

# **Opportunistic Water Quality Monitoring Effort 24-hour Monitoring in Kingston Harbour**

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# The **BIG** Picture

- Water quality monitoring is essential in determining the suitability of a body of water or water source to its actual or intended use.
- The prohibitive cost of monitoring results in us knowing less about the quality of our waters than we could.

# The **BIG** Picture

➤ Monitoring pursuant to permit requirements, provides a platform for getting information on other parameters which, while not strictly a part of the permit requirements, can provide useful information on the general state of the environment.

# The **BIG** Picture

- This paper is based on additional data collected while carrying out hourly monitoring of turbidity/TSS as part of permit conditions for dredging in the vicinity of Kingston Wharves.

# Who? What? Where? When?

- Who: TEMN Ltd. provides consulting services in the field of environmental management.
- What: Opportunistic 24-hr Dissolved Oxygen (DO) water quality monitoring
- Where: Kingston Harbour in the vicinity of Kingston Wharves
- When: March 18 to 19, 2010

# The TEMN Team's FOCUS

- **Dissolved Oxygen:** a relative measure of the amount of oxygen that is dissolved or carried in water. Dissolved oxygen is replenished by diffusion from the surrounding air or photosynthetic activity carried out by aquatic plants/algae.
- The USEPA criteria for marine waters is 4.8mg/l.

# The TEMN Team's FOCUS

- TEMN's decision to use this sampling opportunity to measure DO was based on prior knowledge of organic waste entering this section of the harbour .
- This waste disposal was not as a result of activities taking place at Kingston Wharves but was observed to be coming from a storm drain on the northeastern berthface.

# The TEMN Team's FOCUS

File photos taken on March 14, 2007, three years prior to this study



Figure 1: Bloody water? near Kingston Wharves



Figure 2: Chicken head in bloody water

# Dissolved Oxygen (DO)

DO concentration in water is influenced by:

- Atmospheric pressure/altitude,
- Temperature,
- Salinity,
- algal population
- Aeration
- Organic Waste

# METHODOLOGY

- Monitoring was carried out by three shifts of monitors operating out of Greenwich Fishing Beach. Each monitor was accompanied by a boatman/fisher.
- Sampling commenced at 3:18PM on March 18 and terminated at 8:23PM on March 19.

# METHODOLOGY

- Three sites were selected just south of the actual dredging operation and denoted as Kingston Wharves West (KWW), Kingston Wharves Central (KWC) and Kingston Wharves East (KWE).
- A control station to monitor turbidity outside of the dredge impact zone was established at the buoy near Greenwich Beach (GB). Sampling sites are shown in Figure 3.

# Kingston Wharves dredge Monitoring Berths 8 and 9 Sampling Sites



Figure 3: Sampling Area

# METHODOLOGY

- DO was monitored using the YSI Model 85 Hand Held Oxygen, Conductivity, Salinity, and Temperature System.
- Calibration was done in moist air in accordance with the instruction manual (YSI 1998).
- Calibration was performed hourly before each sampling occasion.

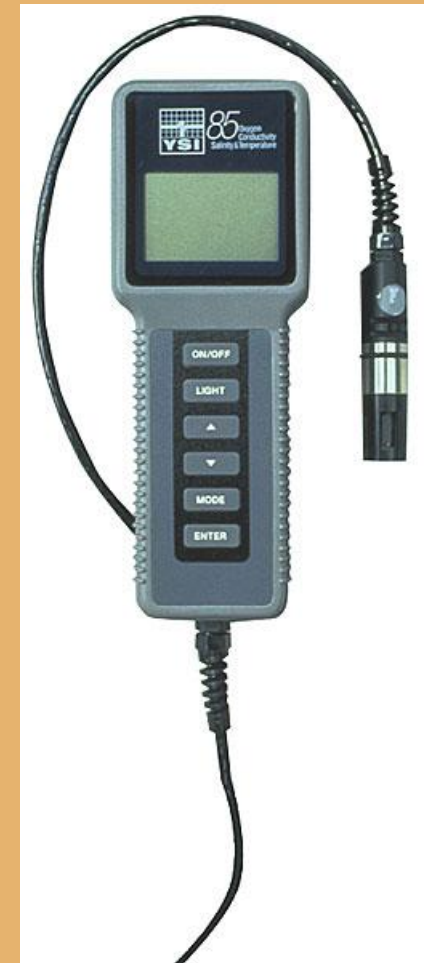
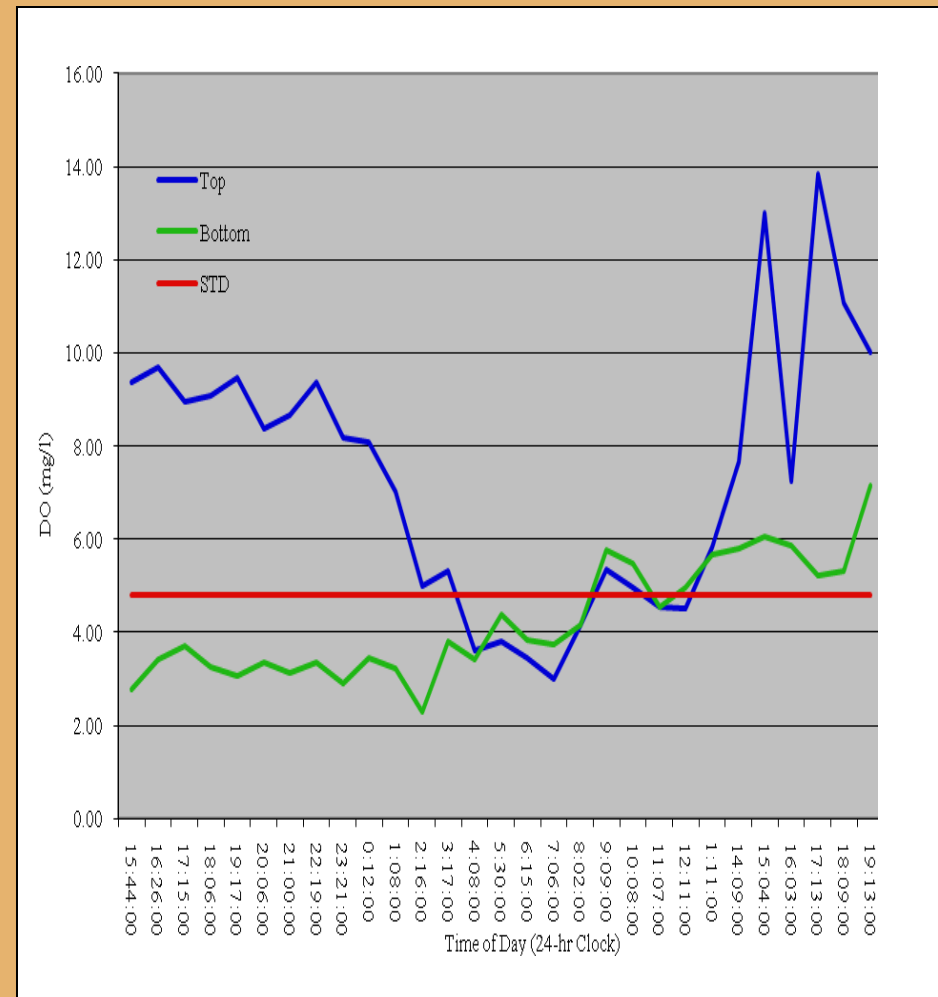


Figure 4: YSI 85

# Results

## Kingston Wharves West (KWW)

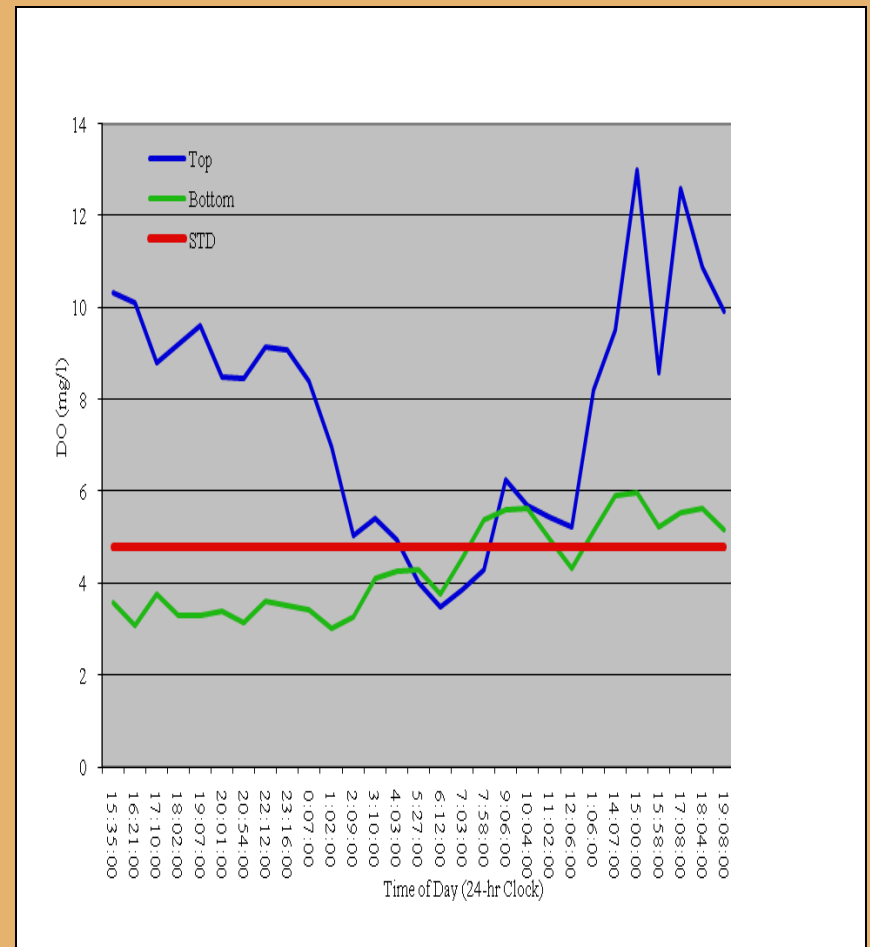
- **Temperature** was within the relatively narrow range 28.0°C to 29.8°C being slightly lower at the bottom of the water column
- **Dissolved oxygen (DO)** levels varied from a low of 2.28mg/l at the bottom of the water column to a high of 13.84mg/l at the surface



# Results

## Kingston Wharves Central (KWC)

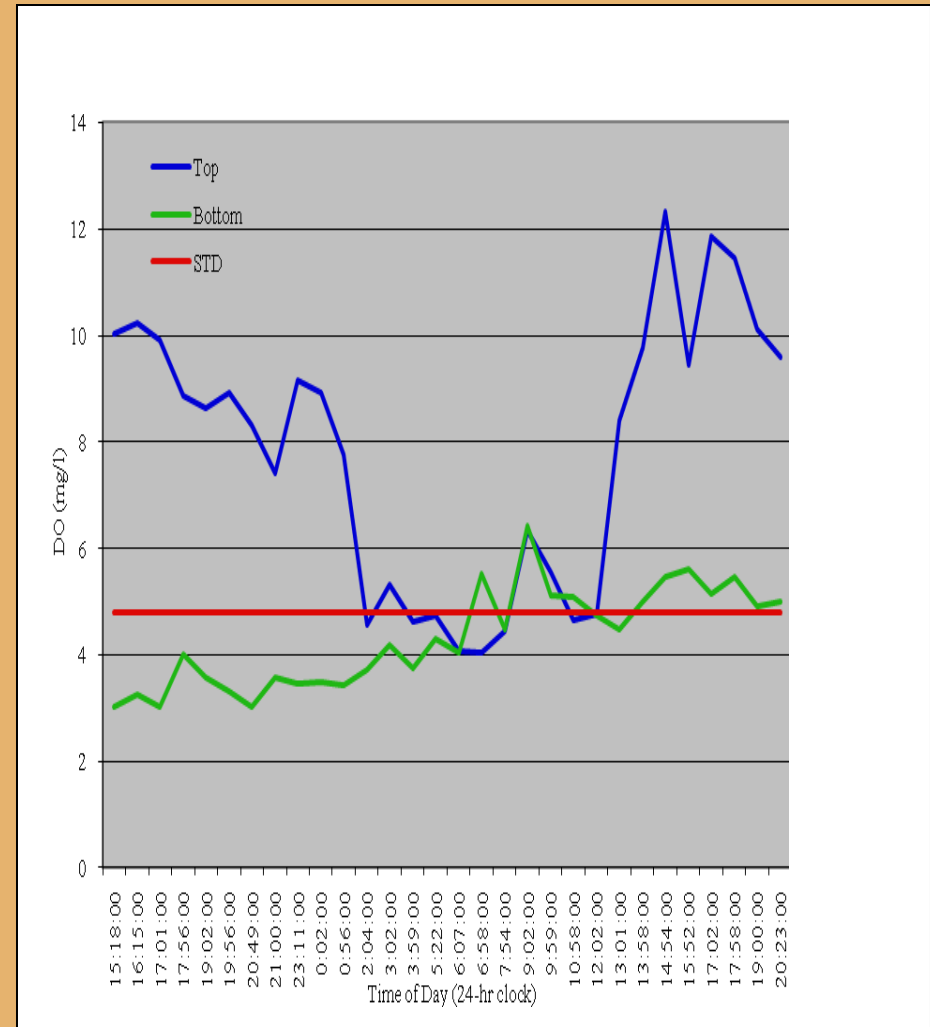
- **Temperature** was within the relatively narrow range 28.0°C to 29.9°C being slightly lower at the bottom of the water column
- **Dissolved oxygen (DO)** levels varied from a low of 3.02mg/l at the bottom of the water column to a high of 12.98mg/l at the surface



# Results

## Kingston Wharves East (KWE)

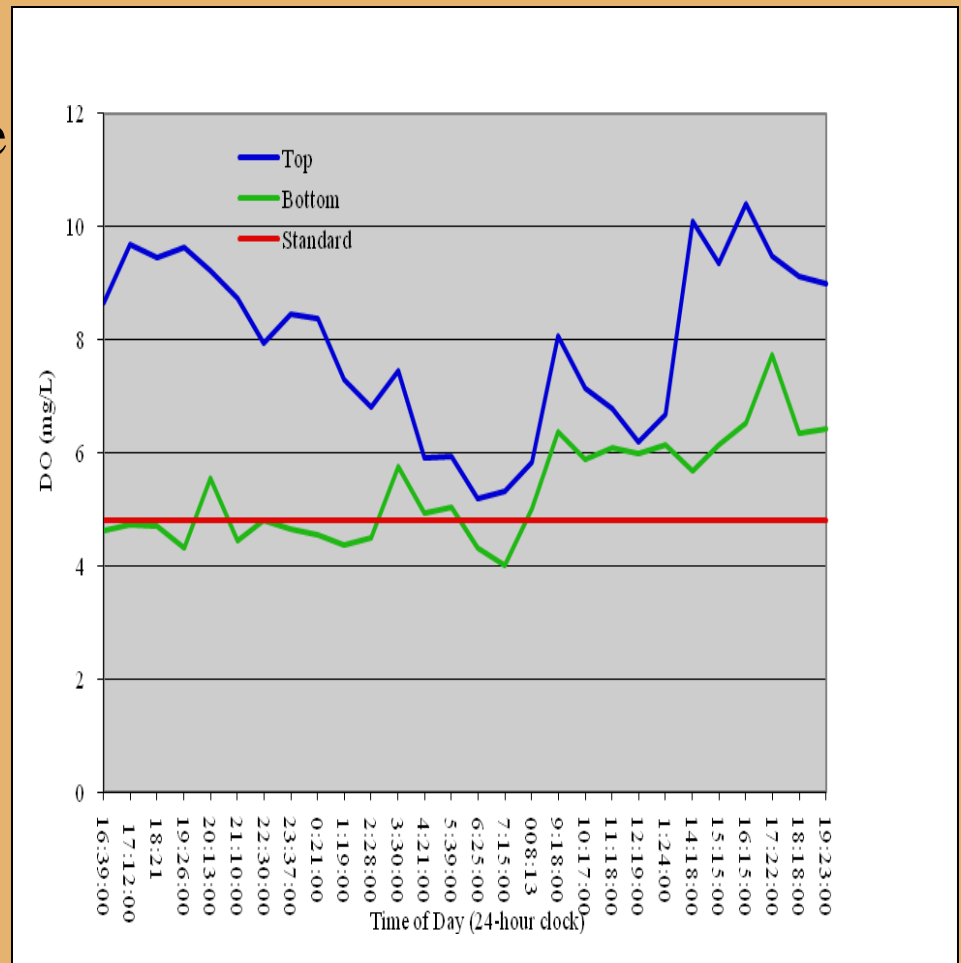
- **Temperature** was within the relatively narrow range 27.9°C to 29.9°C being slightly lower at the bottom of the water column
- **Dissolved oxygen DO** levels varied significantly from a low of 3.01mg/l at the bottom of the water column to a high of 12.32mg/l at the surface

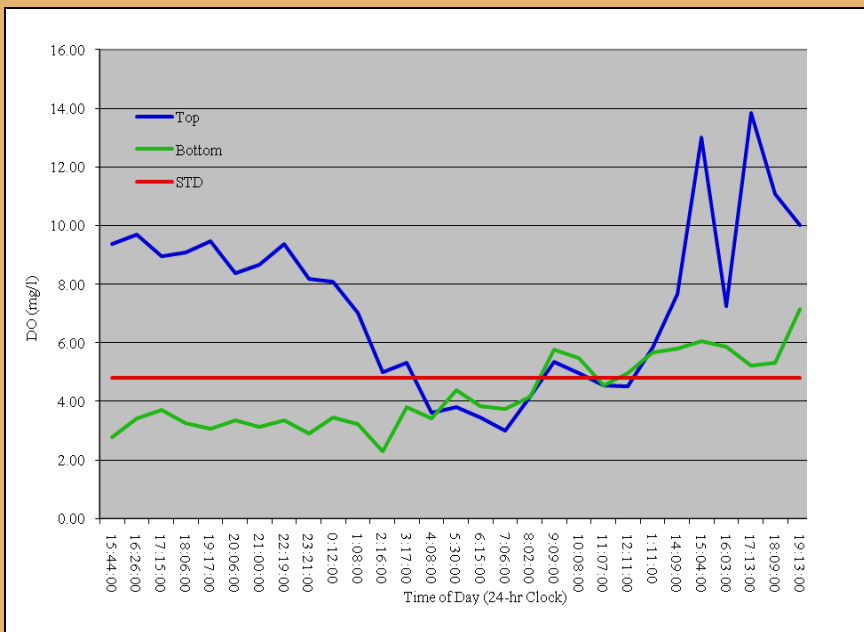


# Results

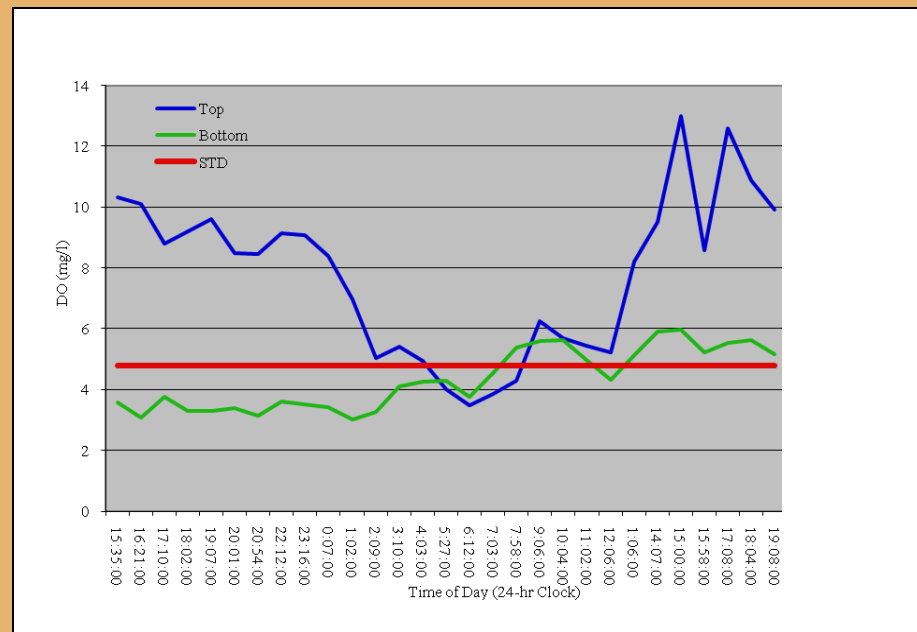
## Greenwich Beach (KWGB)

- **Temperature** was within the relatively narrow range 28.0°C To 29.8°C being slightly lower at the bottom of the water column
- **Dissolved oxygen (DO)** levels varied from a low of 4.02mg/l at the bottom of the water column to a high of 10.40mg/l at the surface

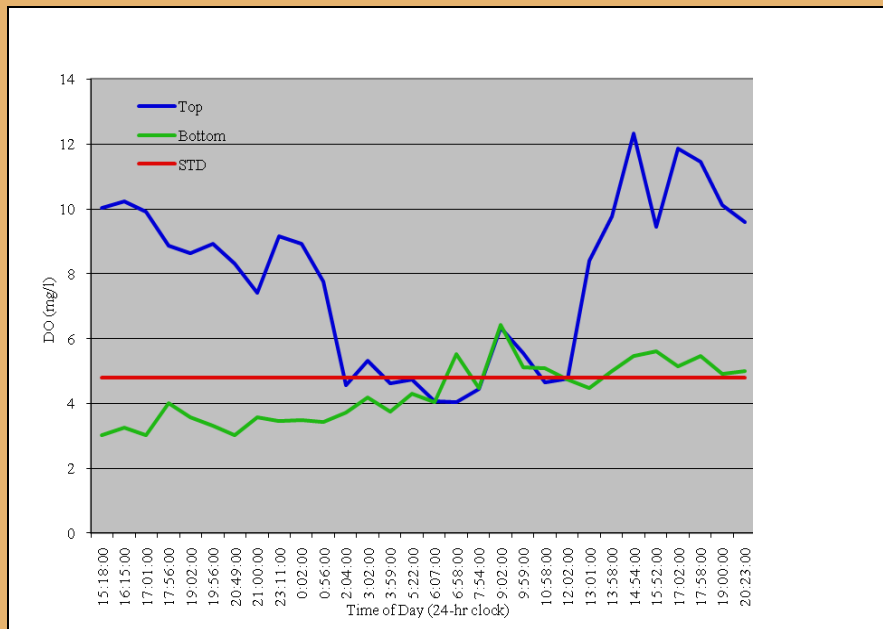




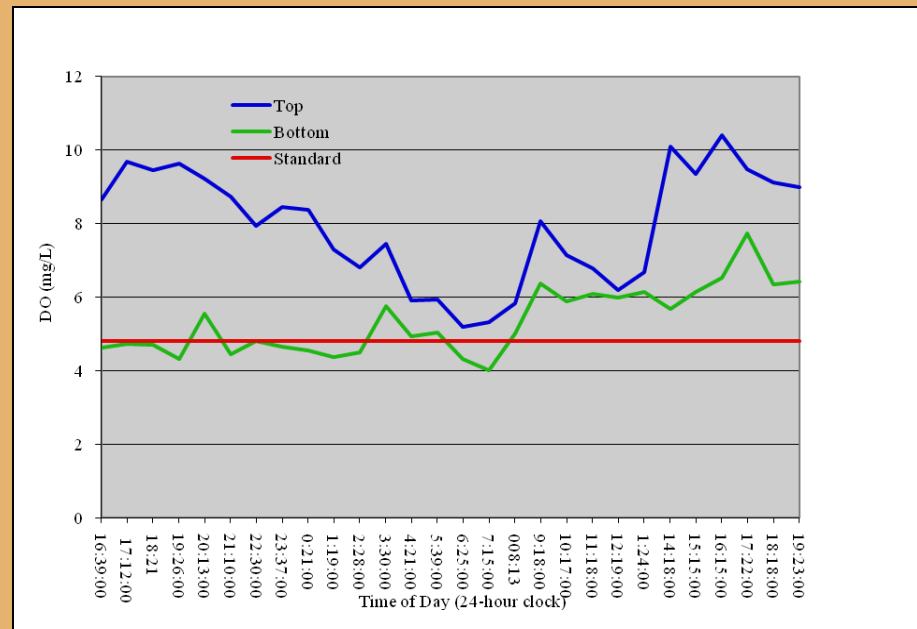
KWW, March 18 to 19, 2010



KWC, March 18 to 19, 2010



KWE, March 18 to 19, 2010



Near Greenwich Beach, March 18 to 19, 2010

# So, what did we learn.....

- For a 24-hr period the concentration of oxygen in surface water can vary widely from supersaturated levels to levels below the USEPA criterion value of 4.8mg/l.
- The lowest DO was generally determined for the twelve hour period between midnight to midday, particularly the early morning hours.
- The small temperature variation recorded would not significantly affect the solubility of oxygen in water.

# So, what did we learn.....

- Photosynthesising organisms in the surface water would account for the big variation between bottom and surface DO readings as well as surface day and night variation.
- As these organisms are nutrient dependent, increase in their populations indicates the presence of nutrients in a body of water.

# Conclusion

- The extreme diurnal fluctuations in DO levels, especially in surface waters, is in all probability an indication of eutrophic conditions.
- **Opportunistic monitoring can significantly cut the cost of water quality sampling.**

# Conclusion

- This study also highlights the importance of investing in multi-parameter water quality instruments.

# ACKNOWLEDGEMENTS

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QUESTIONS?

