Groundwater quality in coastal Oriental Mindoro: Results from 35 well samples

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Overview

- Analyzed several water quality parameters (pH, electrical conductivity (EC), total dissolved solids (TDS), Chloride (Cl), and temperature) based on 35 well samples collected by local government staff in Oriental Mindoro Province of the Philippines.
- Cl- concentration was calculated using salinity values based on Equation: Sal (ppt) = 0.00180665 Cl (mg/L) (Effler et al., 1986)
- 26% of water samples exhibited higher values EC values than WHO limits (WHO, 2011), implying that consuming the water for long periods of time may pose a serious threat to human health.
- Number of water samples exceeding WHO limits was (from most to least): EC > pH = Cl > TDS > Salinity.
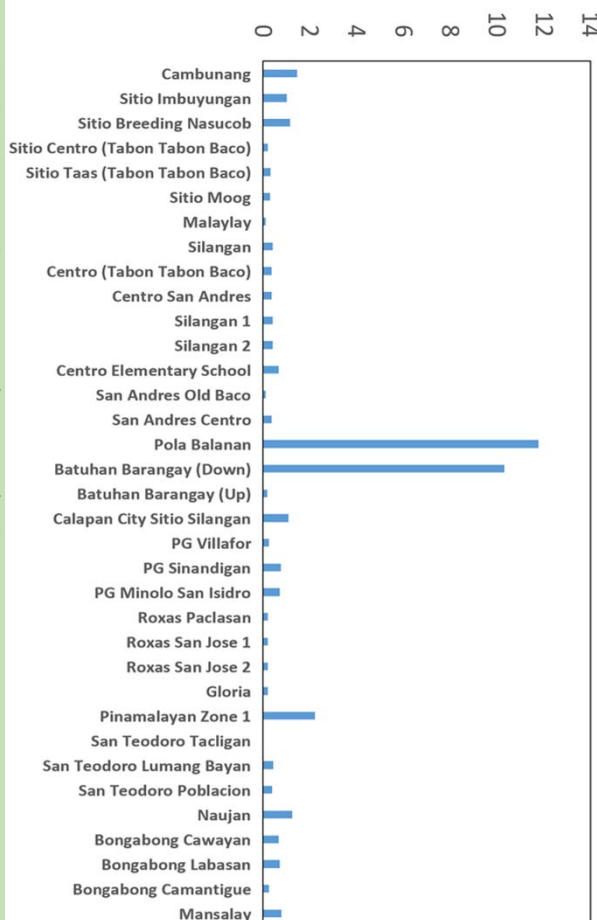

Mindoro Island

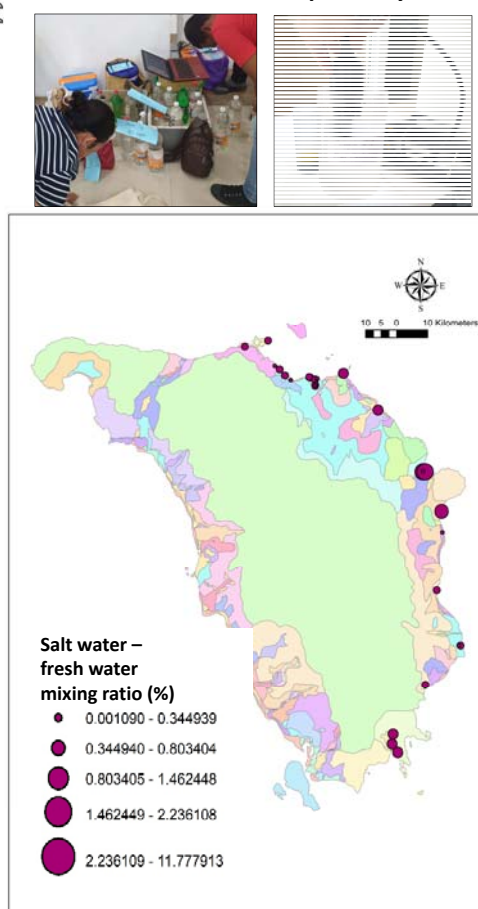| Parameters	Minimum	Maximum	Average	St Dev	WHO permissible limit (WHO, 2011)	% of samples beyond limit	Health effect
pH	6.23	8.76	7.764	0.64	6.5-8.5	23%	Tastes bad, Bitter taste, mucous membrane allergy
DO (mg/L)	2.31	11.5	5.13	2.11			
EC (µs/cm)	129	5140	714	1083	500	26%	Gastro-intestinal irritation
TDS (mg/L)	83.2	4901	587	1014	500	20%	Gastro-intestinal irritation, Not good for people with hypertension, diabetics
Salinity (ppt)	0.06	4.17	0.47	0.87	<1	6%	Salty taste and laxatic effect and not suitable for ecosystem health
Cl (mg/L)	33.21	2308.14	258.09	479.05	200	23%	Salty taste and laxatic effect
Temp (C)	2.3	26	18.6	7.38			
Distance from sea (meter)	34	6220	979	1451.06			
Depth (m)	0	104	37	39.33			

Key Points

- Two samples (from barangays Pola Balanan and Batuhan Barangay (downstream) had very high salinity levels, indicating salt water intrusion.

- Higher groundwater salinization was found for samples located in sandy or sandy loam soil types.

- Chloride was most abundant ion in the water samples. To better decipher hydrological processes (like rock water interaction, ion exchange, sewerage leaching) governing water quality, additional water quality parameters should be measured as a follow-up (Na^+, K^+, Ca^{2+}, Mg^{2+}, NO_3^-, SO_4^{2-} and HCO_3^-).

- Well sample data will be used to develop a contamination transport model for prediction of future groundwater quality under land-use change and climate change scenarios.

Salt water – fresh water mixing ratio (%)

Groundwater sample analysis

Salt water – fresh water mixing ratio (%)
- 0.001090 - 0.344939
- 0.344940 - 0.803404
- 0.803405 - 1.462448
- 1.462449 - 2.236108
- 2.236109 - 11.777913

*Landsat 8 satellite image courtesy of the United States Geologic Survey (USGS). Soil map courtesy of PhilGIS.org

References

1.World Health Organization (WHO) (2011) Guidelines or drinking water quality, 4th edn. World Health Organization, Geneva, p 563

2.Effler, S.W., Schimel, K., Millero, F.J., (1986) Salinity, chloride and density relationship in ion enriched Onondaga lake, NY. Water, air and soil pollution, 27, 169-180.