WATER AND WASTEWATER MONITORING

Field Work and Sampling

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Types of Water Quality Monitoring

Grab Sampling:

- Provides a snapshot of water quality at the time the sample was taken

Continuous Sampling:

- Provides a clearer picture of water quality over time

Sample Containers

Silver	250 ml polyethylene (amber)	Rinse three times with tap water, once with chromic acid[2], three times with tap water, once with 1:1 nitric acid and then three times with ultrapure distilled water[5] in that order
Mercury	100 ml glass (Sovirel)	Rinse three times with tap water, once with chromic acid[2], three times with tap water, once with 1:1 nitric acid and then three times with ultrapure distilled water[5] in that order
Acidity, Alkalinity, Arsenic, Calcium, Chloride, Colour, Fluoride, Hardness, Magnesium, Non-filterable residue, pH, Potassium, Sodium, Specific conductance, Sulphate, Turbidity	1,000 ml polyethylene	Rinse three times with tap water, once with chromic acid[2], three times with tap water, once with 1:1 nitric acid and then three times with distilled water in that order
Carbon, total organic Nitrogen: ammonia Nitrogen: nitrate, nitrite Nitrogen: total	250 ml polyethylene	Rinse three times with tap water, once with chromic acid[2], three times with tap water, and three times with distilled water, in that order
Phosphorus, total	50 ml glass (Sovirel)	Rinse three times with tap water, once with chromic acid[2], three times with tap water, and three times with distilled water, in that order

Source: Jamie Bartram and Richard Balance, 1996

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Type of samples

- Sampling surface waters and groundwaters

Sampling surface waters

✓ The simplest, a “grab” sample, is taken at a selected location, depth and time.

✓ if the sampler is small and many analyses are to be done, two grab samples will be taken at the station and will be mixed in the same transport container

Composite sample

- Depth-integrated: most commonly made up of two or more equal parts collected at predetermined depth intervals between the surface and the bottom.
- Area-integrated: made by combining a series of samples taken at various sampling points spatially distributed in the water body.
- Time-integrated: made by mixing equal volumes of water collected at a sampling station at regular time intervals
- Discharge-integrated: It is first necessary to collect samples and to measure the rate of discharge at regular intervals over the period of interest.

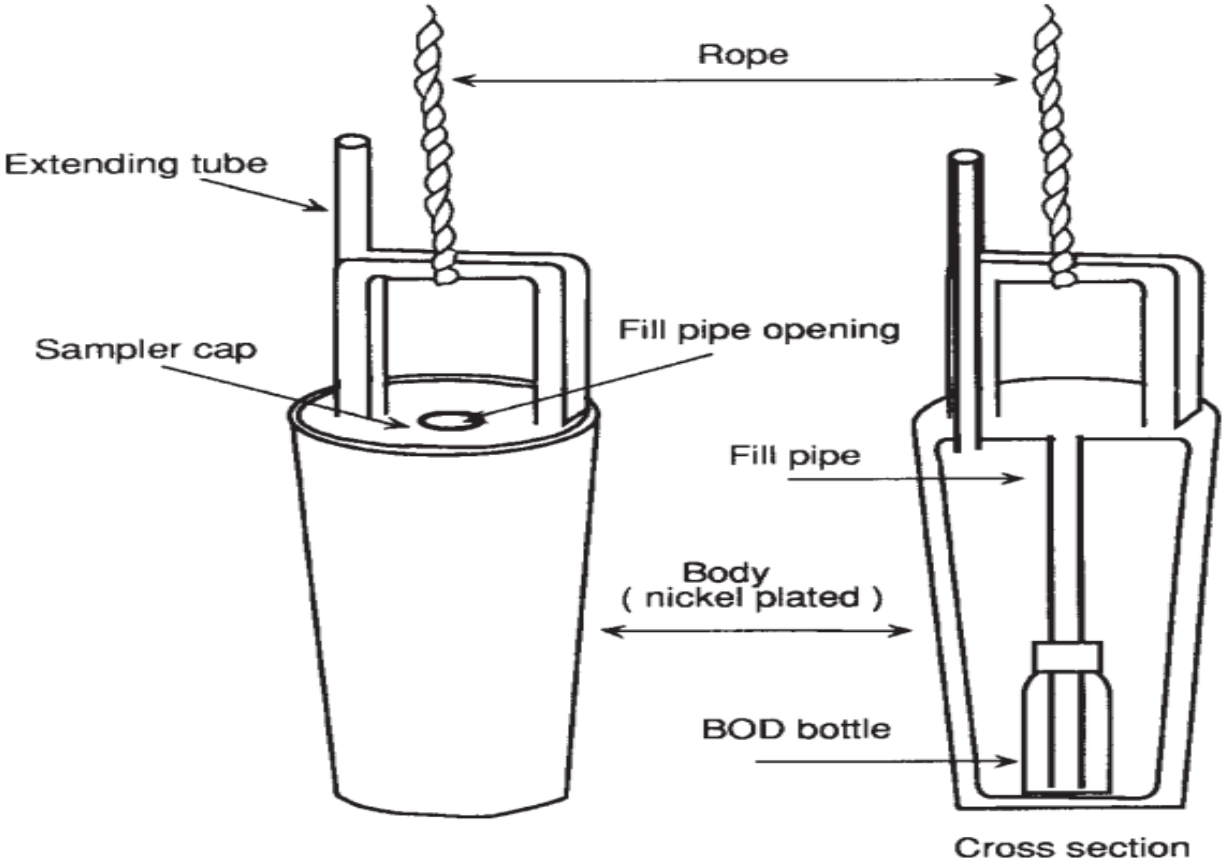
Sampling Groundwater

- Obtain from existing drilled wells, dug (shallow) wells or springs.
- The water should be allowed to flow into the bottle for sufficient time to displace the contents of the bottle at least three times.
- The sampling container must not be allowed to touch the bottom of the well or spring catchment

Water Sampler

- Dissolved oxygen sampler
- Depth sampler
- Multipurpose sampler

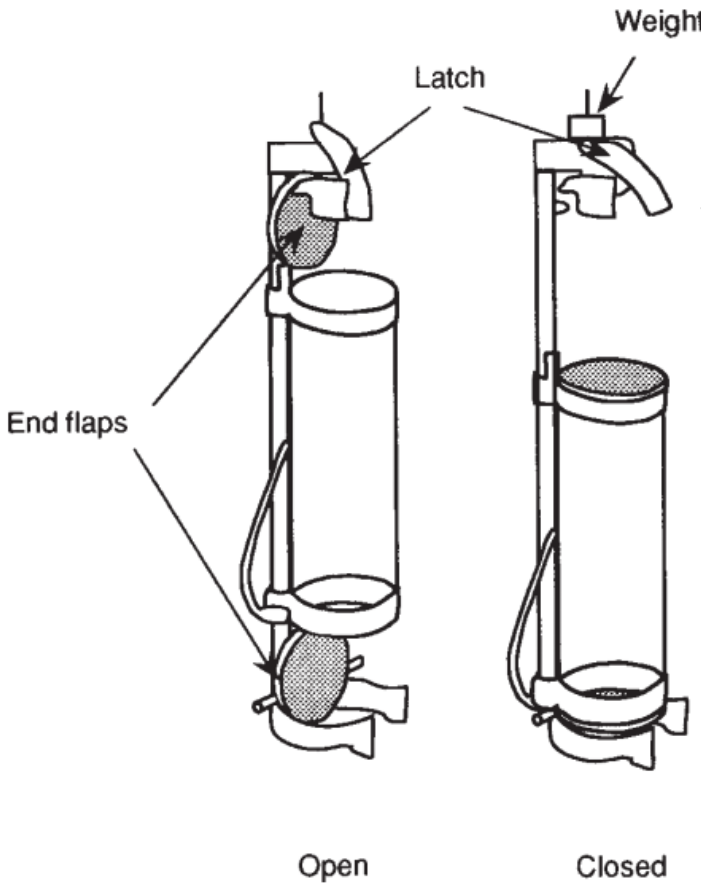
Dissolved oxygen sampler



Source: Jamie Bartram and Richard Balance, 1996

Depth sampler

- Called as “Grab sample”
- Can retrieve a sample from any predetermined depth
- Used for all chemical analyses except dissolved oxygen



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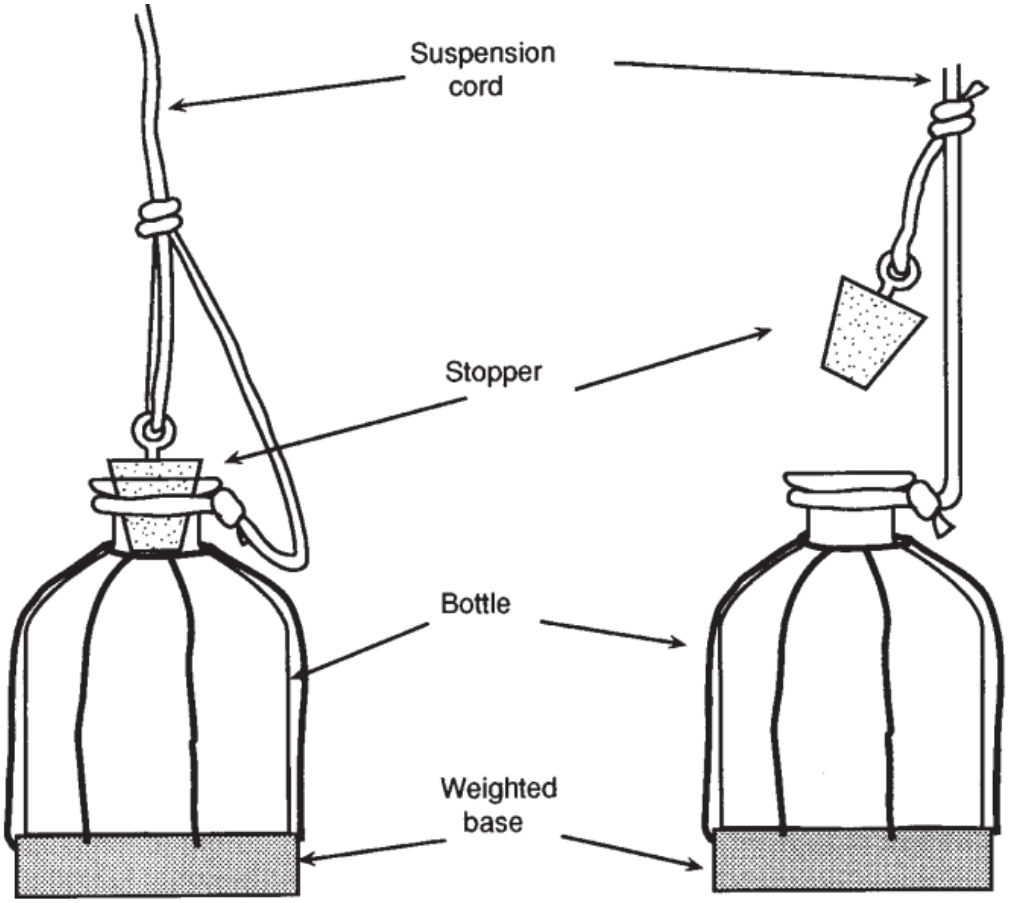
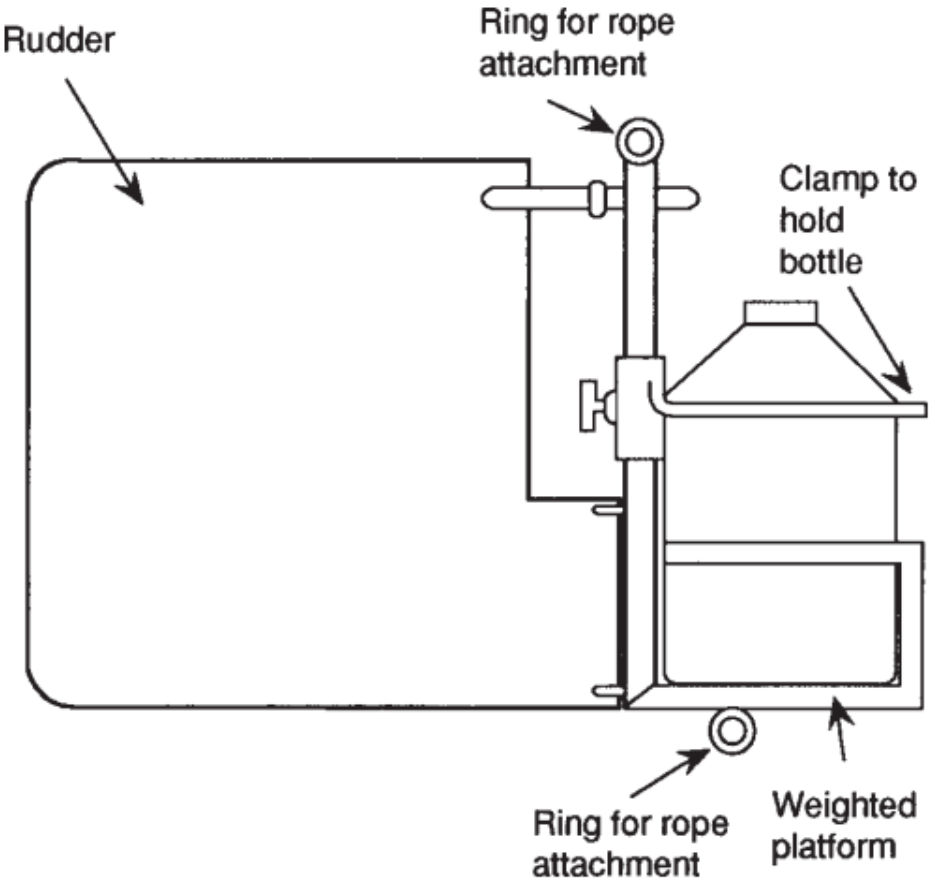
Depth sampler suitable for moderate depths



Source: Jamie Bartram and Richard Balance, 1996

Multipurpose sampler

- Used for taking samples in flowing streams or rivers.



Source: Jamie Bartram and Richard Balance, 1996

Sample preservation

- In general, sample bottles should be resealed and stored in a clean, cool, dark environment and protected from recontamination.
- Additional methods of preservation include freezing, solvent extraction and the addition of chemical preservatives.

Preservatives and Permissible Storage

Variable	Recommended container[1]	Preservative	Max. permissible storage time
Alkalinity	Polyethylene	Cool 4 °C	24 h
Aluminium	Polyethylene	2 ml Conc. HNO_3 l^{-1} sample	6 months
Arsenic	Polyethylene	Cool 4 °C	6 months
BOD	Polyethylene	Cool 4 °C	4 h
Boron	Polyethylene	Cool 4 °C	6 months
Cadmium	Polyethylene	2 ml Conc. HNO_3 l^{-1} sample	6 months
Calcium	Polyethylene	Cool 4 °C	7 days
Carbamate pesticides	Glass	H_2SO_4 to pH < 4, 10g Na_2SO_4 l^{-1}	Extract immediately
Carbon inorganic/organic	Polyethylene	Cool 4 °C	24 h
particulate	Plastic Petri dish	Filter using GF/C filter; Cool, 4 °C	6 months
Chloride	Polyethylene	Cool 4 °C	7 days
Chlorinated hydrocarbon	Glass	Cool 4 °C	Extract immediately
Chlorophyll	Plastic Petri dish	Filter on GF/C filter; freeze –20 °C	7 days
Chromium	Polyethylene	2 ml Conc. HNO_3 l^{-1} sample	6 months
COD	Polyethylene	Cool 4 °C	24 h
Copper	Polyethylene	2 ml Conc. HNO_3 l^{-1} sample	6 months
Dissolved oxygen (Winkler)	Glass	Fix on site	6 h
Fluoride	Polyethylene	Cool 4 °C	7 days
Iron	Polyethylene	2 ml Conc. HNO_3 l^{-1} sample	6 months
Lead	Polyethylene	2 ml Conc. HNO_3 l^{-1} sample	6 months
Magnesium	Polyethylene	Cool 4 °C	7 days
Manganese	Polyethylene	2 ml Conc. HNO_3 l^{-1} sample	6 months
Mercury	Glass or teflon	1 ml Conc. H_2SO_4 + 1 ml 5% $K_2Cr_2O_7$	1 month

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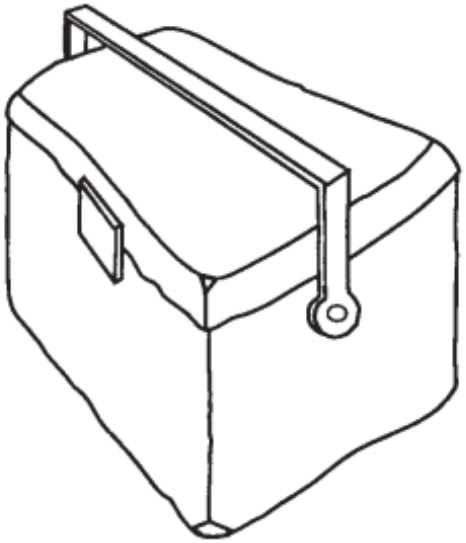
Nickel	Polyethylene	2 ml Conc. HNO_3 l^{-1} sample	6 months
Nitrogen			
Ammonia	Polyethylene	Cool 4 °C, 2 ml 40% H_2SO_4 l^{-1}	24 h
Kjeldahl	Polyethylene	Cool 4 °C	24 h
Nitrate + Nitrite	Polyethylene	Cool 4 °C	24 h
Organic nitrogen	Polyethylene	Cool 4 °C	24 h
Organic particulates	Plastic Petri dish	Filter using GF/C filter, Cool 4 °C	6 months
Organophosphorus pesticides	Glass	Cool, 4 °C, 10% HCl to pH 4.4	No holding, extraction on site
Pentachlorophenol	Glass	H_2SO_4 to pH < 4, 0.5 g $CuSO_4$ l^{-1} sample; Cool 4 °C	24 h
pH	Polyethylene	None	6 h
Phenolics	Glass	H_3PO_4 to pH < 4, 1.0 g $CuSO_4$ l^{-1} sample; Cool 4 °C	24 h
Phenoxy acid herbicides	Glass	Cool 4 °C	Extract immediately
Phosphorus			
Dissolved	Glass	Filter on site using 0.45 µm filter	24 h
Inorganic	Glass	Cool 4 °C	24 h
Total	Glass	Cool 4 °C	1 month
Potassium	Polyethylene	Cool, 4 °C	7 days
Residue	Polyethylene	Cool, 4 °C	7 days
Selenium	Polyethylene	1.5 ml Conc. HNO_3 l^{-1} sample	6 months
Silica	Polyethylene	Cool, 4 °C	7 days
Sodium	Polyethylene	Cool, 4 °C	7 days
Electrical conductivity	Polyethylene	Cool, 4 °C	24 h
Sulphate	Polyethylene	Cool, 4 °C	7 days
Zinc	Polyethylene	2 ml Conc. HNO_3 l^{-1} sample	6 months

Source: Jamie Bartram and Richard Balance, 1996

Transportation and storage of samples

Sample's container information

- Name of the study
- Sample station identification and/or number
- Sampling depth
- Date and time of sampling
- Name of the individual who collected the sample
- Brief details of weather and any unusual conditions prevailing at the time of sampling
- Record of any stabilising preservative treatment
- Results of any measurements completed in the field



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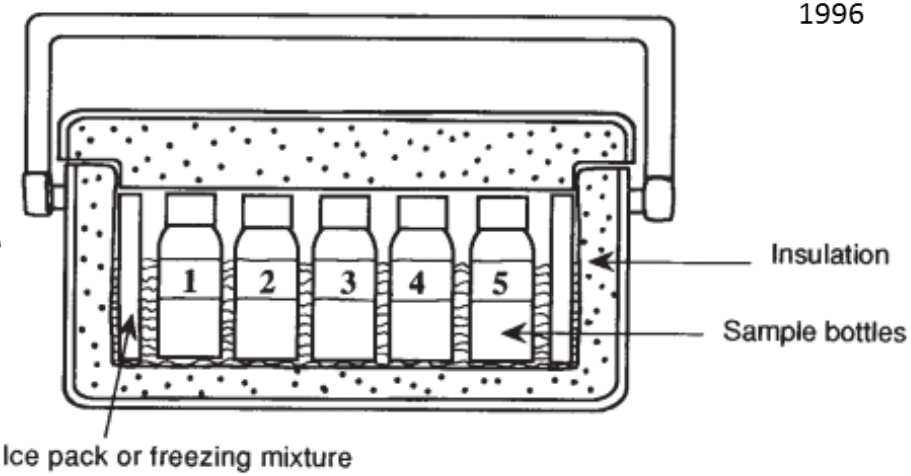

Safety during field work

Field staff will encounter wide range of hazards in their work, includes:

- Highly contaminated water, e.g. sewage or chemicals
- Access to sampling stations involve crossing dangerous terrain
- Wading in streams carries the possibility of slipping and personal injury

Suitable protecting clothing, e.g., rubber gloves, water safety and first-aid

Conclusion of The Chapter

Field work had wide range of hazards includes, highly contaminated water, dangerous sampling location, and high possibility of slipping and personal injury, therefore designing a good monitoring programme is required

Reference

Jamie Bartram and Richard Balance. 1996. **Water Quality Monitoring: A Practical Guide to Design and Implementation of Freshwater Quality Studies and Monitoring Programmes**, CRC Press.