Data Report 2018 on Inland Aquatic Environment (Draft)

ACAP

Network Center for EANET

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Outline of Inland Aquatic Environment Monitoring in 2018

Country	Location	Name of site	Interval
Cambodia	Kampong Speu province	Sras Srang Lake	-
China	Chongqing	Jinyunshan Lake	4 times/yr.
	Xiamen	Xiaoping Dam	4 times/yr.
	Xi'an	Jiwozi River	4 times/yr.
	Zhuhai	Zhuxiandong Stream	4 times/yr.
Indonesia	Bandung	Petenggang Lake	3 times/yr.
	Skabumi	Gunung Lake	3 times/yr.
Japan	Gifu prefecture	Ijira Lake	4 times/yr.
	Shimane prefecture	Banryu Lake	4 times/yr.
Lao PDR	Vientiane Province	Nam Hum Lake	4 times/yr.
Malaysia	-	Semenyih Dam	-
	Danum Valley	Tembaling river	-
Mongolia	Terelj	Terelj River	5 times/yr.
Philippines	San Pablo City	Pandin Lake	-
	Kabayan, Benguet	Ambulalakaw Lake	-
Russia	Listvyanka	Pereemnaya River	4 times/yr.
	Primorskaya	Komarovka River	5 times/yr.
Thailand	Vachiralongkorn Dam	Ban Pong Chang	4 times/yr.
		Ban Pang Pueng	4 times/yr.
Vietnam	Hoa Binh Province	Hoa Binh Reservoir	4 times/yr.

See Table 6.2

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Mandatory parameters

Frequency	Mandatory parameters
4times/year	water temperature(W.T.), pH, electric conductivity (EC) , Alkalinity, SO_4^{2-}, NO_3^-, Cl^-, NH_4^+, Na^+, K^+, Ca^{2+}, Mg^{2+}
Once/year	transparency, water color, DOC(if impossible, COD), NO_2^-, PO_4^{3-}

- It is expected that some additional items (*i.e.* Chlorophyll a, T-P, T-N, DO) will be adopted according to the new manual (to be mentioned later.)

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Sample collection

- Surface water was sampled at the center(or representative point) of the lakes or rivers in two bottles (for double measurement).
- As reference data, measurements of pH and electric conductivity(EC) were conducted at the site before a precise measurement in the laboratory.
- Water samples for analysis were put in tightly stoppered polyethylene (polypropylene) bottles and kept in a cool and dark place.

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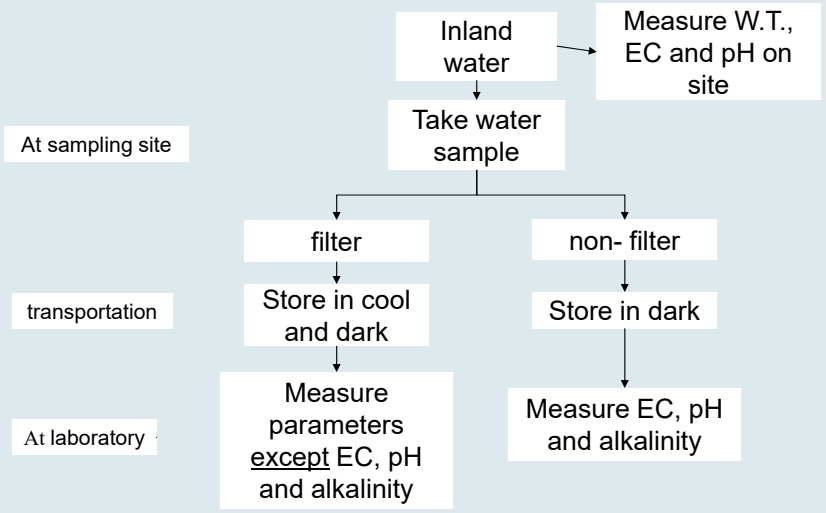
Treatment procedure of sample



See Fig.6.1

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Results(1); Annual mean values of major ions (1)

See Table 6.4(11)

			Mandatory Parameters : 4 times/year											
Country	Location	Site	pH	EC (mS/m)	Alkalinity (meq/L)	Gran's ANC (meq/L)	SO_4^{2-} (mg/L)	NO_3^- (mg/L)	Cl^- (mg/L)	NH_4^+ (mg/L)	Na^+ (mg/L)	K^+ (mg/L)	Ca^{2+} (mg/L)	Mg^{2+} (mg/L)
Cambodia	Kampong Speu province	Sras Srang Lake	-	-	-	-	-	-	-	-	-	-	-	-
China	Chongqing	Jinyunshan Lake	6.74	11.0	0.22	-	26.0	7.2	2.28	0.62	2.48	1.81	10.0	3.00
	Xiamen	Xiaoping Dam	7.31	5.68	0.29	-	2.17	2.53	2.32	0.29	3.99	2.19	3.54	0.57
	Xi'an	Jiwozi River	6.95	6.33	0.33	-	8.59	0.77	1.20	0.02	1.81	0.85	7.62	1.48
	Zhuhai	Zhuxiandong Stream	7.19	8.6	0.63	-	2.11	2.11	5.8	0.03	7.6	1.38	6.0	2.25
Indonesia	Bandung	Patengang Lake*3	7.81	6.39	0.46	-	6.11	0.787	2.22	0.02	3.57	1.32	6.57	1.82
	Sukabumi, West Java	Gunung Lake*3	6.99	4.87	0.49	-	0.84	0.153	1.12	0.03	2.35	0.65	6.31	1.61
Japan	Gifu pref.	Ijira Lake (Center, surface)	6.95	3.59	0.16	0.14	4.54	0.741	1.87	<0.01*1	1.82	0.26	2.75	1.16
	Shimane pref.	Banryu Lake (Center, surface)	6.92	9.64	0.19	0.15	3.97	0.087	21.3	<0.05*1	12.7	1.78	1.59	1.70
Lao PDR	Vientiane province	Nam Hum Lake	7.43	4.11	0.390	-	2.26	0.41	0.40	-	-	-	-	-

note
- : Items were not analyzed.
*1: Less than determination/detection limit.
*2: Surveyed three times a year.

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Results(1); Annual mean values of major ions (2)

See Table 6.4(11)

			Mandatory Parameters : 4 times/year											
Country	Location	Site	pH	EC (mS/m)	Alkalinity (meq/L)	Gran's ANC (meq/L)	SO_4^{2-} (mg/L)	NO_3^- (mg/L)	Cl^- (mg/L)	NH_4^+ (mg/L)	Na^+ (mg/L)	K^+ (mg/L)	Ca^{2+} (mg/L)	Mg^{2+} (mg/L)
Malaysia	Selangor	Semenyih Dam	-	-	-	-	-	-	-	-	-	-	-	-
	Sabah	Tembaling river	-	-	-	-	-	-	-	-	-	-	-	-
Mongolia	Terelj	Terelj River*1	6.79	4.38	0.28	-	3.52	0.83	0.30	0.00	1.90	0.43	5.72	0.70
Philippines	San Pablo City	Pandin Lake	-	-	-	-	-	-	-	-	-	-	-	-
	Benguet	Ambulalakaw Lake	-	-	-	-	-	-	-	-	-	-	-	-
Russia	Southern Baikal	Pereemnaya River	6.68	4.30	0.11	-	11.2	0.74	0.25	0.01	1.06	0.59	4.43	0.80
	Primorskaya	Komarovka River*1	6.98	8.50	0.38	-	12.8	3.72	2.25	0.08	4.06	1.02	9.2	2.54
Thailand	Kanchanaburi Province	Vajiralongkorn Dam (Ban Pong Chang)	7.88	12.4	1.13	-	1.11	0.10	0.95	0.01	1.23	1.04	17.2	3.16
		Vajiralongkorn Dam (Ban Pang Pueng)	7.99	11.4	1.11	-	1.29	0.10	0.89	0.01	1.21	1.03	16.9	2.69
Vietnam	Hoa Binh Province	Hoa Binh Reservoir	7.81	16.3	1.32	-	4.54	2.13	4.15	0.16	5.82	1.60	18.3	4.56

note
- : Items were not analyzed.
*1: Surveyed five times a year.

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Results (2)

- Almost all the participating countries measured mandatory parameters whose frequency is 4 times/year completely.
- Participating countries should also make efforts to submit some additional data (transparency, water color, PO_4^{3-}, NO_2^-, DOC or COD), since the frequency is just once/year.
- The data in some lakes were out of the allowable range of R_1 and/or R_2. However, the cause has not been identified.

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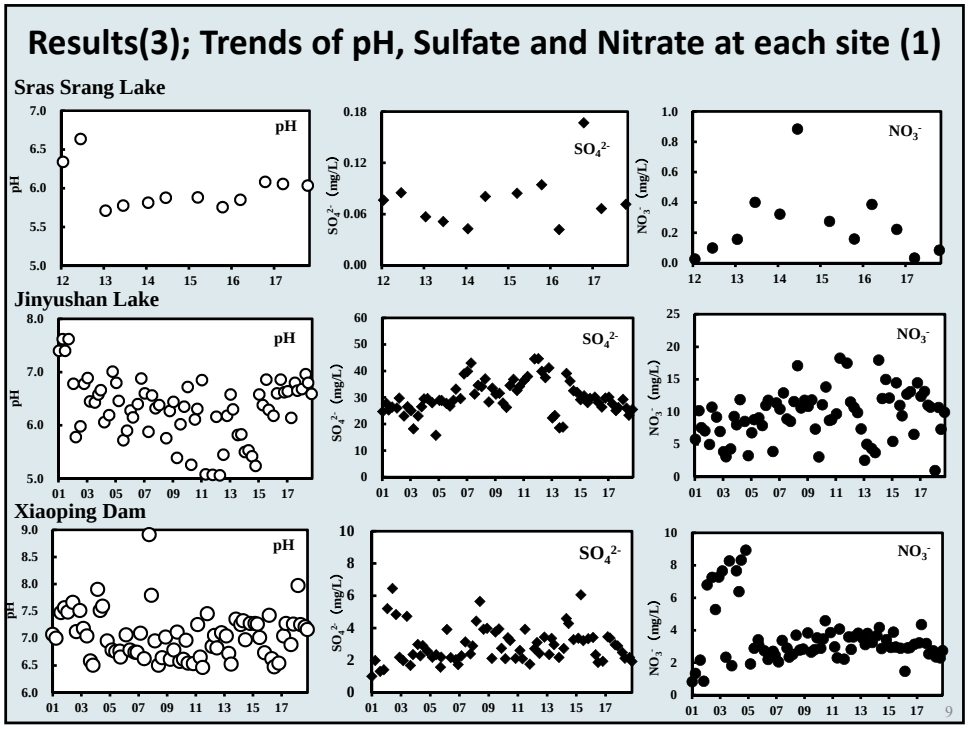
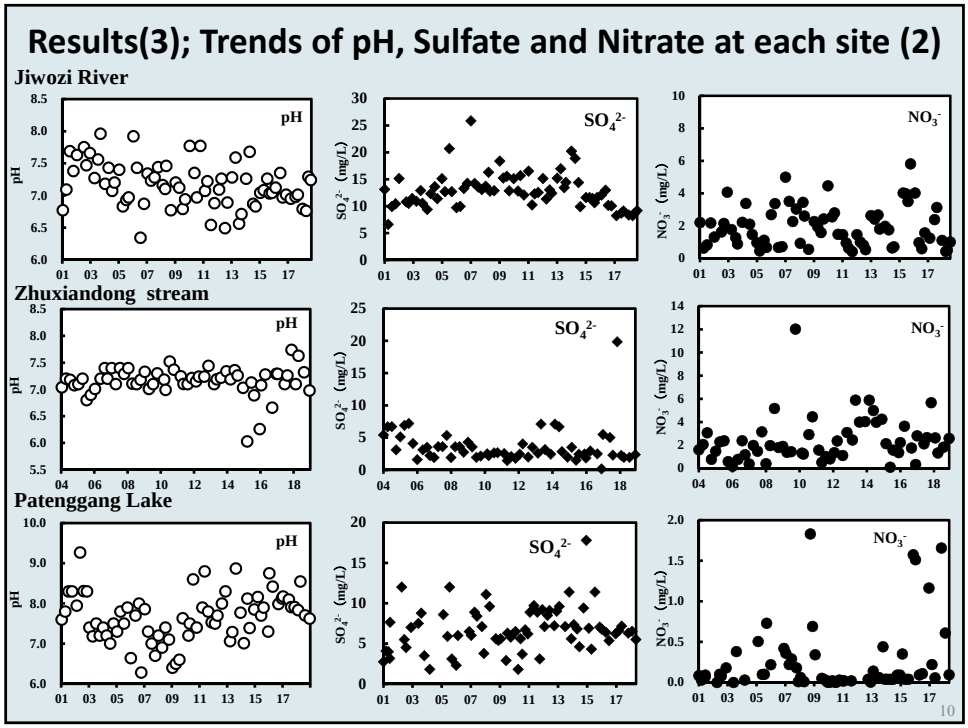
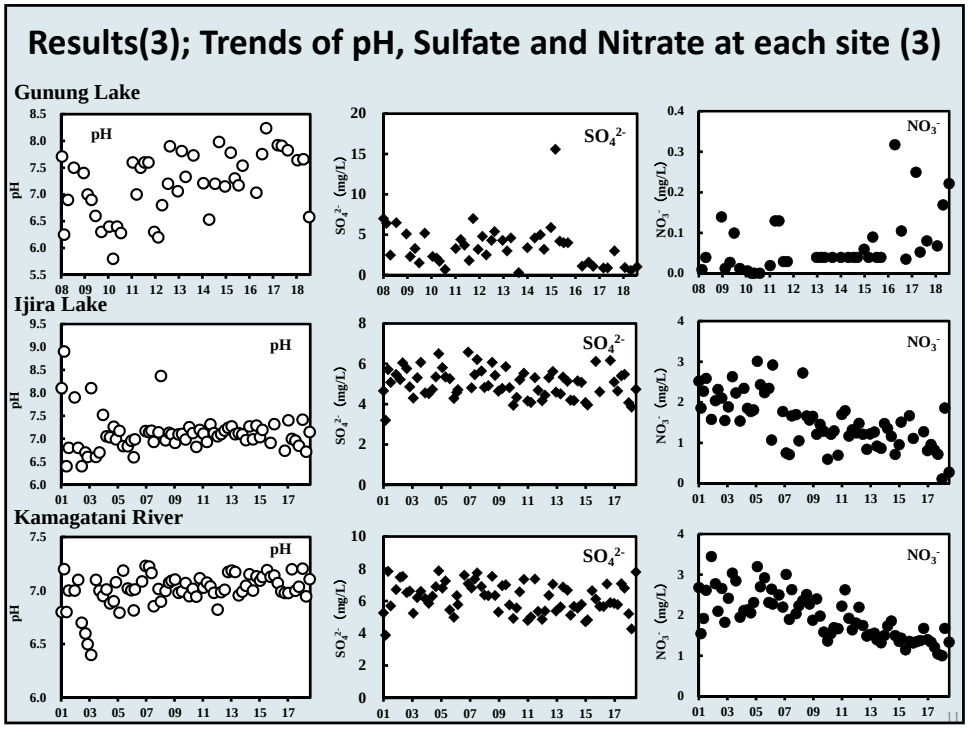
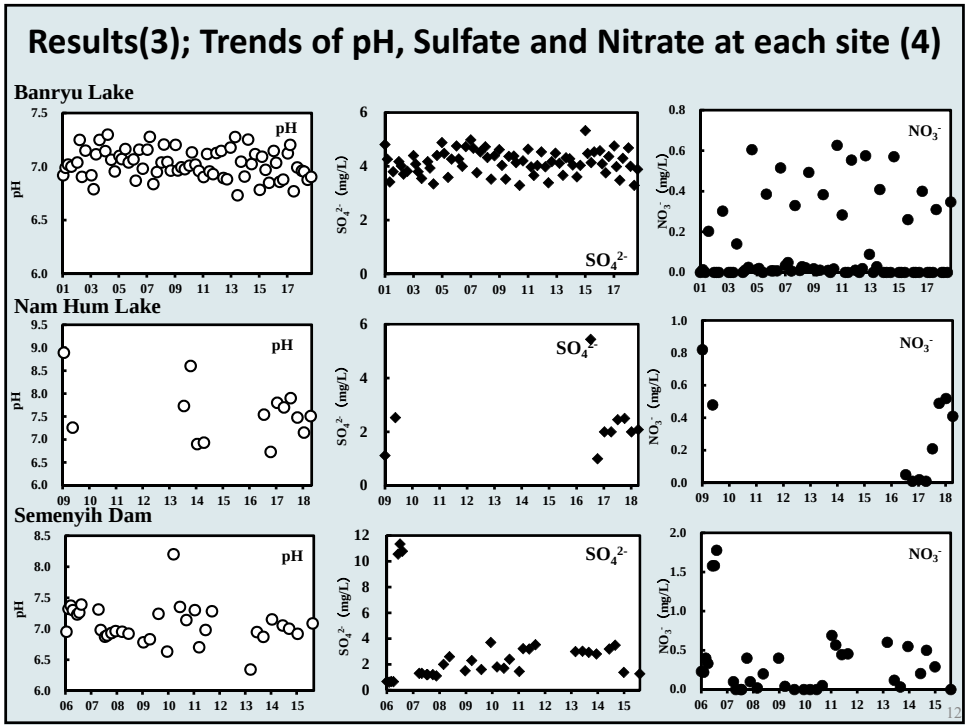
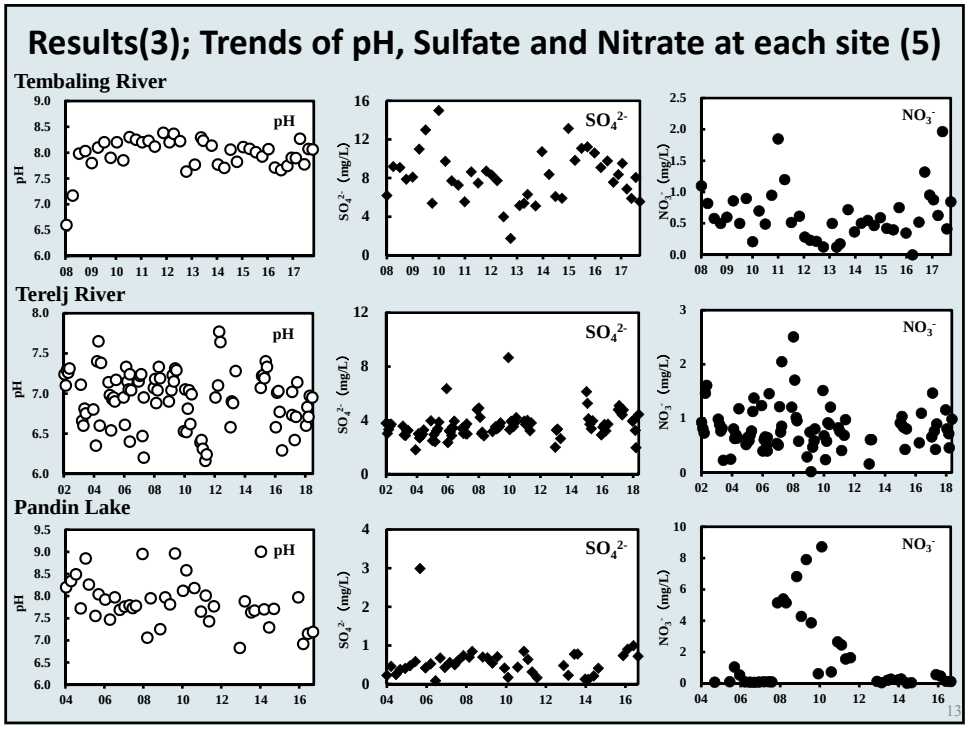
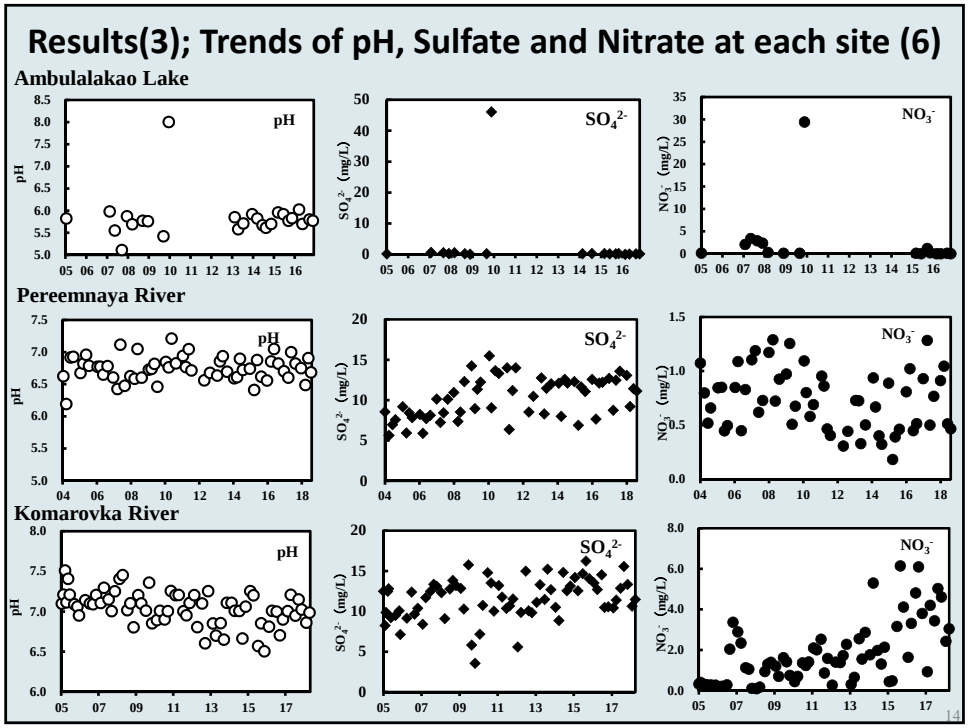

Results(3); Trends of pH, Sulfate and Nitrate at each site (1)
Sras Srang Lake
Jinyushan Lake
Xiaoping Dam
pH
SO4 2- (mg/L)
NO3- (mg/L)
9


Results(3); Trends of pH, Sulfate and Nitrate at each site (2)
Jiwozi River
Zhuxiandong stream
Patenggang Lake
pH
SO4 2- (mg/L)
NO3- (mg/L)
10

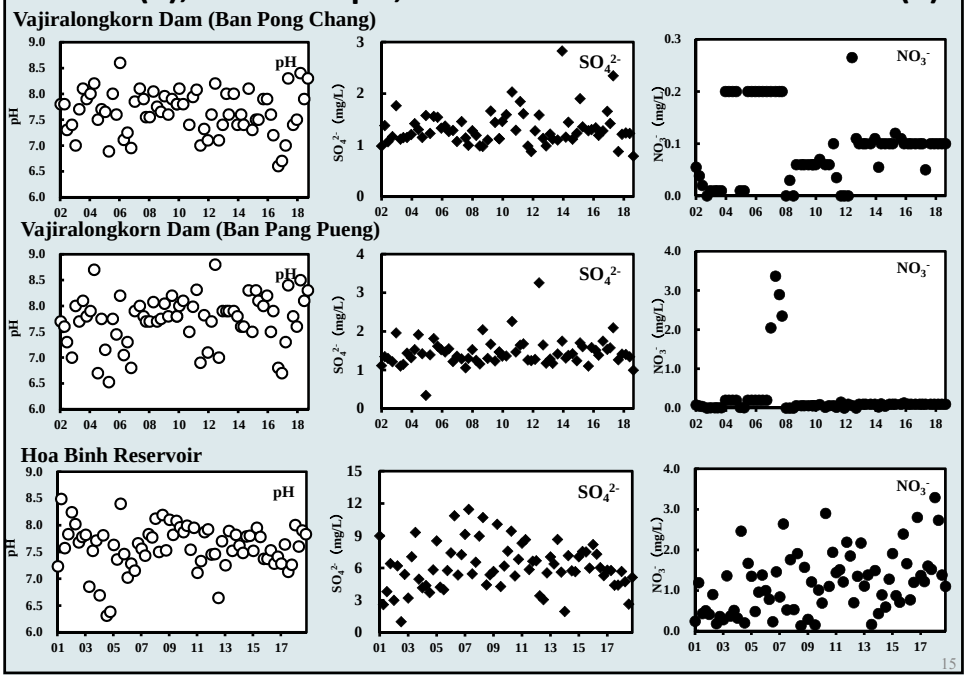

Results(3); Trends of pH, Sulfate and Nitrate at each site (3)
Gunung Lake
Ijira Lake
Kamagatani River
pH
SO_4^{2-} (mg/L)
NO_3^- (mg/L)
11


Results(3); Trends of pH, Sulfate and Nitrate at each site (4)
Banryu Lake
Nam Hum Lake
Semenyih Dam
pH
SO_4^{2-} (mg/L)
NO_3^- (mg/L)
12


Results(3); Trends of pH, Sulfate and Nitrate at each site (5)
Tembaling River
Terelj River
Pandin Lake
pH
SO4 2- (mg/L)
NO3- (mg/L)
13


Results(3); Trends of pH, Sulfate and Nitrate at each site (6)
Ambulalakao Lake
Pereemnaya River
Komarovka River
pH
SO4 2- (mg/L)
NO3- (mg/L)
14

Results(3); Trends of pH, Sulfate and Nitrate at each site (7)



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Note

- All the participating countries should submit the information on property of lakes or rivers to NC every year. For example, the information of rain amount is important for understanding the monitoring data.
- According to the new technical manual (2010), in addition to the pH 4.8-endpoint method, Gran's titration method should be applied to determination of alkalinity.

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Summary

- **7 countries submitted the data to the NC.**
- **The NC is still waiting for the data from the countries, which have not submitted the data in 2018.**

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Please refer the new manual!

- The new Technical Manual is available on the web!

  The Technical Manual for Inland Aquatic Environment Monitoring – 2010

- Please visit the EANET website! eanet.asia
- Some modifications have been done for measurement parameters and methods, such as alkalinity (Gran's plot titration method).

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Major revised part

1. Rivers and streams can be selected as the monitoring site more freely. Consequently, modification on sampling frequency and measurement parameters was proposed.
2. Clearer criteria on selection of lakes and rivers was described, including size of the catchment, priority among natural lake, rivers/streams, and reservoir/dam, etc.
3. Parallel measurements by the end-point pH 4.8 method and the Gran's Plot titration method were recommended for alkalinity.
4. The reporting forms are included in the same book.

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Table 2.5. Mandatory and optional parameters

Mandatory Parameters	Optional Parameters	Frequency
W.T., pH, EC, Alkalinity, Major cations, Major anions, Transparency*, water color, DOC or TOC, NO_2^- and PO_4^{3-}, Chlorophyll a*, Total P, Total N, DO*, SS**	Hydrological flow**, Total dissolved Al, Reactive Al (if total dissolved Al > 200 µg L^{-1}), COD, Phytoplankton (diatom species)* Epilithic algae (diatom species)**	4 times a year for lakes Every one or two month(s) for rivers
Sediment (SO_4^{2-}, NO_3^- and NH_4^+ in pore water)*	Other living organisms, Sediment (Pb, Pb-210 and stable isotope of S)*	Once 3-5 years

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Table 2.2 Recommended criteria for site selection

Recommendation items	Lakes	Rivers (streams)
Alkalinity	less than 200 μeq L^{-1}	
EC	less than 10 mS m^{-1}	
Trophic level	oligotrophic	-
BOD (COD), TOC	low	
Retention time	Less than 1 year	-
Depth	Less than 10 m (max)	Less than 2 m (cross-sectional mean)
Discharge	-	< 5 m^3 s^{-1}
Water area	1~100 ha	-
Surface situation	No coverage of aquatic plants	
Human activities	No or minimal	

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Parallel measurements of alkalinity

- Various methods for alkalinity
  - EANET: End point 4.8
  - ICP Waters (CLRTAP in Europe): (lab No. in inter-lab 2010)
    - Gran's Plot titration (20)
    - Two end point (4.5 and 4.2) (12)
    - End point 5.4 (3)
    - Other end points (8)
- For international comparability, Gran's Plot titration (Gran plot, Gran titration, or Gran's ANC) should also be considered as an additional parameter for alkalinity.

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Definition of ANC

- Acid Neutralizing Capacity (ANC) = $\Sigma C_B - \Sigma C_A$ (1)

where

$\Sigma C_B = Na^+ + K^+ + NH_4^+ + Ca^{2+} + Mg^{2+} + Al^{n+} + Mn^{2+} + Fe^{3+}$ (2)

$\Sigma C_A = F^- + Cl^- + NO^{3-} + SO_4^{2-}$ (3)

In clear surface water, in which organic acid anion contributes little to ANC,

- $\Sigma C_B + H^+ = \Sigma C_A + HCO_3^-$ (4)

Based on the equations (1) and (4), ANC can be expressed as,

- $ANC = HCO_3^- - H^+$

Since end-point 4.8 alkalinity was considered as HCO_3^-,

Gran's ANC = end-point 4.8 alkalinity − H^+

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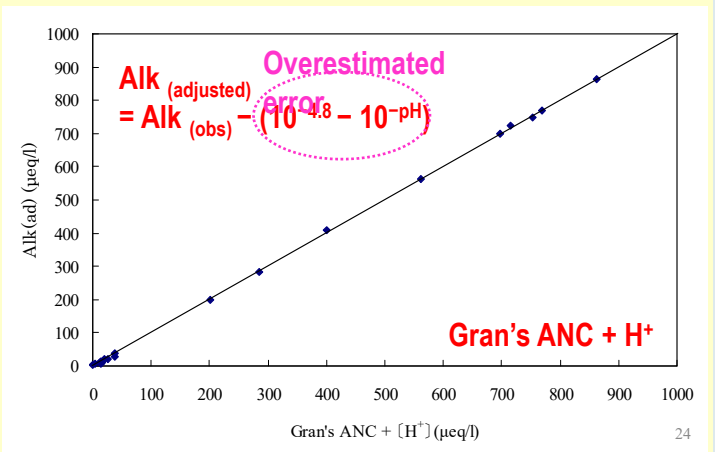
Gran's ANC vs. end-point 4.8

- Inner error of the end-point 4.8 method

The 1 L pure water (pH 7.0) is titrated to pH 4.8 by acids,

$10^{-4.8} - 10^{-7.0} = 15.7 \times 10^{-6}$ (mole) = 15.7 (μeq)



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Criteria for site selection

- It is recommended that harmonic lakes which are considered to be potentially susceptible to acidification should be selected.
- If there are no appropriate lakes in an area, rivers/streams that are potentially susceptible to acidification should be selected, where a minimum pollution of human activities in the upper stream area.