → Carbon Dioxide + Water + Energy (ATP)
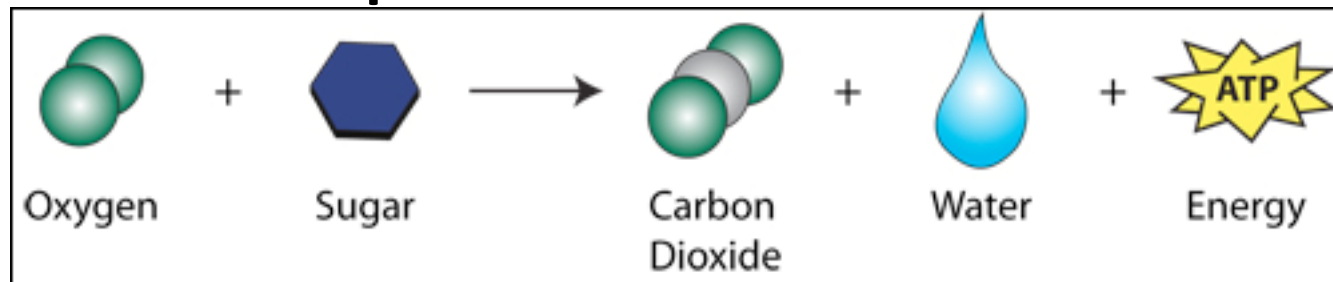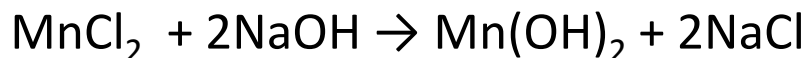
Collecting Samples

Incubation

- Incubation of light bottles and dark bottles over a 23 hour period.

Winkler Titration Reactions

$$MnCl_2 + 2NaOH \rightarrow Mn(OH)_2 + 2NaCl$$

- Added Manganous Chloride and Alkaline Iodide reagent to the water sample.

$$2Mn(OH)_2 + O_2 \rightarrow 2MnO(OH)_2$$
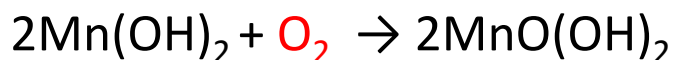
- A brown precipitate, Manganic basic oxide, formed which is a clear indicator of Oxygen present in the water sample.

$$MnO(OH)_2 + 2H_2SO_4 \rightarrow Mn(SO_4)_2 + 3H_2O$$
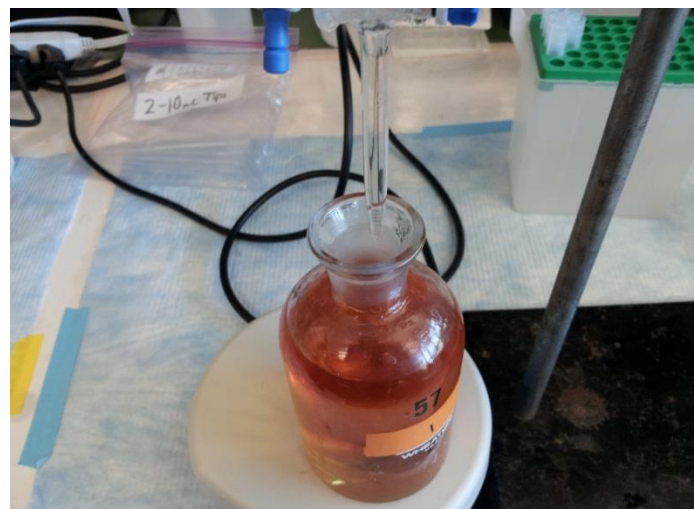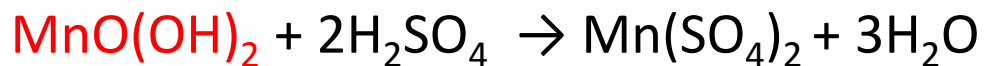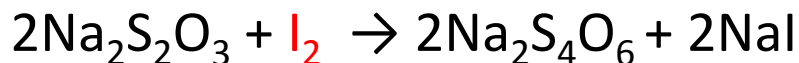
- Added Sulfuric Acid to the sample which dissolved the brown precipitate and formed Manganic Sulfate.

$$Mn(SO_4)_2 + 2KI \rightarrow MnSO_4 + K_2SO_4 + I_2$$

- Manganic Sulfate reacted with Potassium Iodide from first step

$$2Na_2S_2O_3 + I_2 \rightarrow 2Na_2S_4O_6 + 2NaI$$

- The solution was titrated with Standardized Sodium Thiosulfate

$2Na_2S_2O_3 + I_2 \rightarrow 2Na_2S_4O_6 + 2NaI$
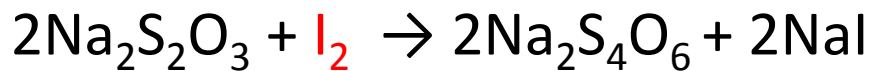
- Added Starch solution to the sample which acted an indicator for oxygen.

- Titrated the sample with Sodium Thiosulfate until it reached its endpoint.
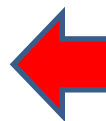
Calculating Dissolved Oxygen of the Samples

O_2 **mg/L =** (mLs $Na_2S_2O_3$ used) * (normality of $Na_2S_2O_3$) * (8,000 mg O_2 / mol $Na_2S_2O_3$)

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(mLs of sample titrated) * (<u>BOD bottle volume – reagent volume</u>)

BOD bottle volume

Light Bottle - T_0 = **Net Primary Production**

Dark Bottle - T_0 = **Respiration**

Net Primary Production – Respiration = **Gross Primary Production**

Calculating Dissolved Oxygen

Average O_2 Levels
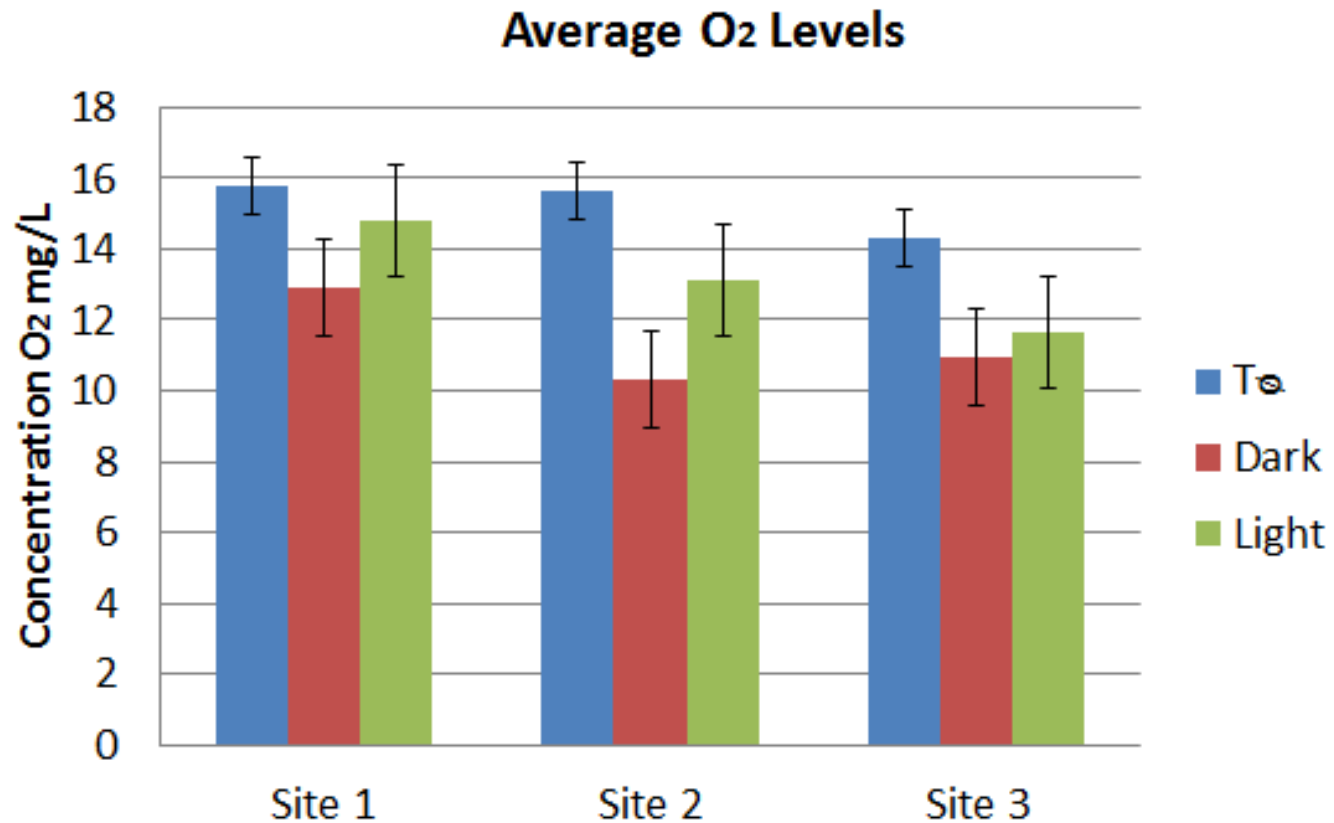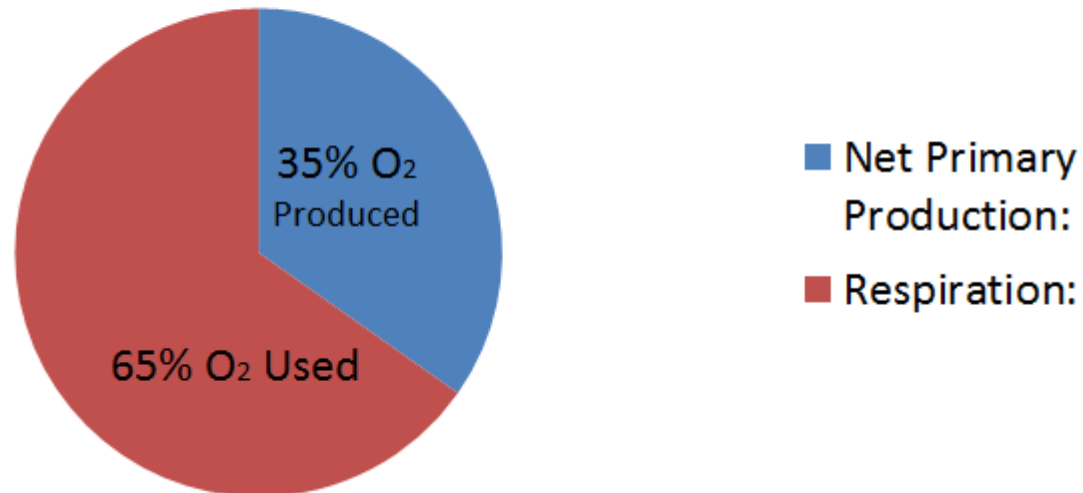
Results

- Lagoon is not producing enough oxygen for its organisms

- Lagoon is considered **Heterotrophic**

Gross Primary Production

35% O$_2$ Produced

65% O$_2$ Used

■ Net Primary Production:

■ Respiration:

Future Improvements

- Collect more samples.

- Sample middle areas of the lagoon and around larger plants.

- Work with the reactions faster.

- Incubate for less time.

- Functional Dissolved Oxygen Meter – YSI

Acknowledgments

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THANK YOU ALL FOR COMING!