Transboundary Waters Assessment Programme (TWAP)

Washington, D.C. July 11-13, 2016

Transboundary Lakes and Reservoirs

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Transboundary Lakes Presentation

I. Key Messages from Lakes Assessment

--- including Lakes and Ecosystem Service

II. Transboundary Lakes and Basins

--- including Lake and Reservoir Degradation Factors

III. Lake Threats and Risks

--- including transboundary lake threat scores

IV. TWAP Lake Lessons learned

--- including summary analysis of SDGs and lakes/lentic water systems

CONCLUDING REMARKS related to

--- 'Effective Identification & Remediation of Institutional, Policy, Adequacy, and Magnitude of Transboundary Lake Threats Using ILBM'

I. Key Messages from Lakes Assessment

- Lakes & other lentic (standing) water systems: Contain >90% of liquid freshwater on Earth's surface; provide widest range of water-based ecosystem goods and services;
- Large water volumes, long flushing times & integrating nature → Incremental, unpredictable non-linear responses to environmental stresses, complicating accurate assessment;
- Drainage basin characteristics and specific assumptions → African lakes as a group exhibited greatest Adjusted Human Water Security (Adj-HWS) and Reverse Biodiversity (Rv BD) threats, followed by lakes in Asia and South America;
- Developing country lakes → Lesser threats based on Incident HWS & Biodiversity (BD).

- Lake/reservoir management often subsumed under river basin concerns → Not realistically considering capacity to buffer basin-derived environmental stresses, or interactions with upstream/downstream water systems; Buffering capacity → mask upstream basin degradation;
- Accurate ranking of lake threats: Detailed case-by-case assessment, considering full range of interlinked scientific/governance factors; also funding levels far beyond scope of TWAP assessment.

Lakes and Ecosystem Services

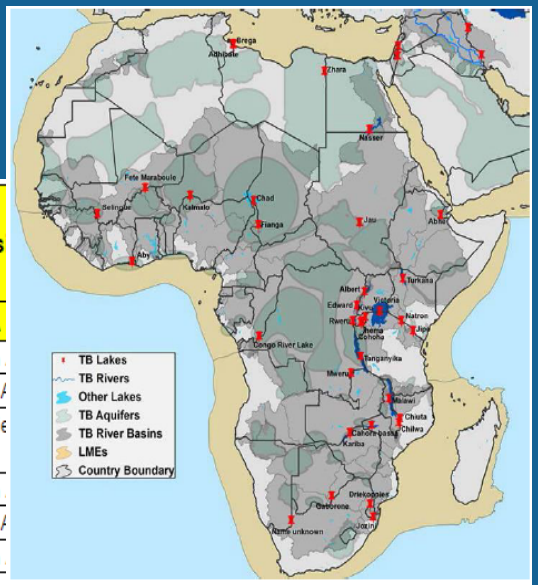
Lakes and other lentic water systems provide widest range of ecosystem services directly/indirectly related to human livelihoods, health and well-being , including:

- Resource Provision Services -- *Drinking water supply, agricultural irrigation, fisheries, recreation, transportation, hydropower generation;*
- Regulating Services -- *Flood and drought mitigation, self-purification, climate mediation, shoreline ecotone buffering, diverse food-chains;*
- Cultural Services -- *Aesthetics, spiritual, anthropogenic and historical values;*

II. Transboundary Lakes and Basins

- 1,600 transboundary lakes/reservoirs around world → final study list of 206 candidates: Africa -34; Asia region – 52; Latin America – 30; European region -70; North America – 20;

- Lake area, basin population, temperature preconditions → reduced list of 53 priority transboundary lakes for detailed scenario analysis: Africa -23; Asia region – 8; Latin America – 6; European region – 9; North America - 7



(a) African Transboundary Lakes

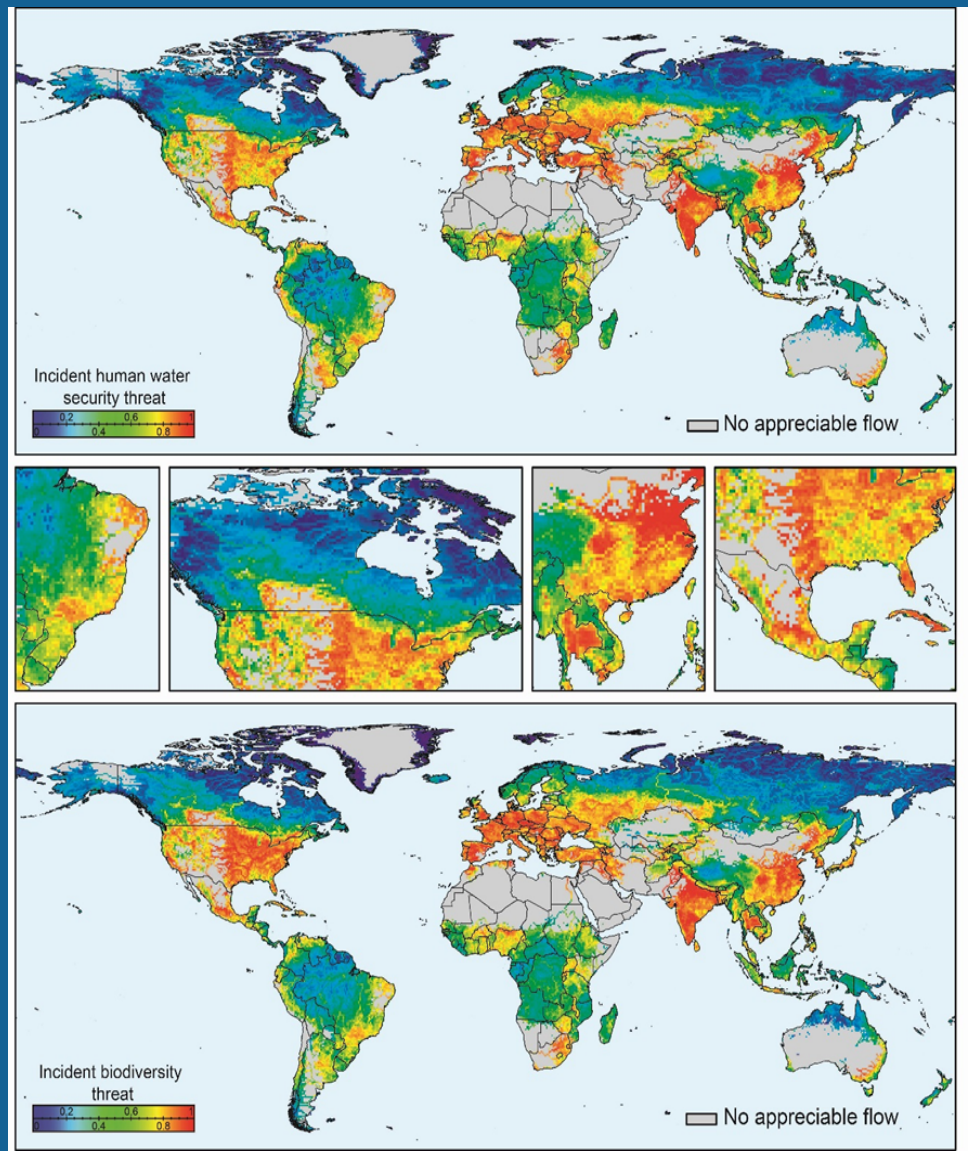
Waterbody Name	TWAP Regional Des		
	AFRICA		
Abbe/Abhe	Eastern & Southern		
Aby	Western & Middle A		
Albert	Eastern & Southern Africa; We Africa		
Cahora Bassa	Eastern & Southern		
Chad	Western & Middle A		
Chilwa	Eastern & Southern		
Chiuta	Eastern & Southern		
Cohoha	Eastern & Southern		
Edward	Eastern & Southern Africa	L	Nile
Ihema	Eastern & Southern Africa	L	Nile
Josini/Pongolapoort Dam	Eastern & Southern Africa	R	Maputo
Kariba	Eastern & Southern Africa	R	Zambezi
Kivu	Eastern & Southern Africa; Western & Middle Africa	R	Ruizizi
Lake Congo River	Western & Middle Africa	L	Congo
Malawi/Nyasa	Eastern & Southern Africa	L	Zambezi
Mweru	Eastern & Southern Africa; Western & Middle Africa	L	Congo
Nasser/Aswan	Northern Africa & Western Asia	R	Nile
Natron/Magadi	Eastern & Southern Africa	L	Southern Ewaso Ng'iro
Rweru/Moero	Eastern & Southern Africa	L	Nile
Selingue	Western & Middle Africa	R	Nile
Tanganyika	Eastern & Southern Africa; Western & Middle Africa	L	Congo
Turkana	Eastern & Southern Africa	L	Turkana (endorheic)
Victoria	Eastern & Southern Africa	L	Nile

Lake and Reservoir Degradation Factors

- Serious lack of uniform, global-scale in-lake data for most transboundary lakes → Lake threats analyzed on basis of drainage basin characteristics (not in-lake conditions);

- Also does does not account for lake capacity to buffer basin-derived stresses;

- Data for analyzing lake threat ranks adapted from global overview of river basin-derived Human Water Security and Biodiversity threats



III. LAKE THREATS AND RISKS

- Based on indicators translated into contextually-determined scores;
- Transboundary lake risks: Incident Water Security (HWS) and Biodiversity (BD) threats; 'Adjusted' Water Security (Adj-HWS) threats; 'Reverse Biodiversity' (RvBD) threats; Human Development Index (HDI) status (latter three most relevant);
- HWS & BD: '*Snapshot' of threats based on drainage basin characteristics*;
- Adj-HWS: *Considers country capacity to invest in water programs to address problems;*
- RvBD: *Surrogate to identify most sensitive (pristine) ecosystems to environmental degradation (merit more attention than already-degraded ecosystems);*
- HDI: *UN statistic to gauge country life expectancy, education level & economic status*

Transboundary Lakes Ranked on Basis of (A) Adjusted Human Water Security (Adj-HWS) Threats, (B) Reverse Biodiversity (RvBD) Threats, and (C) Human Development Index (HCI) Scores

(Cont., continent; Eur, Europe; N.Am, North America; Afr., Africa; S.Am, South America;
Estimated risks: red – highest; orange – moderately high; yellow – medium; green – moderately low; blue – low)

(A) Lakes Ranked on Basis of Adjusted Human Water Security (Adj-HWS) Threats

Lake	Cont.	Surface Area (km^2)	Adj-HWS Threat Score	Rank
Sistan	Asia	488.2	0.98	1
Ihema	Afr.	93.2	0.97	2
Azuei	S.Am	117.3	0.96	3
Rweru/Moero	Afr.	125.6	0.96	4
Cohoha	Afr.	64.8	0.96	5
Edward	Afr.	2232.0	0.94	6
Natron/Magadi	Afr.	560.4	0.93	7
Abbe/Abhe	Afr.	310.6	0.93	8
Victoria	Afr.	66841.5	0.91	9
Albert	Afr.	5502.3	0.91	10
Kivu	Afr.	2371.1	0.91	11
Malawi/Nyasa	Afr.	29429.2	0.91	12
Dead Sea	Eur	642.7	0.90	13
Turkana	Afr.	7439.2	0.90	14
Aras Su Qovsaginin Su Anbari	Asia	52.1	0.89	15
Mangla	Asia	85.4	0.87	16
Galilee	Eur	162.0	0.87	17
Darbandikhan	Asia	114.3	0.87	18
Selingue	Afr.	334.4	0.87	19
Shardara/Kara-Kul	Asia	746.1	0.86	20
Nasser/Aswan	Afr.	5362.7	0.86	21
Chilwa	Afr.	1084.2	0.86	22
Josini/Pongola-poort Dam	Afr.	128.6	0.85	23

(B) Lakes Ranked on Basis of Reverse Biodiversity (RvBD) Threats

Lake	Cont.	Surface area (km^2)	RvBD Threat Score	Rank
Lake Congo River	Afr.	306.0	0.80	1
Sarygamysh	Asia	3777.7	0.75	2
Chiuta	Afr.	143.3	0.74	3
Mweru	Afr.	5021.5	0.72	4
Aral Sea	Asia	23919.3	0.72	5
Tanganyika	Afr.	32685.5	0.71	6
Abbe/Abhe	Afr.	310.6	0.71	7
Titicaca	S.Am	7480.0	0.71	8
Chilwa	Afr.	1084.2	0.70	9
Salto Grande	S.Am	532.9	0.70	10
Turkana	Afr.	7439.2	0.70	11
Cahora Bassa	Afr.	4347.4	0.69	12
Chungarkkota	S.Am	52.6	0.69	13
Malawi/Nyasa	Afr.	29429.2	0.68	14
Nasser/Aswan	Afr.	5362.7	0.68	15
Selingue	Afr.	334.4	0.68	16
Kivu	Afr.	2371.1	0.67	17
Natron/Magadi	Afr.	560.4	0.67	18
Lago de Yacyreta	S.Am	1109.4	0.66	19
Kariba	Afr.	5258.6	0.66	20
Edward	Afr.	2232.0	0.65	21
Aby	Afr.	438.8	0.65	22
Chad	Afr.	1294.6	0.64	23

(C) Lakes Ranked on Basis of Human Development Index (HDI) Scores

Lake	Cont.	Surface area (km^2)	HDI Score	Rank
Lake Congo River	Afr	306.0	0.34	1
Selingue	Afr	334.4	0.36	2
Rweru/Moero	Afr	125.6	0.36	3
Cohoha	Afr	64.8	0.38	4
Kivu	Afr	2371.1	0.38	5
Mweru	Afr	5021.5	0.38	6
Abbe/Abhe	Afr	310.6	0.40	7
Tanganyika	Afr	32685.5	0.40	8
Turkana	Afr	7439.2	0.41	9
Chiuta	Afr	143.3	0.41	10
Chilwa	Afr	1084.2	0.41	11
Malawi/Nyasa	Afr	29429.2	0.42	12
Edward	Afr	2232.0	0.43	13
Nasser/Aswan	Afr	5362.7	0.43	14
Cahora Bassa	Afr	4347.4	0.43	15
Chad	Afr	1294.6	0.43	16
Kariba	Afr	5358.6	0.43	17
Ihema	Afr	93.2	0.44	18
Sistan	Asia	488.2	0.46	19
Albert	Afr	5502.3	0.46	20
Azuei	S.Am,	117.3	0.46	21
Victoria	Afr	66841.5	0.47	22
Natron/Magadi	Afr	560.4	0.51	23

TRANSBOUNDARY LAKE THREAT SCORES

- Top dozen TB lakes exhibiting greatest Incident HWS threats = *5 European, 4 Asian, 2 North American, 1 African lake* vs.
- Top dozen TB lakes exhibiting greatest Adj-HWS threats = *10 African, 1 Asian, 1 South American;*

- Top dozen TB lakes exhibiting greatest Incident BD threats = *5 European, 4 North American, 3 Asian lakes*

vs.

- Top dozen TB lakes exhibiting greatest RvBD threats = *8 African, 2 Asian, 2 South American*

Chiuta	Afr.	143.3	0.85	24	Albert	Afr.	5502.3	0.63	24	Aby	Afr	438.8	0.52	24
Chad	Afr.	1294.6	0.84	25	Sistan	Asia	488.2	0.62	25	Mangla	Asia	85.4	0.54	25
Aral Sea	Asia	23919.3	0.84	26	Amistad	N.Am	131.3	0.61	26	Aral Sea		23919.3	0.60	26
Tanganyika	Afr.	32685.5	0.84	27	Caspian Sea	Asia	377543.2	0.60	27	Josini/Pongola-poort Dam	Afr	128.6	0.61	27
Aby	Afr.	438.8	0.83	28	Cohoha	Afr.	64.8	059	28	Shardara/Kara-kul	Asia	746.1	0.65	28
Cahul	Eur	89.0	0.82	29	Itaipu	S.Am	1154.1	0.58	29	Sarygamysh	Asia	3777.7	0.67	29
Chungarkkota	S.Am	52.6	0.82	30	Rweru/Moero	Afr.	125.6	0.58	30	Darbandikhan	Asia	114.3	0.68	30
Titicaca	S.Am	7480.0	0.82	31	Azuei	S.Am	117.3	0.57	31	Cahul	Eur	89.0	0.69	31
Sarygamysh	Asia	3777.7	0.82	32	Ihema	Afr.	93.2	0.56	32	Titicaca	S.Am	7480.0	0.71	32
Mweru	Afr.	5021.5	0.81	33	Victoria	Afr.	66841.5	0.56	33	Chungarkkota	S.Am	52.6	0.71	33
Cahora Bassa	Afr.	4347.4	0.78	34	Scutari/Skadar	Eur	381.5	0.55	34	Dead Sea	Eur	642.7	0.72	34
Itaipu	S.Am	1154.1	0.75	35	Shardara/Kara-Kul	Asia	746.1	0.54	35	Lago de Yacyreta	S.Am	1109.4	0.73	35
Kariba	Afr.	5258.6	0.75	36	Huron	N.Am	60565.2	0.53	36	Aras Su Qovsaginin Su Anbari	Asia	52.1	0.73	36
Lago de Yacyreta	S.Am	1109.4	0.75	37	Josini/Pongola-poort Dam	Afr.	128.6	0.52	37	Itaipu	S.Am	1154.1	0.73	37
Lake Congo River	Afr.	306.0	0.75	38	Champlain	N.Am	1098.9	0.51	38	Salto Grande	S.Am	532.9	0.74	38
Caspian Sea	Asia	377543.2	0.73	39	Ohrid	Eur	354.3	0.51	39	Ohrid	Eur	354.3	0.74	39
Salto Grande	S.Am	532.9	0.67	40	Macro Prespa	Eur	263.0	0.51	40	Macro Prespa	Eur	263.0	0.75	40
Scutari/Skadar	Eur	381.5	0.62	41	Dead Sea	Eur	642.7	0.51	41	Caspian Sea	Asia	377543.2	0.77	41
Neusiedler/Ferto	Eur	141.9	0.58	42	Maggiore	Eur	211.4	0.49	42	Scutari/Skadar	Eur	381.5	0.78	42
Szczecin Lagoon	Eur	822.4	0.53	43	Szczecin Lagoon	Eur	822.4	0.49	43	Szczecin Lagoon	Eur	822.4	0.83	43
Erie	N.Am	26560.8	0.51	44	Ontario	N.Am	19062.2	0.47	44	Falcon	N.Am	120.6	0.85	44
Macro Prespa)	Eur	263.0	0.51	45	Aras Su Qovsaginin Su Anbari	Asia	52.1	0.47	45	Amistad	N.Am	131.3	0.86	45
Falcon	N.Am	120.6	0.50	46	Darbandikhan	Asia	114.3	0.46	46	Galilee	Eur	162.0	0.88	46
Amistad	N.Am	131.3	0.49	47	Galilee	Eur	162.0	0.45	47	Neusiedler/Ferto	Eur	141.9	0.88	47
Ontario	N.Am	19062.2	0.48	48	Michigan	N.Am	58535.5	0.44	48	Lake Maggiore	Eur	211.4	0.89	48
Ohrid	Eur	354.3	0.47	49	Erie	N.Am	26560.8	0.43	49	Ontario	N.Am	19062.2	0.92	49
Michigan	N.Am	58535.5	0.44	50	Neusiedler/Ferto	Eur	141.9	0.39	50	Huron	N.Am	60565.2	0.93	50
Huron	N.Am	60565.2	0.42	51	Cahul	Eur	89.0	0.39	51	Erie	N.Am	26560.8	0.93	51
Maggiore	Eur	211.4	0.33	52	Mangla	Asia	85.4	0.38	52	Champlain	N.Am	1098.9	0.94	52
Champlain	N.Am	1098.9	0.29	53	Falcon	N.Am	120.6	0.38	53	Michigan	N.Am	58535.5	0.94	53

Table 2. Transboundary Lake Threat Ranks by Multiple Ranking Criteria

(Cont., continent; Eur, Europe; N.Am, North America; Afr, Africa; S.Am, South America;
Adj-HWS, Adjusted Human Water Security threat; HWS, Incident Human Water Security threat; BD, Incident Biodiversity threat;
HDI, Human Development Index, RvBD, surrogate for 'Adjusted' Biodiversity threat;
Estimated risks: Red – highest; Orange – moderately high; Yellow – medium; Green – moderately low; Blue – low)

Cont.	Lake Name	Adj-HWS	HWS	BD	HDI	Adj-HWS Rank	HDI Rank	RvBD Rank	Sum Adj HWS + RvBD	Overall Rank	Sum Adj HWS + HDI	Overall Rank	Sum Adj-HWS + RvBD + HDI	Overall Rank
Afr	Abbe/Abhe	0.93	0.31	0.29	0.40	7	7	7	14	1	14	3	21	1
Afr	Turkana	0.90	0.33	0.30	0.41	13	10	9	22	2	23	10	32	2
Afr	Selingue	0.87	0.30	0.32	0.36	16	2	15	31	11	18	5	33	3
Afr	Malawi/Nyasa	0.91	0.29	0.32	0.42	9	12	14	23	3	21	9	35	4
Afr	Chiuta	0.85	0.25	0.26	0.41	23	9	3	26	5	32	15	35	4
Afr	Cohoha	0.96	0.39	0.41	0.38	3	4	28	31	2	7	1	35	4
Afr	Kivu	0.91	0.31	0.33	0.38	12	6	18	30	8	18	4	36	7
Afr	Rweru/Moero	0.96	0.40	0.42	0.36	4	3	30	34	16	7	2	37	8
Afr	Lake Congo River	0.75	0.20	0.22	0.34	35	1	1	36	18	36	19	37	8
Afr	Tanganyika	0.84	0.25	0.29	0.40	26	8	6	32	14	34	17	40	10
Afr	Edward	0.94	0.34	0.35	0.43	6	13	22	28	7	19	6	41	11
Afr	Chilwa	0.86	0.28	0.30	0.41	21	11	10	31	10	32	14	42	12
Afr	Mweru	0.81	0.24	0.28	0.38	33	5	4	37	21	38	20	42	12
Asia	Sistan	0.98	0.41	0.38	0.46	1	20	25	26	6	21	8	46	14
Afr	Natron/Magad	0.93	0.36	0.33	0.51	8	23	17	25	4	31	13	48	15
Afr	Nasser/Aswan	0.86	0.29	0.32	0.43	20	16	16	36	19	36	18	52	16
Afr	Albert	0.91	0.35	0.37	0.46	10	19	24	34	15	29	12	53	17
Afr	Ihema	0.97	0.41	0.44	0.44	2	18	33	35	17	20	7	53	17
S.Am,	Azuei	0.96	0.50	0.43	0.46	5	21	31	36	20	26	11	57	19
	Aral Sea	0.84	0.29	0.38	0.60	27	26	5	32	13	31	31	58	20
Asia	Sarygamysh	0.82	0.26	0.25	0.67	29	29	2	31	9	32	32	60	21
Afr	Cahora Bassa	0.78	0.29	0.31	0.43	34	15	13	47	25	25	25	62	22
Afr	Victoria	0.91	0.42	0.44	0.47	11	22	32	43	24	16	16	65	23
Afr	Chad	0.84	0.38	0.36	0.43	25	17	23	48	26	21	21	65	23
Afr	Kariba	0.75	0.33	0.34	0.43	36	14	19	55	30	28	28	69	25

Afr	Aby	0.83	0.65	0.52	28	24	21	49	27	52	30	73	27
S.Am	Chungarkkota	0.82	0.69	0.71	31	33	12	43	23	64	34	76	28
Asia	Shardara/Kara-kul	0.86	0.54	0.65	22	28	35	57	31	50	27	85	29
Eur	Dead Sea	0.90	0.51	0.72	14	34	38	52	29	48	24	86	30
Afr	Josini/Pongola-poort Dam	0.85	0.52	0.61	24	27	37	61	34	51	29	88	31
S.Am	Salto Grande	0.67	0.70	0.74	40	38	11	51	28	78	39	89	32
Asia	Darbandikhan	0.87	0.46	0.68	17	30	46	63	35	47	23	93	33
S.Am	Lago de Yacyreta	0.75	0.66	0.73	38	36	20	58	32	74	38	94	34
Asia	Aras Su Qovsaginin Su Anbari	0.89	0.47	0.73	15	35	44	59	33	50	26	94	34
Asia	Mangla	0.87	0.38	0.54	18	25	53	71	39	43	22	96	36
S.Am	Itaipu	0.75	0.58	0.73	37	37	29	66	37	74	37	103	37
Asia	Caspian Sea	0.73	0.60	0.77	39	41	27	66	36	80	40	107	38
Eur	Galilee	0.87	0.45	0.88	19	46	47	66	38	65	36	112	39
Eur	Cahul	0.82	0.39	0.69	30	31	51	81	42	61	33	112	39
Eur	Scutari/Skadar	0.62	0.55	0.78	41	42	34	75	41	83	41	117	41
N.Am	Amistad	0.49	0.61	0.86	47	45	26	73	40	47	40	118	42
Eur	Macro Prespa (Large Prespa)	0.51	0.51	0.75	44	40	40	84	43	84	42	124	43
Eur	Ohrid	0.47	0.51	0.74	49	39	39	88	46	88	44	127	44
Eur	Szczecin Lagoon	0.53	0.49	0.83	43	43	43	86	44	86	43	129	45
N.Am	Huron	0.42	0.53	0.93	51	50	36	87	45	101	51	137	46
Eur	Neusiedler/Ferto	0.58	0.39	0.88	42	47	50	92	47	89	45	139	47
N.Am	Ontario	0.48	0.47	0.92	48	49	45	93	48	97	49	142	48
Eur	Lake Maggiore	0.33	0.50	0.89	52	48	42	94	50	100	50	142	48
N.Am	Falcon	0.50	0.38	0.85	46	44	52	98	53	90	46	142	48
N.Am	Erie	0.51	0.43	0.93	45	51	49	94	51	96	48	145	51
N.Am	Champlain	0.29	0.51	0.94	53	52	41	94	49	105	53	146	52
N.Am	Michigan	0.44	0.44	0.94	50	53	48	98	52	103	52	151	53

- Lake threat ranks based on specific set of assumptions & preconditions;
- best interpreted on basis of most important factors to users of results (lake managers; decision-makers);
- Different assumptions and preconditions
  → markedly different threat rankings

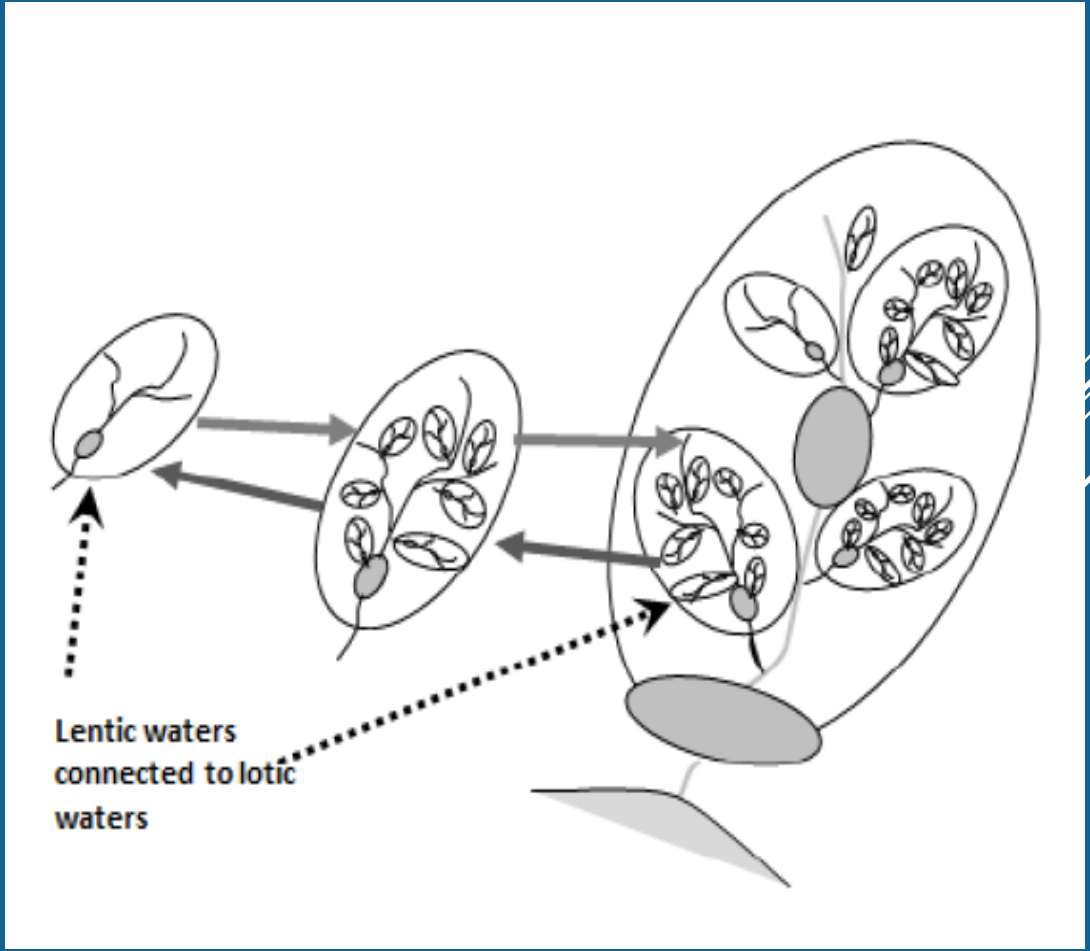
Table 4.5 Lakes Exhibiting Highest Adj-HWS Threat Scores for Different Filtering Criteria

Adjusted HWS (Adj-HWS)	Lake area (km^2)	Population number	Population density (persons km^{-2})	Per-capita Gross National Income (GNI)
AFRICA REGION				
Ihema	Victoria	Nasser/Aswan	Kivu	Rweru/Moero
Rweru/Moero	Tanganyika	Lake Congo River	Cohoha	Cohoha
Cohoha	Malawi/Nyasa	Albert	Rweru/Moero	Chilwa
Edward	Turkana	Victoria	Victoria	Chiuta
Abbe/Abhe	Albert	Chad	Edward	Malawi/Nyasa
ASIA REGION				
Sistan	Caspian Sea	Caspian Sea	Mangla	Mangla
Aras Su Qovsaginin Su Anbari	Aral Sea	Aral Sea	Darbandikhan	Shandara/Kara-kul
Mangla	Sarygamysh	Shandara/Kara-kul	Shandara/Kara-kul	Aral Sea
Darbandikhan	Shandara/Kara-kul	Mangla	Aras Su Qovsaginin Su Anbari	Sistan
Shardara/Kara-kul	Sistan	Aras Su Qovsaginin Su Anbari	Aral Sea	Sarygamysh
EUROPE REGION				
Dead Sea	Szczecin Lagoon	Szczecin Lagoon	Galilee	Cahul
Galilee	Dead Sea	Dead Sea	Dead Sea	Ohrid
Cahul	Scutari/Skadar	Lago Maggiore	Lago Maggiore	Macro Prespa
Scutari/Skadar	Ohrid	Galilee	Neuseidler/Ferto	Scutari/Skadar
Neuseidler/Ferto	Macro Prespa	Scutari/Skadar	Szczecin Lagoon	Dead Sea
NORTH AMERICA REGION				
Erie	Huron	Erie	Erie	Falcon
Falcon	Michigan	Ontario	Ontario	Amistad
Amistad	Erie	Michigan	Michigan	Michigan
Ontario	Ontario	Falcon	Champlain	Champlain
Michigan	Champlain	Amistad	Huron	Erie
SOUTH AMERICA AND CARIBBEAN REGION				

INTEGRATED LAKE BASIN MANAGEMENT

- TWAP analysis → data & information needed for water resources management (Integrated Water Resources Management (IWRM);

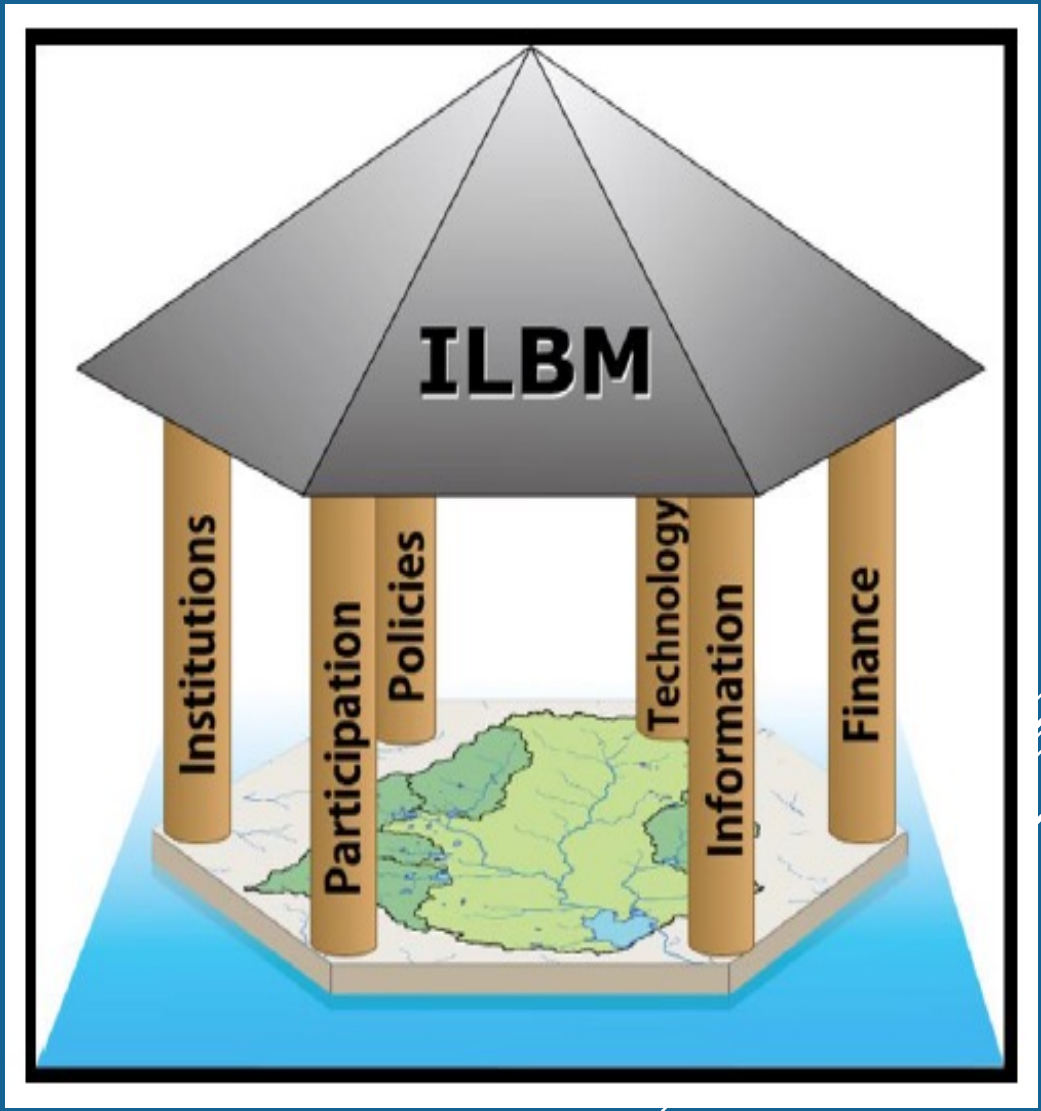
- IWRM does not adequately consider nature/implications of lentic (standing, pooled) water systems or nested lentic-lotic linkages within basins;



Lake assessment/ management framework embodied in Integrated Lake Basin Management (ILBM);

As complement to IWRM, ILBM focus on strengthening governance elements → approach to address lentic management needs;

Combined with continuing assessment activities, ILBM focus on continuous, holistic improvement in lake basin governance.



IV. TWAP LAKE LESSONS LEARNED

- Lakes (lentic waterbodies): Complex water systems used for widest range of ecosystem services for human health, livelihoods & well-being;

- Little uniform lake data on global scale
  → Complicates accurate assessment (and management);
- Sustainable use of lake-based ecosystem services: Requires detailed analysis of characteristics within context of integrated management framework (ILBM);
- Ranking lakes regarding nature/magnitude of threats: Not simple number-crunching exercise; best interpreted from perspective/needs of users of ranking results.

- Based on basin characteristics/specific assumptions/ preconditions: African transboundary lakes as a group exhibited greatest Adj-HWS threats, followed by lakes in Asia and South America; goals/assumptions/capacities important in selecting initial management intervention targets;
- Developing countries: Tend to have most sensitive (and relatively undisturbed) biodiversity → highest RvBD threats;
- Integrated water management framework (e.g., ILBM as complement to IWRM) needed to better assess and manage lakes & other lentic water systems;
- Accurate assessment of lentic and lotic water systems: Consideration of upstream/downstream water system linkages.

SDGs and Lentic Water Systems

Sustainability agenda pursued on global scale enhances our ability to achieve 2030 SDG goals and targets;

- SDG Goal 6/Target 6.5 (*"Ensure availability and sustainable management of water and sanitation for all"*) includes need to *implement integrated water resources management at all levels, including through transboundary cooperation as appropriate…";*
- Achieving target requires transboundary lake (& other transboundary water systems) assessment methodology to: (1) identify threats in uniform, understandable manner; (2) provide guidance to effectively address them; (3) basis for transboundary cooperation;
- Integrated elements encompassed within ILBM, as complement to IWRM → Framework for achieving assessment/management goals for transboundary lakes & other lentic water systems.

SDGs and Lentic Water Systems

SDG Goal 6/Target 6.6 (*"Ensure availability and sustainable management of water and sanitation for all"*) includes need *to protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes…."*);

- Tied to sustainable water-based ecosystem services for human health, livelihoods and well-being;
- Concerted global-scale efforts needed to acquire data & management experiences to identify & address stresses/constraints to sustainable water-based ecosystem services; Lakes; lentic –lotic water systems particularly important because of wide range of ecosystem services

SDGs and Lentic Water Systems

SDG biodiversity goals and targets:

- SDG Goal 15 (*"Protect, restore and promote sustainable use of terrestrial ecosystems…. and halt biodiversity loss"):*

  - Target 1: *"..Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands ……in line with obligations under international agreements"*
  - Target 5: *"Take urgent and significant action to reduce degradation of natural habitats, halt the loss of biodiversity…"*
  - Target 9: *"Integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts."*

- Biodiversity goals: Strongly linked to ecosystem services and functions provided by lakes/other lentic water systems

SDGs and Lentic Water Systems

SDG Goal 14 (“*Conserve and sustainably use the oceans, seas and marine resources for sustainable development* “):

- Target 1: *“….prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including ….nutrient pollution*”;
- Target 2: *“…..sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration…”*

- Upstream lentic water systems draining into coastal areas buffer upstream pollutant impacts → masking downstream coastal water quality and biodiversity impacts until upstream system becomes seriously degraded → also becomes pollutant source;
- Accurate assessment of magnitude and assimilative capacity of upstream lentic waterbodies: Important consideration to protect downstream coastal areas from land-based activities.

Effective Identification & Remediation of Institutional, Policy, Adequacy, and Magnitude of Transboundary Lake Threats Using ILBM

- *Mainstreaming lakes & other lentic water systems in global water discussions, including future transboundary assessments;*

- *Identifying needed capacity-building to address transboundary lake assessment/management needs & sustainability of ecosystem services;*

- *Considering linkages/interactions of transboundary lakes with upstream, downstream & sub-surface water systems, (transboundary & non-transboundary);*

Effective Identification & Remediation of Institutional, Policy, Adequacy, and Magnitude of Transboundary Lake Threats Using ILBM

- *Developing adequate, uniform, meaningful and understandable lake data and Information data bases;*
- *Ensuring sufficient and sustainable financial, institutional and policy support to assess and manage lakes/other lentic-lotic water systems;*
- *Considering other factors that could make national lakes 'transboundary' s impact (e.g., located in transboundary basins; trans-continental migratory bird flyways;).*

TWAP
TRANSBOUNDARY WATERS ASSESSMENT PROGRAMME

Transboundary Lakes and Reservoirs

Status and Future Trends

SUMMARY FOR POLICY MAKERS

VOLUME 2: LAKE BASINS AND RESERVOIRS

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