Devol Pond Water Quality and Restoration Options

Devol Pond Association
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What's the Problem?

Water Quality Parameters

- Parameters
  - Physical: sedimentation, temperature, transparency
  - Chemical: DO, pH, alkalinity, nutrients (N/P)
  - Biological: algal/macrophyte biomass, fish survey
  - Use of trophic state indices

- Locations: AUV
- Time: Buoy

YSI Sensors

YSI 6-Series Parameters

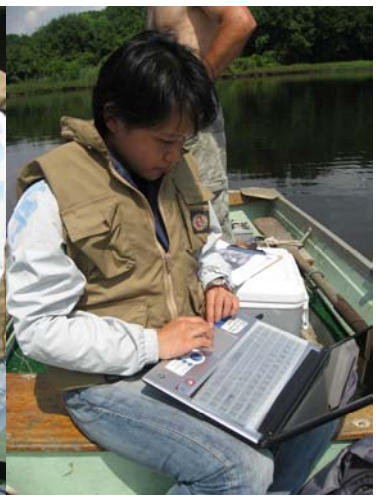
Temperature	Optical DO (ODO)
Conductivity	Turbidity
Specific Conductance	Chlorophyll
Salinity	Blue-Green Algae *NEW*
Resistivity	(Phycocyanin or Phycoerythrin)
TDS	Rhodamine
TSS	Depth
pH	PAR - Upward facing
ORP	PAR - Downward facing

Nutrient & Transparency

Equipment & Instrument

Secchi Depth

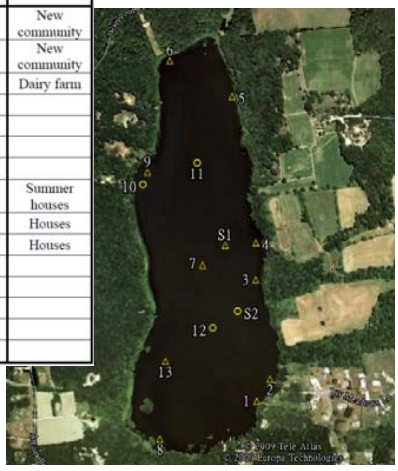
Sample & Data Collection



Water Samples

Sampling Locations

Sampling site	Sampling depth (m)	location	Latitude	Longitude	Remark
1	0.5	In-flow	41° 36.262'	71° 7.180'	New community
2	0.5	In-flow	41° 36.299'	71° 7.153'	New community
3	0.5	In-flow	41° 36.460'	71° 7.193'	Dairy farm
4	0.5	In-flow	41° 36.520'	71° 7.196'	
5	0.5	In-flow	41° 36.757'	71° 7.261'	
6	0.5	Out-flow	41° 36.811'	71° 7.401'	
7	0.5	Mid-lake	41° 36.480'	71° 7.311'	
8	0.5	In-flow	41° 36.194'	71° 7.389'	Summer houses
9	0.5		41° 36.628'	71° 7.440'	Houses
10	0.5		41° 36.607'	71° 7.449'	Houses
11	0.5	Mid-lake	41° 36.646'	71° 7.332'	
12	0.5 , 1	Mid-lake	41° 36.378'	71° 7.283'	
13	0.5 , 1		41° 36.321'	71° 7.384'	
S1	0.5 , 2	Spring	41° 36.514'	71° 7.263'	
S2	0.5 , 2	Spring	41° 36.407'	71° 7.230'	



Field Study Results

Location	Temperature (°C)			pH			Turbidity (NTU)			DO (mg/L)		
	7/20	8/11	8/25	7/20	8/11	8/25	7/20	8/11	8/25	7/11	8/11	8/25
1	25.94	27.53	27.50	8.91	8.19	8.86	28.24	10.37	16.77	10.55	10.85	9.89
2	26.22	27.48	27.37	9.41	8.26	8.87	28.26	7.86	18.07	10.93	10.52	10.25
3	26.65	27.82	27.34	9.61	7.79	8.77	38.53	5.77	15.10	10.86	9.77	9.73
4	27.64	27.28	27.25	10.16	7.37	7.88	52.56	4.97	18.24	13.93	8.72	8.98
5	26.64	26.61	27.03	10.00	7.31	6.95	29.61	2.59	50.15	12.60	9.32	6.38
6	29.65	26.36	27.20	9.96	7.46	6.94	30.42	2.08	12.79	12.64	9.49	6.95
7	27.73	27.84	27.37	10.09	8.50	8.69	36.22	4.75	15.43	13.20	10.84	9.73
8	27.55	29.37	27.75	10.12	9.20	9.29	52.68	15.03	22.98	13.80	13.13	11.40
9	N/A	27.76	28.20	N/A	7.48	8.65	N/A	5.50	14.04	N/A	9.42	9.45
10	N/A	25.60	27.85	N/A	7.23	8.49	N/A	2.09	13.88	N/A	5.44	9.09
11	N/A	27.73	27.81	N/A	7.87	8.55	N/A	2.61	12.20	N/A	10.10	9.64
12	N/A	29.12	27.45	N/A	8.77	9.00	N/A	10.45	15.82	N/A	11.73	10.15
13	N/A	28.46	27.87	N/A	9.19	9.34	N/A	12.71	19.39	N/A	12.96	11.65
S1	N/A	24.68	27.33	N/A	7.38	8.33	N/A	N/A	13.32	N/A	4.88	9.33
S2	N/A	24.45	27.69	N/A	7.38	8.86	N/A	N/A	13.69	N/A	5.13	9.83

Field Study Results (2)

Location	TP (µg/L P)			TN (mg/L N)			Chlorophyll (ug/L)			Secchi depth (m)	
	7/20	8/11	8/25	7/20	8/11	8/25	7/20	8/11	8/25	8/11	8/25
1	46.67	83.33	80.00	(0.8)*	2.9	(0.2)	5.86	6.47	3.74	0.83	0.89
2	73.33	93.33	96.67	(0.5)	(1.2)	(1.0)	4.65	6.84	4.01	0.96	0.80
3	33.33	66.67	66.67	2.0	(0.7)	2.0	5.58	7.24	4.05	1.12	0.89
4	53.33	56.67	70.00	(1.7)	(1.2)	(1.1)	6.06	6.90	4.61	1.37	0.85
5	N/A	53.33	60.00	N/A	(0.9)	(0.9)	5.19	7.26	6.16	1.24	0.75
6	40.00	66.67	73.33	(0.6)	(1.3)	(1.8)	4.25	6.49	3.84	1.37	0.90
7	53.33	63.33	76.67	2.2	(1.1)	2.2	5.19	7.07	4.00	1.18	0.96
8	46.67	73.33	86.67	(1.5)	2.2	(0.5)	6.99	6.45	4.33	0.71	0.70
9	N/A	83.33	66.67	N/A	(1.5)	(0.7)	N/A	7.81	3.65	1.32	0.95
10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.56	3.86	1.18	0.85
11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.07	3.81	1.41	1.08
12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.56	3.75	0.95	0.90
13	N/A	110.00	106.67	N/A	2.4	(0.7)	N/A	7.34	4.21	0.89	0.73
S1	N/A	100.00	73.33	N/A	(1.8)	(1.3)	N/A	6.34	3.66	1.00	0.98
S2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.65	3.73	N/A	1.00

Trophic State Index

8/11							
Location	**Chl-a (ug/L)**	**CTSI Chl-a**	**Secchi (m)**	**CTSI (SD)**	**TP (µg/L)**	**CTSI TP**	**CTSI**
1	6.47	48.91	0.83	62.69	83.33	67.93	59.84
2	6.84	49.46	0.96	60.59	93.33	69.56	59.87
3	7.24	50.02	1.12	58.37	66.67	64.71	57.70
4	6.90	49.55	1.37	55.46	56.67	62.37	55.79
5	7.26	50.05	1.24	56.90	53.33	61.49	56.15
6	6.49	48.95	1.37	55.46	66.67	64.71	56.37
7	7.07	49.79	1.18	57.61	63.33	63.97	57.13
8	6.45	48.89	0.71	64.94	73.33	66.08	59.97
9	7.81	50.77	1.32	56.00	83.33	67.93	58.23
13	7.34	50.16	0.89	61.68	110.00	71.93	61.26
S1	6.34	48.72	1.00	60.00	100.00	70.56	59.76

Trophic State Index (2)

8/25							
Location	**Chl-a (ug/L)**	**CTSI Chl-a**	**Secchi (m)**	**CTSI (SD)**	**TP (µg/L)**	**CTSI (TP)**	**CTSI**
1	3.74	43.54	0.89	61.68	80.00	67.34	57.52
2	4.01	44.22	0.80	63.22	96.67	70.07	59.17
3	4.05	44.33	0.89	61.68	66.67	64.71	56.91
4	4.61	45.59	0.85	62.34	70.00	65.41	57.78
5	6.16	48.43	0.75	64.15	60.00	63.19	58.59
6	3.84	43.80	0.90	61.52	73.33	66.08	57.13
7	4.00	44.19	0.96	60.59	76.67	66.73	57.17
8	4.33	44.99	0.70	65.14	86.67	68.49	59.54
9	3.65	43.29	0.95	60.74	66.67	64.71	56.25
13	4.21	44.70	0.73	64.53	106.67	71.49	60.24
S1	3.66	43.32	0.98	60.29	73.33	66.08	56.57

Water Clarity

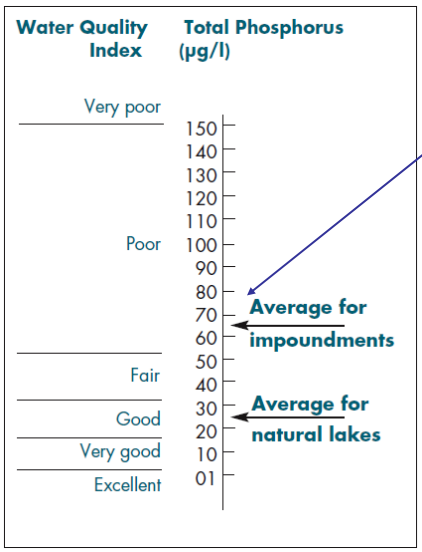
(Adapted from Lillie and Mason, 1983.)

TABLE 2. Water clarity index.

Water clarity	Secchi depth (ft.)
Very poor	3
Poor	5
Fair	7
Good	10
Very good	20
Excellent	32

(Devol Pond: 2.5 – 4 ft)

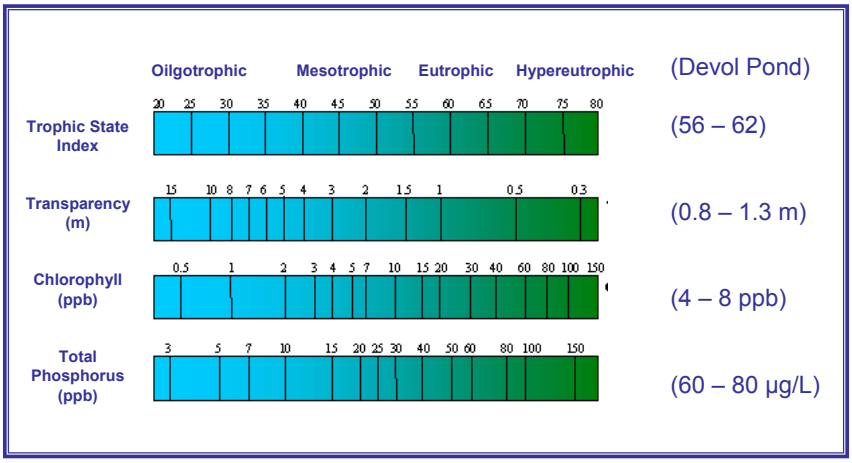
Total Phosphorus



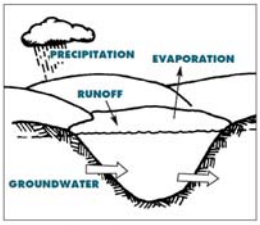
(Devol Pond: 60 – 80 µg/L)

(Adapted from Lillie and Mason, 1983.)

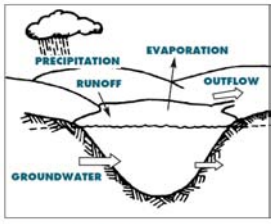
Trophic State Index



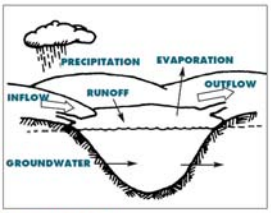
Lake Types



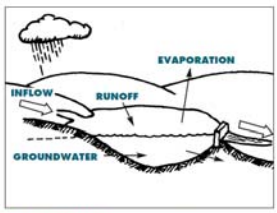
1. SEEPAGE LAKE—a natural lake fed by precipitation, limited runoff and groundwater. It does not have a stream outlet.



2. GROUNDWATER DRAINAGE LAKE—a natural lake fed by groundwater, precipitation and limited runoff. It has a stream outlet.

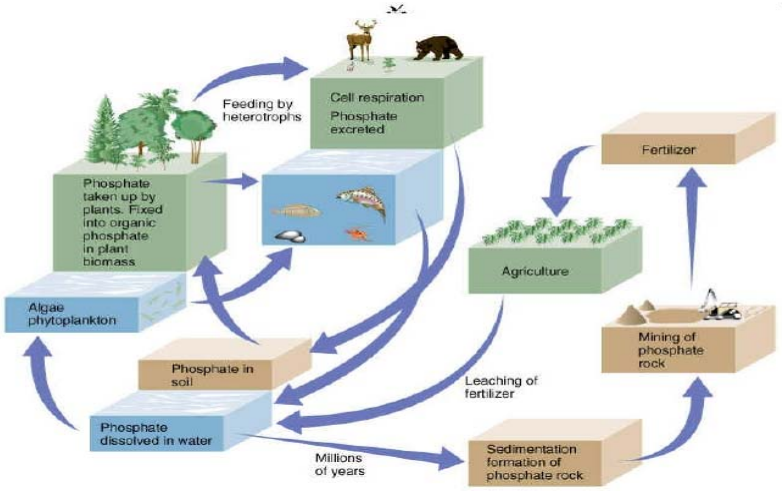


3. DRAINAGE LAKE—a lake fed by streams, groundwater, precipitation and runoff and drained by a stream.

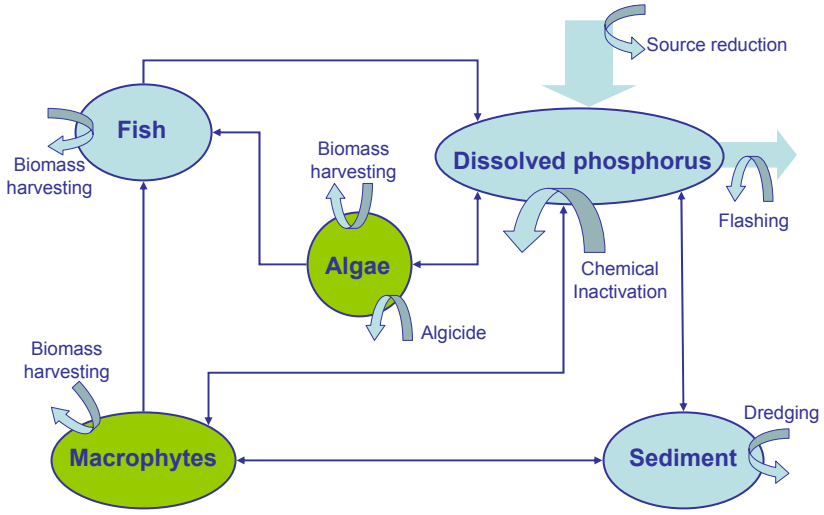


4. IMPOUNDMENT—a manmade lake created by damming a stream. An impoundment is also drained by a stream.

Phosphorus Cycle



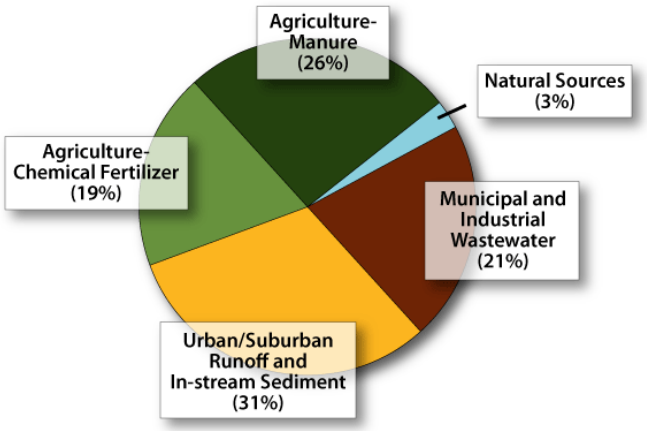
Phosphorus Removal



Restoration Options

1. Source reduction
2. Phosphorus precipitation/inactivation
3. Sediment removal
4. Biomass harvesting
5. Food chain manipulation
6. Dilution and flushing
7. Algicides

Phosphorus Sources

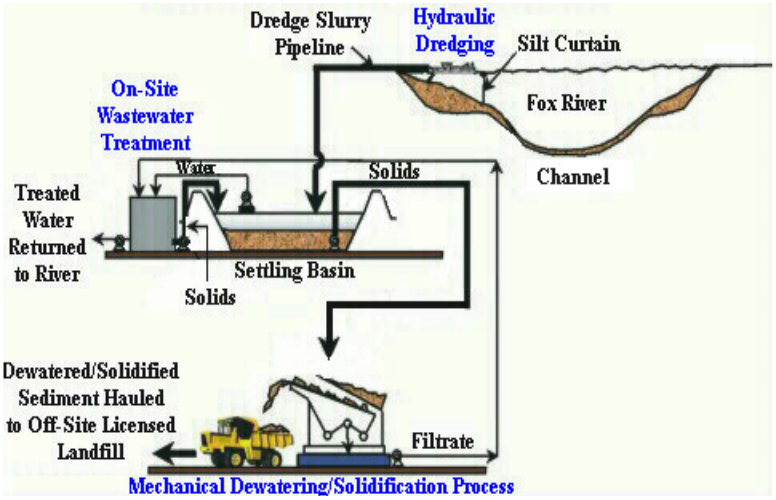


Source Reduction

- Fertilizers
- Detergents
- Animal wastes

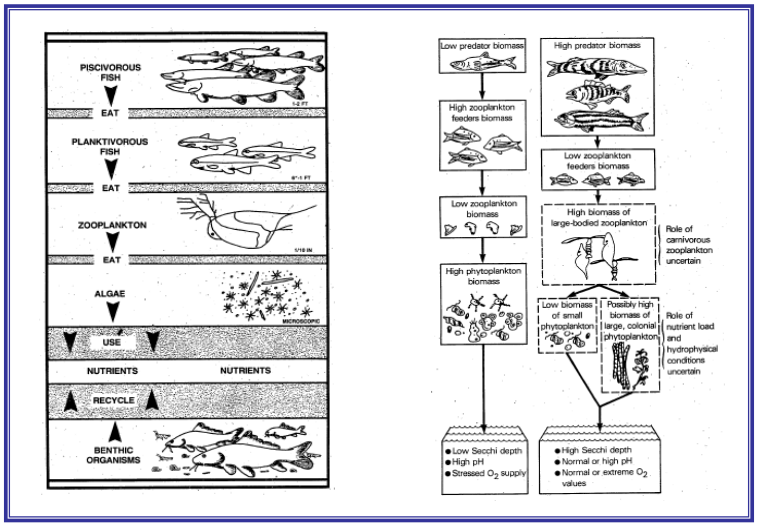
Phosphorus Inactivation

Sediment Removal



Biomass Harvesting

Food Chain Manipulation



Asian Carp

Asian Carp Invasion

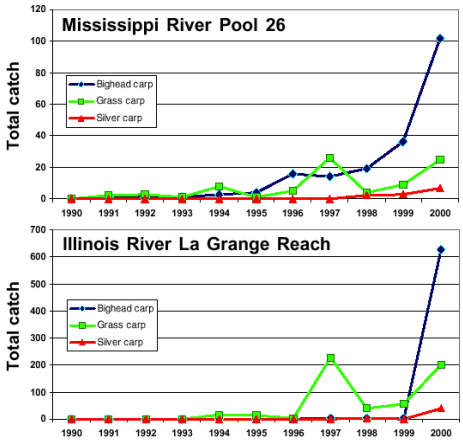


Figure 2. Annual catch of Asian carp collected by the Long Term Resource Monitoring Program from pool 26 of the Mississippi River and La Grange Reach of the Illinois River, 1990-2000. Monitoring during 1990-1999 occurred during June 15 – October 31 of each year. Monitoring in 2000 was done from June 15 to September 15.

Dilution and Flushing

Acknowledgement

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