Water Quality Monitoring – An Introduction

Dr. Prasad Modak

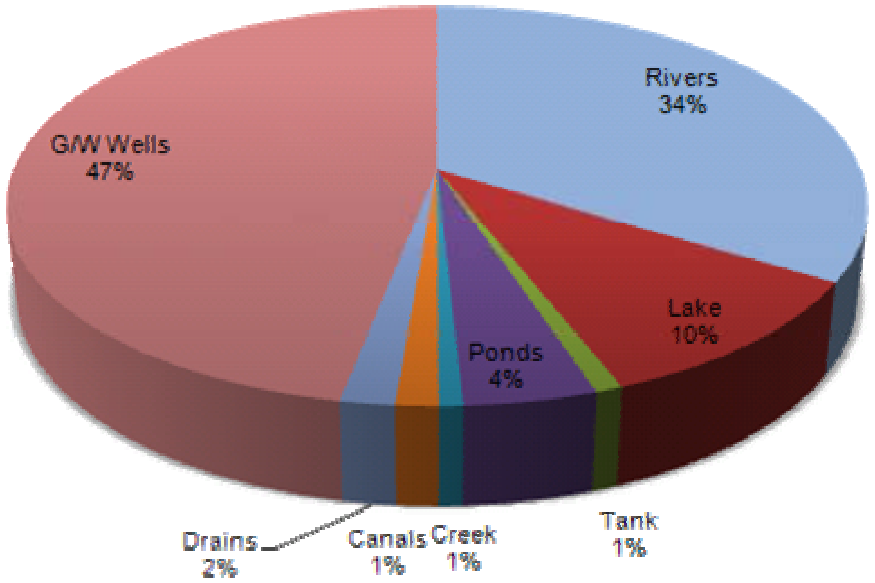
Environmental Management Centre, Mumbai

Background

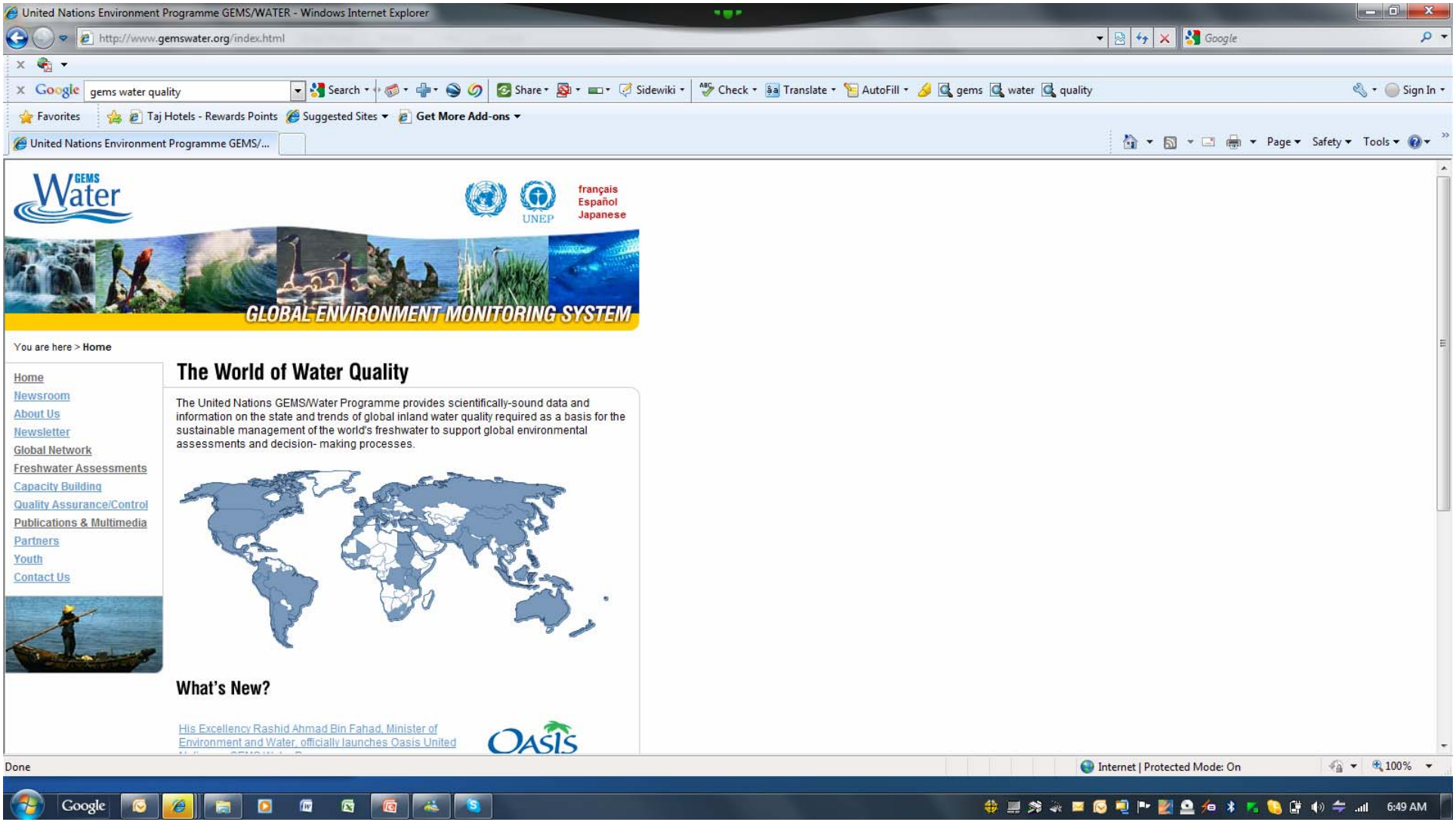
- State Pollution Control Boards (SPCBs) are responsible for maintaining the ‘wholesomeness’ of natural and manmade water bodies in respective States under the Water Act, 1974
- SPCBs invest considerable resources in monitoring water quality
- Monitoring is undertaken under MINARS & GEMS programme
- GEMS data is uploaded in GEMS website http://www.gemswater.org.
- MINARS data is collated and placed as Environmental Data Bank (EDB) on CPCB’s website

A Glimpse of MINARS

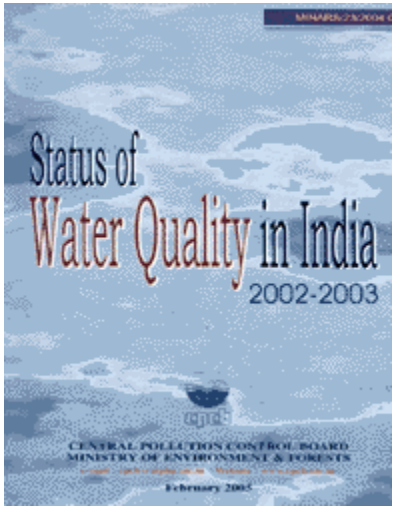
- The present MINARS network comprises of 1700 stations in 27 States and 6 Union Territories
- Priority parameters include pH, DO, BOD, TDS, Total Conductivity, Faecal Coliforms
- Monitoring is done on monthly or quarterly basis for surface waters and on half yearly basis for ground water.



GEMS Website http://www.gemswater.org/index.html



Use of MINARS data



CPCB publishes Annual Statistics on Water Quality

Analysis is however limited and opportunities for data interpretation are not fully exploited

But, why monitor in the first place?

- What do we achieve by monitoring Water Quality (WQ)?
- What are our WQ criteria?
- What are our WQ Goals (what do we want to achieve)?
- Are parameters we sample are in line with criteria and objectives?
- Is monitoring frequency sufficient?
- Are sampling and analysis protocols OK (am I using the right practice and reference method)?
- Is QA/QC done on data (e.g. replicating sample, statistical analysis like control charts etc.)?

Objectives of Water Quality Monitoring

- Objective is linked to water use at a location/reach
- The designated use in that reach (CPCB's classification)
- WQ goals (what we need to achieve)
- WQ criteria (why we need to achieve a specific level of WQ parameters)
- WQ Standard (prescriptive and legally supported translation of the WQ criteria)

- Targets are then set based on
- Techno-economic feasibility of achieving the standard (possible to reach x level)
- Resources available

CPCB's best designated use based on WQ Criteria

Designated-Best-Use	Class	Criteria
Drinking Water Source without conventional treatment but after disinfection	**A**	Total Coliforms Organism MPN/100ml shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen 6mg/l or more Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
Outdoor bathing (Organized)	**B**	Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Drinking water source after conventional treatment and disinfection	**C**	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Propagation of Wild life and Fisheries	**D**	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	**E**	pH between 6.0 to 8.5 Electrical Conductivity at 25°C micro mhos/cm Max.2250 Sodium absorption Ratio Max. 26 Boron Max. 2mg/l

Why analyze data?

- To “extract” “hidden features” from the data
- To see a bigger picture!
- To assess trends
- To check compliance
- To serve as early warning system
- To facilitate decision making process on managing water resource and its use
- To facilitate data communication stakeholders

But you know the story of the man who drowned crossing a stream with an average depth of six inches. ~W.I.E. Gates

What type of Tools we typically use?

- For data completeness and quality checks (e.g. filling missing data, finding outliers)
- Descriptive statistics (univariate)
  - Central tendencies
  - Dispersion parameter (spread), measures of variance
- Bivariate statistics
  - Trend analysis
  - Correlation and Regression
  - Time series analysis
- Using MS Excel
  - How to use excel for above analysis
  - Plotting/Presentation of data using MS Excel
  - Where MS Excel falls shot & what to do then (Add in)