APPENDIXES

APPENDIX A

1) Classification of water characteristics, dominant algae and other species following Wetzel, 1983

General lake trophic level	Water characteristics	Dominant algae	Other commonly occurring algae
Oligotrophic	Slightly acidic, very salinity	Desmids *Staurodesmus, Staurastrum*	*Sphaerocystis, Gloeocystis, Rhizosolenia, Tabellaria*
Oligotrophic	Neutral to slightly alkaline; nutrient poor-lakes	Diatoms, especially, *Cymbella* and *Tabellaria*	Some *Asterionella* spp., some *Melosira* spp., *Dinobryon*
Oligotrophic	Neutral to slightly alkaline; nutrient poor-lakes or more productive lakes at seasons of nutrient reduction	Chrysophycean algae, especially *Dinobryon*, some *Mallomonas*	Other Chrysophyceans, e.g. *Synura, Uroglena*: diatom *Tabellaria*
Oligotrophic	Neutral to slight alkaline nutrient-poor lakes	Chlorococcal *Oocystis* or Chrysophycean *Botryococcus*	Oligotrophic diatoms
Oligotrophic	Neutral to slight alkaline generally nutrient poor; common is shallow Arctic lakes	Dinoflagellates, especially some *Peridinium* and *Ceratium* spp.	Small chrysophytes cryptophytes and diato ms
Mesotrophic or Eutrophic	Neutral to slight alkaline annual dominants or in eutrophic lakes at certain seasons	Dinoflagellates, some *Peridinium* and *Ceratium* spp.	*Glenodinium* and many other algae
Eutrophic	Usually alkaline lakes with nutrient enrichment	Diatoms much of year, especially *Asterionella, Fragilaria crotonensis, Synedra, Ctephanodiscus* and *Melosira granulate*	Many other algae, especially green and blue-greens during warmer periods of year; desmids of dissolved organic matter is fairly high

1) **Classification of water characteristics, dominant algae and other species following Wetzel, 1983 (continued)**

General lake trophic level	Water characteristics	Dominant algae	Other commonly occurring algae
Eutrophic	Usually alkaline; nutrient enriched; common in warmer periods of temperature lakes or perennially in enriched tropical lakes	Blye-green algae, especially *Anacystis* (=*Microcystis*), *Aphanizomenon, Anabaena*	Other blue-green; euglenophytes if organically enriched or polluted

2) **Classification of water quality by using total phosphorus, total nitrogen, chlorophyll-a and Secchi depth values following Lorraine and Vollenweider, 1981**

Variable (Annual Mean Values)		Oligotrophic	Mesotrophic	Eutrophic	Hypereutrophic
Total phosphorus		8.0	26.7	84.4	
$mg.m^{-3}$	x ± 1 s.d.	4.85-13.3	14.5-49	38-189	
	x ± 2 s.d.	2.9-22.1	7.9-90.8	16.8-424	
	range	3.0-17.7	10.9-95.6	16.2-386	750-1200
	n	21	19(21)	71(72)	2
Total nitrogen		661	753	1875	
$mg.m^{-3}$	x ± 1 s.d.	371-1180	485-1170	861-4081	
	x ± 2 s.d.	208-2103	313-1816	395-8913	
	range	307-1630	361-1387	393-6100	100-150
	n	11	8	37(38)	2
Chlorophyll a		4.2	16.1	42.6	
$mg.m^{-3}$	x ± 1 s.d.	2.6-7.6	8.9-29	16.9-107	
	x ± 2 s.d.	1.5-13	4.9-52.5	6.7-270	
	range	1.3-10.6	4.9-19.5	9.5-275	
	n	1.3-10.6	4.9-19.5	9.5-275	

2) Classification of water quality by using total phosphorus, total nitrogen, chlorophyll-a and Secchi depth values following Lorraine and Vollenweider, 1981 (continued)

Secchi Depth		9.9	4.2	2.45	
m.	x ± 1 s.d.	5.9-16.5	2.7-7.4	1.5-4.0	
	x ± 2 s.d.	3.6-27.5	14-13	0.9-6.7	
	range	5.4-28.3	1.5-8.1	0.8-7.0	
	n	13	20	70(72)	2

3) AARL-PP score (Peerapornpisal, 2006)

Genus	Score	Genus	Score
Actinastrum	5	*Gymnodinium*	6
Acanthoceras	5	*Gyrosigma*	7
Achnanthes	6	*Hantzschia*	8
Amphora	6	*Isthmochloron*	5
Anabaena	8	*Kirchneriella*	5
Ankistrodesmus	7	*Melosiera*	5
Aphanocapsa	5	*Merismopedia*	9
Aphanothece	5	*Micractinium*	7
Aulacoseira	6	*Micrasterias*	2
Bacillaria	7	*Microcystis*	8
Botryococcus	4	*Monoraphidium*	7
Centritractus	4	*Navicula*	5
Ceratium	4	*Nephrocytium*	5
Chlamydomonas	6	*Nitzschia*	9
Chlorella	6	*Oocystis*	6
Chroococcus	6	*Oscillatoria*	9
Closterium	6	*Pandorina*	6
Cocconeis	6	*Pediastrum*	7
Coelastrum	7	*Peridiniopsis*	6
Cosmarium	2	*Peridinium*	6
Crucigenia	7	*Phacus*	8

AARL-PP score (contiued)

Genus	Score	Genus	Score
Crucigeniella	7	*Phormidium*	9
Cryptomonas	8	*Pinnularia*	5
Cyclotella	2	*Planktolyngbya*	7
Cylindrospermopsis	7	*Pseudanabaena*	7
Cymbella	5	*Rhizosolenia*	6
Dictyosphaerium	7	*Rhodomonas*	8
Dimorphococcus	7	*Rhopalodia*	5
Dinobryon	1	*Scenedesmus*	8
Elakatothrix	3	*Spirulina*	9
Encyonema	6	*Staurastrum*	3
Epithemia	6	*Staurodesmus*	3
Euastrum	3	*Stauroneis*	5
Eudorina	6	*Strombomonas*	8
Euglena	10	*Surirella*	6
Eunotia	2	*Synedra*	6
Fragilaria	5	*Synura*	8
Golenkinia	5	*Tetraedron*	6
Gomphonema	6	*Trachelomonas*	8
Gonium	6	*Volvox*	6

Trophic score	Trophic status	Water quality
1.0-2.0	Oligotrophic	Clean water
2.1-3.5	Oligo-mesotrophic	Medium clean water
3.6-5.5	Mesotrophic	Fairy clean water
5.6-7.5	Meso-eutrophic	Verge dirty water
7.6-9.0	Eutrophic	Dirty water
9.1-10.0	Hypereutrophic	Very dirty water

Example

Resevoir A occurring three dominant phytoplankton e.g. *Euglena* sp. *Trachelomonas* sp. and *Fragilaria* sp.

Scores of each genus are the following;

Euglena sp. = 10
Trachelomonas sp. = 8
Fragilaria sp. = 5

Total = 23

Then the total score is divided by the number of dominant genus/genera;

= 23/3

The trophic score of the reservoir A = 7.6

So that, reservoir A could be classified into eutrophic status

4) AARL-PC score (Peerapornpisal *et al*., 2004)

Conductivity (µS cm^{-1})	**Score**
<5	0.1
5-10	0.2
10-30	0.3
30-60	0.4
60-100	0.5
100-150	0.6
150-200	0.7
200-300	0.8
300-450	0.9
>450	1.0

AARL-PC score (continued)

Dissolved oxygen (mg l^{-1})	Score
>8	0.1
7-8	0.2
6-7	0.3
5-6	0.4
4-5	0.5
3-4	0.6
2-3	0.7
1-2	0.8
0.5-1	0.9
<0.5	1.0

Biochemical oxygen demand (mg l^{-1})	Score
<0.1	0.1
0.1-0.2	0.2
0.2-0.5	0.3
0.5-1.5	0.4
1.5-3.0	0.5
3.0-6.0	0.6
6.0-10.0	0.7
10.0-20.0	0.8
20.0-40.0	0.9
>40.0	1.0

AARL-PC score (continued)

Nitrate-Nitrogen (mg l^{-1})	Score
<0.01	0.1
0.01-0.05	0.2
0.05-0.1	0.3
0.1-0.2	0.4
0.2-0.4	0.5
0.4-0.8	0.6
0.8-1.5	0.7
1.5-3.0	0.8
3.0-5.0	0.9
>5.0	1.0

Ammonium-Nitrogen (mg l^{-1})	Score
<0.01	0.1
0.01-0.05	0.2
0.05-0.1	0.3
0.1-0.15	0.4
0.15-0.3	0.5
0.3-0.5	0.6
0.5-0.8	0.7
0.8-1.5	0.8
1.5-5.0	0.9
>5.0	1.0

AARL-PC score (continued)

Soluble reactive phosphorus (mg l^{-1})	Score
<0.01	0.1
0.01-0.03	0.2
0.03-0.06	0.3
0.06-0.1	0.4
0.1-0.25	0.5
0.25-0.4	0.6
0.4-0.8	0.7
0.8-1.5	0.8
1.5-5.0	0.9
>5.0	1.0

Chlorophyll-a (µg l^{-1})	Score
<0.05	0.1
0.05-0.1	0.2
0.1-0.5	0.3
0.5-1.5	0.4
1.5-3.0	0.5
3.0-5.0	0.6
5.0-10.0	0.7
10.0-25.0	0.8
25.0-50.0	0.9
>50.0	1.0

Trophic score	Trophic status	Water quality
0.1-0.9	Hyper-oligotrophic	Very clean water
1.0-1.8	Oligotrophic	Clean water
1.9-2.7	Oligo-mesotrophic	Medium clean water
2.8-3.6	Mesotrophic	Fairy clean water
3.7-4.5	Meso-eutrophic	Verge dirty water
4.6-5.4	Eutrophic	Dirty water
> 5.4	Hyper-eutrophic	Very dirty water

Example

Reservoir A

DO	7.5	mg l^{-1}
Chlrophyll a	20	$\mu g.l^{-1}$
Conductivity	186	$\mu S.cm^{-1}$
Nitrate nitrogen	0.3	mg l^{-1}
Ammonium nitrogen	1.2	mg l^{-1}
Soluble Reactive Phosphorus	0.3	mg l^{-1}

Score

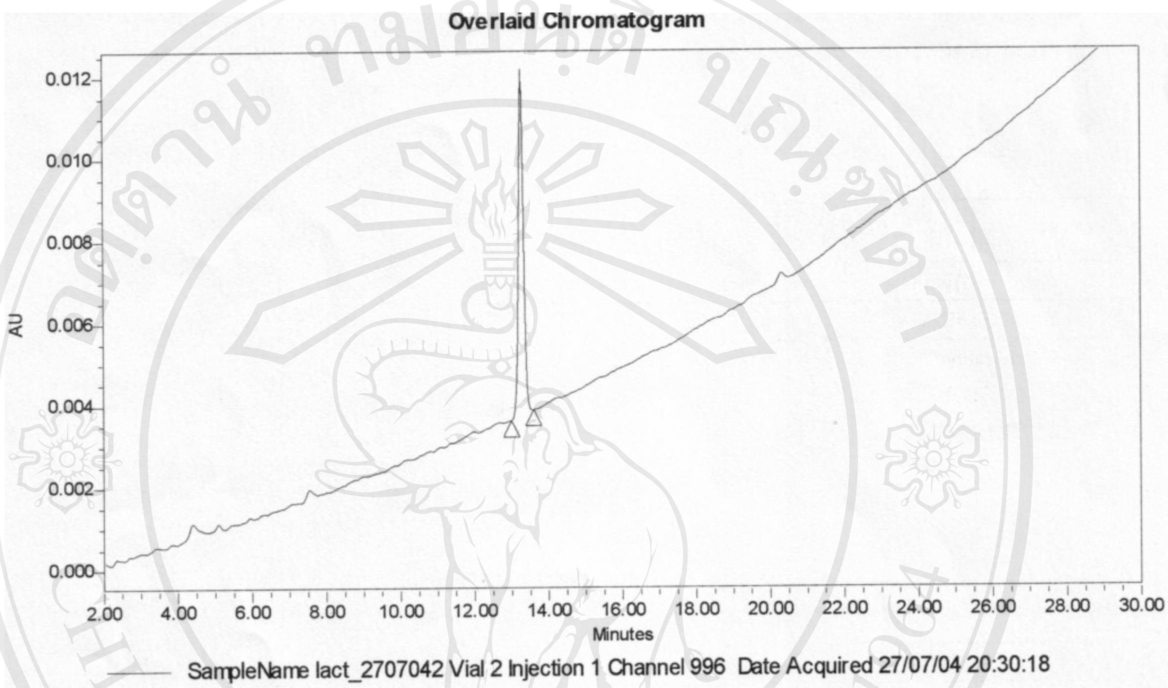
DO	0.2
Chlrophyll a	0.8
Conductivity	0.7
Nitrate nitrogen	0.5
Ammonium nitrogen	0.9
Soluble Reactive Phosphorus	0.6
Total	3.7

The trophic score of the reservoir A = 3.7

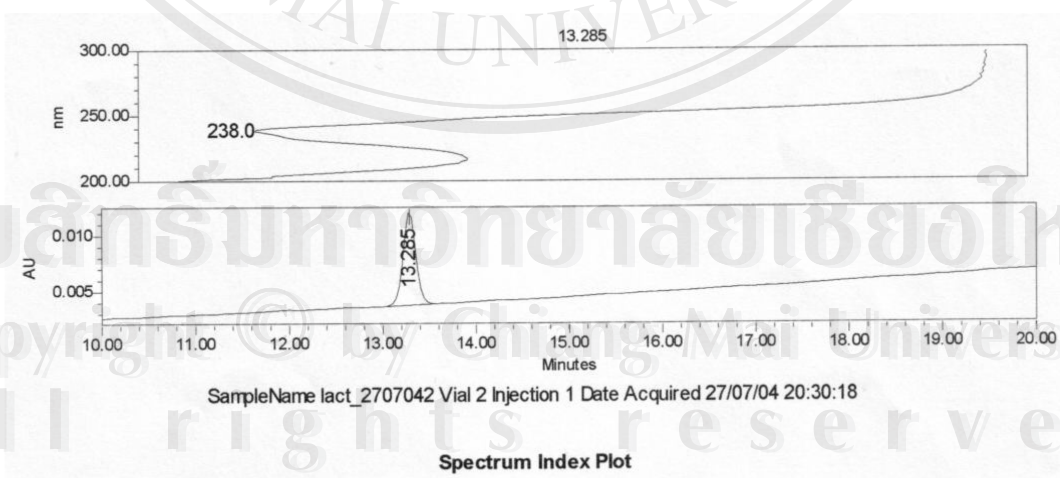
So that, the resource A could be classified into meso-eutrophic status

APPENDIX B

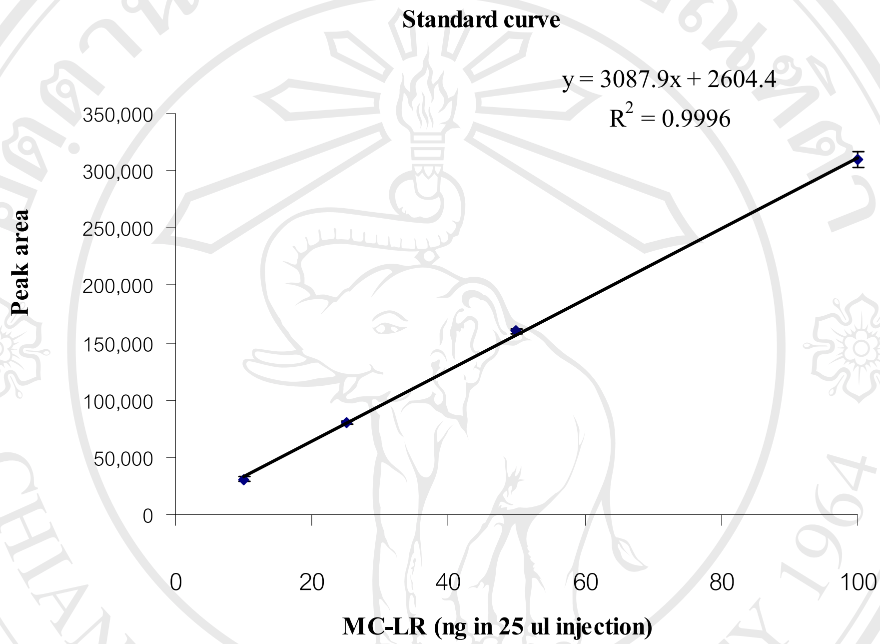
1) The chromatogram peak of microcystin-LR detected by HPLC



2) The spectrum at 238 nm confirming the purity of microcystin-LR detected by Water ® 996 photodiode array detector.



3) Calibration curve of microcystin-LR in range of 10 - 100 ng in 25µl of injection



Microcystin-LR concentration (µg/ml)	ng in 25µl	Injection 1	injection 2	Injection 3	MEAN	SD
0.4	10	30,029	30,506	32,826	31,120	1,496
1	25	79,820	80,002	82,370	80,731	1,423
2	50	158,912	158,979	161,680	159,857	1,579
4	100	303,460	310,084	316,355	309,966	6,448

4) The calculation of limit of detection by use of linearity curve

The LOD is the lowest amount of analyst which can be detected with an acceptable statistical significance. LOD is calculated from the blank mean and three times of the SD as shown in equation 1.

$$Y_{LOD} = Y_B + 3SD_B \qquad (1)$$

Where Y_{LOD} = signal at the limit of detection

Y_B = signal of blank value

SD_B = estimate of standard deviation of blank value

Linear regression analysis used for validation of linearity is made under the assumption that the Y-values are normally distributed around the regression line with a standard deviation Sy/x may therefore be used instead of SD_B in the equation for calculation of LOD. An estimate for Y_B may also be obtained from the regression line as the Y axis intercept value. Inserting these values in equation 1 and combination with the linear equation yield;

$$LOD = (a + 3 \cdot Sy/x - a) / b = (3 \cdot Sy/x) / b \qquad (2)$$

Where b is the slope and a the intercept of the regression line with the Y-axis and Sy/x is mean SD from the regression line of signal values Y. If this approach is to be used, the factor of curvature, n, for the regression line should be between 0.9 and 1.0

By: Miller, J.C. and Miller, J.N. Statistics for Analytical Chemistry, 2nd ed.. Chichester: Ellis HOrwood Limited, 1988.

APPENDIX C

Statistical out put data of MVSP

1) Principal components analysis (PCA) for environmental factors of water

Data file - E:\MVSP\PhD.dissertation\Water env. factors.mvs

Water quality
Analysing 18 variables x 29 cases
Tolerance of eigenanalysis set at 1E-7
Data not centred
Data standardized

Eigenvalues

	Axis 1	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**	**Axis 6**
Eigenvalues	127.737	6.857	2.715	2.517	1.177	1.008
Percentage	88.551	4.753	1.882	1.745	0.816	0.699
Cum. Percentage	88.551	93.304	95.186	96.930	97.746	98.445

PCA variable loadings

	Axis 1	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**	**Axis 6**
dep	0.064	-0.227	0.288	0.388	-0.015	0.117
temp	0.664	-0.051	0.149	-0.078	-0.023	-0.180
cond	0.130	0.259	-0.136	-0.124	0.248	0.549
ph	0.662	-0.129	-0.219	-0.073	0.071	0.022
to_bac	0.023	0.107	-0.130	0.203	-0.695	0.256
chlo	0.034	0.221	-0.187	0.341	0.323	-0.328
do	0.165	-0.260	-0.100	0.042	-0.233	-0.142
secchi	0.073	-0.275	0.237	0.308	0.006	0.068
alk	0.203	0.351	-0.068	-0.102	-0.198	0.097
bod	0.032	0.208	-0.243	0.366	0.234	-0.273
nitr	0.046	0.123	0.367	-0.190	0.203	0.161
amo	0.047	0.284	-0.156	0.284	-0.156	0.086
phos	0.102	0.196	0.104	0.270	0.273	0.434
total mc in water	0.044	0.294	0.328	-0.024	-0.125	-0.112
water MC-RR	0.029	0.212	0.414	-0.101	-0.003	-0.275
water MC-LR	0.046	0.320	0.041	0.260	-0.155	-0.168
water other MCs	0.042	0.278	0.334	-0.056	-0.127	-0.077
Water volume	0.043	-0.215	0.292	0.391	0.031	0.162

PCA case scores						
	Axis 1	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**	**Axis 6**
FPR1	2.269	1.024	1.128	-0.342	-0.017	-0.292
FPR2	2.046	0.586	0.018	0.138	0.032	0.003
FPC1	2.205	0.683	-0.002	0.111	-0.193	0.092
FPC2	1.805	0.720	-0.385	0.438	-0.764	0.227
FPS1	2.264	0.974	-0.565	0.824	0.511	-0.392
FPS2	2.379	1.014	0.278	-0.036	-0.057	0.135
HYrR1	2.388	-0.321	-0.153	-0.190	-0.107	-0.196
HYrR2	2.095	-0.301	-0.122	-0.148	-0.113	-0.205
HYrC1	2.012	-0.261	-0.132	-0.168	-0.090	-0.132
HYrC2	1.817	-0.186	-0.119	-0.154	-0.142	-0.121
HYrS1	2.155	-0.240	-0.171	-0.205	-0.032	-0.124
HYrS2	2.249	-0.229	-0.168	-0.221	-0.030	-0.122
HYsR1	2.018	-0.124	-0.071	-0.218	-0.012	-0.130
HYsR2	1.978	-0.228	-0.081	-0.188	-0.092	-0.207
HYsC1	1.796	-0.065	-0.158	-0.217	-0.019	-0.046
HYsC2	1.699	-0.013	-0.098	-0.201	-0.033	-0.025
HYsS1	1.822	-0.103	-0.168	-0.210	0.038	-0.088
MKR1	2.188	-0.540	0.279	0.275	-0.010	-0.024
MKR2	2.421	-0.738	0.427	0.503	0.055	0.054
MKC1	1.890	-0.512	0.374	0.460	0.055	0.135
MKC2	1.806	-0.495	0.311	0.362	0.028	0.090
MKS1	2.198	-0.530	0.127	0.344	-0.106	0.117
MKS2	2.282	-0.523	0.094	0.135	0.002	-0.074
SKR1	2.064	0.086	-0.116	-0.142	0.119	0.239
SKR2	2.390	-0.117	-0.212	-0.209	0.044	0.048
SKC1	1.771	0.200	-0.030	-0.203	0.170	0.278
SKC2	1.786	0.215	0.071	-0.336	0.310	0.391
SKS1	2.330	0.063	-0.212	-0.089	0.226	0.353
SKS2	2.384	-0.090	-0.255	-0.218	0.119	0.119

2) Principal components analysis (PCA) for environmental factors of sediment

Data file - E:\MVSP\PhD.dissertation\Sediment env. factors.mvs

Analysing 11 variables x 29 cases
Tolerance of eigenanalysis set at 1E-7

Data not centred
Data standardized

Eigenvalues					
	Axis 1	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**
Eigenvalues	48.639	3.397	2.614	1.292	1.100
Percentage	93.727	2.142	1.648	0.815	0.694
Cum. Percentage	93.727	95.869	97.517	98.331	99.025

PCA variable loadings					
	Axis 1	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**
S pH	0.924	-0.138	-0.105	0.006	-0.119
S total bacterial plat count (CFU/ml)	0.022	0.413	-0.103	-0.073	-0.355
S nitrate	0.057	-0.059	0.179	0.711	-0.269
S ammonium	0.099	0.503	0.067	-0.001	0.162
S phosphate	0.076	-0.116	-0.274	0.401	0.360
%OM	0.112	0.434	0.168	-0.152	0.195
%sand	0.161	-0.034	-0.588	-0.214	0.124
%silt	0.151	0.303	0.237	0.384	0.235
%clay	0.164	-0.201	0.490	-0.258	-0.397
total mc in sed.	0.068	0.467	-0.167	0.005	-0.295
percent mc sorption	0.183	-0.037	0.410	-0.214	0.528

PCA case scores					
	Axis 1	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**
FPR1	2.396	0.565	0.160	-0.029	0.223
FPR2	2.335	0.333	0.117	0.012	0.250
FPC1	2.387	0.481	-0.032	-0.152	0.243
FPC2	2.398	0.360	0.046	-0.111	0.242
FPS1	2.478	0.437	0.183	0.174	0.169
FPS2	2.145	1.315	-0.292	-0.106	-0.413
HYrR1	2.298	-0.115	0.382	-0.023	-0.060
HYrR2	2.263	-0.185	0.205	-0.131	-0.001
HYrC1	2.296	0.001	0.079	0.195	-0.507
HYrC2	2.445	-0.215	0.088	0.083	-0.100
HYrS1	2.356	-0.106	0.032	0.333	-0.363
HYrS2	2.623	-0.066	-0.111	0.094	-0.022
HYsR1	2.503	-0.069	0.220	0.488	0.014
HYsR2	2.410	-0.169	0.232	0.425	0.060
HYsC1	2.477	-0.164	0.140	0.119	0.122
HYsC2	2.239	-0.140	0.105	0.146	0.105
HYsS1	2.422	-0.082	0.199	0.084	0.043

PCA case scores (continued)					
	Axis 1	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**
MKR1	1.947	-0.145	0.252	-0.312	-0.036
MKR2	1.962	-0.162	0.242	-0.305	-0.045
MKC1	1.953	-0.157	0.300	-0.303	-0.070
MKC2	1.969	-0.190	0.208	-0.276	-0.034
MKS1	1.958	-0.214	0.218	-0.267	-0.053
MKS2	1.940	-0.278	0.202	-0.226	-0.065
SKR1	2.122	-0.190	-0.609	-0.013	-0.024
SKR2	2.230	-0.281	-0.466	-0.184	-0.285
SKC1	2.129	-0.166	-0.543	-0.020	-0.015
SKC2	2.175	-0.189	-0.600	0.060	0.077
SKS1	2.309	-0.156	-0.403	-0.210	0.075
SKS2	2.256	-0.234	-0.561	0.087	0.354

3) Detrended correspondence analysis (DCA) for plankton species composition

Data file - E:\MVSP\PhD.dissertation\Dominant species.mvs
Analysing 21 variables x 29 cases
Data log(e) transformed
Tolerance of eigenanalysis set at 1E-7

Scores will be detrended

Eigenvalues			
	Axis 1	**Axis 2**	**Axis 3**
Eigenvalues	0.511	0.265	0.188
Percentage	14.672	7.608	5.401
Cum. Percentage	14.672	22.281	27.682

CA variable scores			
	Axis 1	**Axis 2**	**Axis 3**
Total biovolume	1.432	1.472	1.055
Microcystis biovol	0.736	1.067	1.431
Cylindro raci biovol	-0.507	0.113	-0.400
Plankto lim biovol	-0.840	1.323	0.932
Oscil sp1 biovol	-1.031	2.577	4.628
Trache obl biovol	1.821	2.746	0.164
Peridiniop sp1	-0.909	1.201	-1.602

CA variable scores (continued)			
	Axis 1	**Axis 2**	**Axis 3**
Crypto sp	2.695	3.884	2.196
Peridiniop sp2 biovol	0.250	3.255	2.953
Stauro cra biovol	3.364	-0.676	1.828
Peridini sp1 biovol	3.155	-1.563	2.312
Staura gra biovol	3.144	-0.658	-0.079
Cylin phil biovol	3.457	-0.099	1.496
Staura smi biovol	3.015	-0.557	0.751
Cos sp1 biovol	3.015	-0.557	0.751
Staura man biovol	3.200	3.573	1.504
Staura cha biovol	3.542	2.694	0.698
Cos sp2 biovol	3.542	2.694	0.698
Spi pla biovol	-0.208	1.706	2.251
Diato sp biovol	-0.206	2.354	2.187
Oscil sp2 biovol	-0.210	1.299	2.234

CA case scores			
	Axis 1	**Axis 2**	**Axis 3**
FPR1	0.503	1.292	1.142
FPR2	1.088	1.271	1.241
FPC1	1.084	1.269	1.243
FPC2	1.085	1.270	1.242
FPS1	1.086	1.270	1.242
FPS2	1.084	1.269	1.243
HYrR1	0.000	1.010	0.251
HYrR2	0.156	0.945	0.000
HYrC1	0.170	0.941	0.014
HYrC2	0.840	1.314	0.450
HYrS1	0.152	1.029	0.689
HYrS2	0.490	1.389	0.571
HYsR1	0.122	1.354	1.717
HYsR2	0.518	1.329	0.075
HYsC1	1.729	2.347	1.115
HYsC2	1.112	2.173	1.352
HYsS1	1.460	1.913	0.764
MKR1	1.965	0.000	1.089
MKR2	2.445	0.413	1.425
MKC1	2.211	0.653	0.654
MKC2	2.004	2.560	1.227

CA case scores (continued)			
	Axis 1	**Axis 2**	**Axis 3**
MKS1	2.703	1.697	0.860
MKS2	1.801	1.315	0.606
SKR1	0.773	1.870	1.372
SKR2	0.715	1.636	1.445
SKC1	0.768	1.955	1.371
SKC2	0.733	1.640	1.423
SKS1	0.731	1.642	1.423
SKS2	0.752	1.649	1.405

4) Carnonical correspondence analysis (CCA) for environmental factors of water, phytoplankton species composition and microcystins

Data file - E:\MVSP\PhD.dissertation\Dominant species.mvs

Analysing 21 variables x 29 cases
Environmental data file - E:\MVSP\PhD.dissertation\Water env. factors.mvs
Water quality
Analysing 18 variables x 29 cases
Data log(e) transformed
Tolerance of eigenanalysis set at 1E-7

Scores scaled by species

Variable	Weighted mean	Weighted SD	Inflation Factor
dep	5.876	8.025	69.260
temp	27.044	3.571	3.881
cond	277.302	195.196	18.127
ph	7.463	1.023	5.695
to_bac	468688.364	1738710.306	6.876
chlo	219.246	676.955	183.210
do	4.290	2.144	2.961
secchi	0.848	0.989	17.560
alk	79.049	32.963	18.076
bod	45.135	144.601	296.694
nitr	1.544	2.756	16.051
amo	95.632	215.357	84.019
phos	2.553	2.267	16.336
total mc in water	2.063	5.116	3954.598

Scores scaled by species

Variable	Weighted mean	Weighted SD	Inflation Factor
water MC-RR	0.153	0.562	78.405
water MC-LR	0.261	0.611	75.662
water other MCs	1.661	4.223	2843.210
Water volume	18538781.746	36767232.419	41.836

Eigenvalues

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7
Eigenvalues	0.488	0.418	0.313	0.255	0.243	0.180	0.168
Percentage	14.022	11.996	8.978	7.319	6.985	5.168	4.833
Cum. Percentage	14.022	26.018	34.996	42.315	49.299	54.467	59.300
Cum.Constr.Percentage	19.998	37.107	49.910	60.348	70.310	77.680	84.572
Spec.-env. correlations	0.988	0.944	0.930	0.890	0.904	0.928	0.846

CCA variable scores

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7
Total biovolume	-0.078	-0.072	0.034	0.049	0.082	0.158	-0.132
Microcystis biovol	-0.157	0.057	0.084	0.042	0.052	0.384	-0.262
Cylindro raci biovol	-0.379	-0.991	-0.293	0.162	-0.297	-0.414	0.238
Plankto lim biovol	-0.541	-1.093	-0.099	-0.652	0.143	0.862	0.085
Oscil sp1 biovol	-0.209	-0.395	0.220	1.591	1.184	0.727	2.935
Trache obl biovol	-0.077	0.468	-0.190	0.252	0.154	-0.324	0.088
Peridiniop sp1	-0.583	-1.313	-0.391	-0.073	-0.603	-1.022	-0.047
Crypto sp	0.312	0.481	-0.299	0.905	1.894	-0.700	-1.085
Peridiniop sp2 biovol	-0.201	0.408	-0.367	1.922	1.812	-0.323	0.963
Stauro cra biovol	1.879	-0.547	0.735	-0.787	-0.100	-0.193	0.171
Peridini sp1 biovol	1.588	-0.606	0.164	0.130	-1.918	0.302	-0.628
Staura gra biovol	1.896	0.053	-0.238	0.273	-0.881	0.211	0.167
Cylin phil biovol	1.672	-1.119	3.305	-1.433	1.555	-0.871	0.469
Staura smi biovol	2.277	0.750	1.430	2.366	-1.466	0.154	-0.124
Cos sp1 biovol	2.277	0.750	1.430	2.366	-1.466	0.154	-0.124
Staura man biovol	1.760	0.545	-1.527	-0.675	1.426	-0.665	-0.926
Staura cha biovol	2.689	0.495	-2.621	-1.179	0.057	0.139	0.951
Cos sp2 biovol	2.689	0.495	-2.621	-1.179	0.057	0.139	0.951
Spi pla biovol	-0.634	1.227	0.287	-0.592	-0.414	-0.236	0.305
Diato sp biovol	-0.644	1.060	0.609	0.006	-0.434	-1.049	-0.291
Oscil sp2 biovol	-0.625	1.387	0.126	-0.863	-0.395	0.128	0.548

CCA case scores	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7
FPR1	-0.505	-0.822	0.030	-0.663	0.374	2.497	-0.643
FPR2	-0.240	-0.020	0.187	0.179	0.277	1.498	-1.167
FPC1	-0.241	-0.018	0.188	0.178	0.276	1.505	-1.171
FPC2	-0.241	-0.019	0.188	0.178	0.276	1.503	-1.170
FPS1	-0.241	-0.019	0.188	0.179	0.276	1.501	-1.169
FPS2	-0.241	-0.018	0.188	0.178	0.276	1.504	-1.171

CA case scores	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7
HYrR1	-0.705	-1.699	-0.456	-0.346	-0.501	-0.103	0.026
HYrR2	-0.632	-1.536	-0.524	0.193	-0.864	-1.556	-0.132
HYrC1	-0.625	-1.524	-0.519	0.201	-0.847	-1.521	-0.116
HYrC2	-0.370	-0.479	-0.360	0.518	-0.081	-0.561	0.091
HYrS1	-0.629	-1.451	-0.271	-0.544	0.000	1.418	0.083
HYrS2	-0.537	-0.945	-0.349	-0.245	0.132	0.752	0.201
HYsR1	-0.424	-0.930	0.019	1.992	1.162	1.096	4.763
HYsR2	-0.527	-0.942	-0.513	0.343	-0.530	-1.502	-0.068
HYsC1	0.000	0.571	-0.327	1.206	2.137	-0.827	-1.835
HYsC2	-0.253	0.519	-0.368	2.200	2.133	-0.254	1.010
HYsS1	-0.189	0.409	-0.152	0.510	0.434	0.026	-0.398
MKR1	1.660	-0.803	0.350	-0.190	-1.966	0.437	-0.463
MKR2	1.907	-1.199	3.983	-2.435	2.069	-1.243	0.678
MKC1	2.042	0.790	1.306	3.430	-2.332	0.577	-0.335
MKC2	0.732	0.698	-1.237	0.405	2.898	-1.323	-2.643
MKS1	2.877	0.479	-2.841	-1.684	0.434	-0.184	0.997
MKS2	0.697	0.333	-0.268	0.617	-0.463	0.361	-0.141
SKR1	-0.621	1.259	0.467	-0.186	-0.403	-1.069	-0.277
SKR2	-0.638	1.398	0.252	-0.845	-0.428	0.132	0.550
SKC1	-0.650	1.345	0.522	-0.141	-0.463	-1.484	-0.293
SKC2	-0.626	1.389	0.228	-0.822	-0.401	0.163	0.553
SKS1	-0.628	1.395	0.227	-0.826	-0.404	0.158	0.561
SKS2	-0.613	1.354	0.220	-0.772	-0.376	0.152	0.507

Site scores, constrained by env. data

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7
FPR1	-0.518	-0.854	0.007	-0.659	0.338	2.452	-0.590
FPR2	-0.363	-0.056	0.070	0.441	0.013	1.413	-1.225
FPC1	-0.352	0.251	0.134	0.625	0.055	1.707	-1.444
FPC2	-0.153	-0.050	0.116	-0.070	0.472	1.408	-1.118
FPS1	-0.243	-0.030	0.300	0.151	0.262	1.480	-1.112
FPS2	-0.150	-0.106	0.316	-0.102	0.468	1.556	-1.068
HYrR1	-0.422	-1.596	0.001	-1.275	-0.226	-0.525	0.458
HYrR2	-0.480	-1.479	-0.686	0.239	-2.034	-1.056	-0.276
HYrC1	-0.675	-1.086	-0.126	-0.266	-0.147	-1.662	-1.235
HYrC2	-0.519	-0.399	-0.904	1.185	-0.332	-1.457	-0.327
HYrS1	-0.640	-1.426	-0.283	-0.510	0.002	1.424	0.072
HYrS2	-0.558	-0.566	-0.084	-0.298	0.413	0.128	0.347
HYsR1	-0.209	-0.395	0.220	1.591	1.184	0.727	2.935
HYsR2	-0.726	-1.138	-0.641	0.718	0.123	-0.778	0.891
HYsC1	-0.275	0.378	-0.060	1.977	1.175	-0.050	0.358
HYsC2	-0.201	0.408	-0.367	1.922	1.812	-0.323	0.963
HYsS1	-0.188	0.151	-1.551	0.965	0.868	0.125	-1.193
MKR1	1.588	-0.606	0.164	0.130	-1.918	0.302	-0.628
MKR2	1.672	-1.119	3.305	-1.433	1.555	-0.871	0.469
MKC1	2.277	0.750	1.430	2.366	-1.466	0.154	-0.124
MKC2	0.929	0.589	-0.549	-0.224	2.651	-1.384	-2.604
MKS1	2.689	0.495	-2.621	-1.179	0.057	0.139	0.951
MKS2	1.000	-0.367	0.040	-0.247	0.029	0.236	0.621
SKR1	-0.711	0.474	0.925	-0.122	-0.649	-1.034	0.171
SKR2	-0.547	0.516	-0.317	-1.205	-0.013	0.274	0.830
SKC1	-0.596	1.476	0.385	0.097	-0.281	-1.060	-0.617
SKC2	-0.641	1.482	0.366	-0.923	-0.514	-0.018	0.729
SKS1	-0.473	2.081	-0.221	-1.227	0.047	-0.386	0.409
SKS2	-0.838	1.360	0.632	-0.110	-1.074	0.685	0.239

Canonical coefficients

	Spec.	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7
dep		1.313	-0.254	1.626	2.609	-6.000	1.053	1.317
temp		-0.036	-0.375	0.262	-0.336	0.148	0.311	1.197
cond		-0.685	0.710	1.753	0.814	-1.628	0.041	-0.523
ph		0.135	-0.027	-0.129	-0.740	0.049	0.273	-0.686
to_bac		0.443	-0.102	-0.801	-0.610	0.979	0.102	0.980
chlo		-0.486	-2.828	1.575	-1.582	-2.624	-2.667	-4.795
do		-0.295	-0.320	-0.200	-0.624	-0.367	-0.728	-0.791

Canonical coefficients (continued)

Spec.	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7
secchi	-0.345	-0.080	0.795	-0.662	2.447	-0.925	0.871
alk	-0.065	-0.508	1.238	-0.060	-0.306	-0.485	0.832
bod	1.173	3.123	-2.981	1.486	4.322	3.177	7.219
nitr	0.162	-0.751	-0.607	-1.815	0.278	-0.466	-0.762
amo	-0.646	-1.564	1.520	-0.531	-2.156	-1.381	-3.977
phos	0.550	0.813	-1.378	-0.579	1.626	0.173	1.612
total mc in water	4.555	11.786	-4.781	6.515	1.538	-11.152	-3.059
water MC-RR	-1.097	-1.866	2.404	0.168	-1.899	0.353	-1.147
water MC-LR	-1.258	-1.191	1.621	-0.491	-1.206	1.947	-1.508
water other MCs	-2.790	-8.484	0.878	-5.455	1.754	10.964	5.214
Water volume	-0.520	0.154	-0.162	-1.444	2.434	-0.415	-2.772

Interset correlations between env. variables and site scores

Envi.	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7
dep	0.925	-0.097	0.211	-0.057	-0.039	-0.121	-0.066
temp	0.082	-0.449	0.217	-0.322	-0.157	0.232	0.252
cond	-0.514	0.624	0.145	-0.246	-0.110	0.211	-0.035
ph	0.033	-0.056	0.001	-0.485	-0.060	0.085	0.219
to_bac	0.121	0.024	-0.137	-0.043	0.085	0.230	-0.121
chlo	-0.089	0.003	0.056	0.016	0.062	0.346	-0.236
do	0.274	-0.354	-0.294	-0.296	-0.291	-0.437	0.017
secchi	0.810	-0.181	0.303	-0.100	0.151	-0.278	0.017
alk	-0.592	0.111	0.074	0.092	0.078	0.414	-0.214
bod	-0.091	0.046	0.050	0.019	0.053	0.337	-0.227
nitr	-0.124	0.241	0.099	-0.211	-0.025	0.143	-0.049
amo	-0.138	0.093	0.086	0.017	0.052	0.458	-0.334
phos	0.214	0.544	0.128	-0.257	-0.069	0.281	-0.221
total mc in water	-0.125	-0.092	0.036	-0.030	0.095	0.577	-0.281
water MC-RR	-0.109	-0.113	0.021	-0.073	0.073	0.452	-0.165
water MC-LR	-0.100	-0.046	0.050	-0.003	0.097	0.607	-0.357
water other MCs	-0.125	-0.096	0.033	-0.029	0.091	0.556	-0.266
Water volume	0.882	-0.032	0.263	-0.016	0.040	-0.137	-0.129

Intraset correlations between env. variables and constrained site scores

Envi.	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7
dep	0.936	-0.103	0.227	-0.064	-0.043	-0.131	-0.078
temp	0.083	-0.475	0.233	-0.361	-0.174	0.250	0.297
cond	-0.520	0.661	0.156	-0.276	-0.121	0.227	-0.041
ph	0.034	-0.059	0.001	-0.545	-0.067	0.092	0.258
to_bac	0.123	0.025	-0.147	-0.048	0.094	0.248	-0.143
chlo	-0.090	0.003	0.060	0.018	0.068	0.373	-0.278
do	0.277	-0.375	-0.316	-0.332	-0.321	-0.471	0.020
secchi	0.820	-0.191	0.325	-0.112	0.167	-0.299	0.021
alk	-0.600	0.117	0.080	0.103	0.087	0.446	-0.252
bod	-0.092	0.049	0.054	0.022	0.059	0.363	-0.268
nitr	-0.125	0.255	0.106	-0.237	-0.027	0.154	-0.057
amo	-0.140	0.098	0.093	0.019	0.058	0.493	-0.395
phos	0.217	0.576	0.137	-0.289	-0.076	0.303	-0.261
total mc in water	-0.126	-0.098	0.039	-0.034	0.105	0.622	-0.333
water MC-RR	-0.110	-0.120	0.022	-0.082	0.081	0.488	-0.195
water MC-LR	-0.101	-0.048	0.054	-0.003	0.108	0.654	-0.422
water other MCs	-0.126	-0.101	0.036	-0.032	0.100	0.599	-0.315
Water volume	0.893	-0.034	0.283	-0.018	0.045	-0.147	-0.153

Biplot scores for env. variables

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7
dep	0.936	-0.103	0.227	-0.064	-0.043	-0.131	-0.078
temp	0.083	-0.475	0.233	-0.361	-0.174	0.250	0.297
cond	-0.520	0.661	0.156	-0.276	-0.121	0.227	-0.041
ph	0.034	-0.059	0.001	-0.545	-0.067	0.092	0.258
to_bac	0.123	0.025	-0.147	-0.048	0.094	0.248	-0.143
chlo	-0.090	0.003	0.060	0.018	0.068	0.373	-0.278
do	0.277	-0.375	-0.316	-0.332	-0.321	-0.471	0.020
secchi	0.820	-0.191	0.325	-0.112	0.167	-0.299	0.021
alk	-0.600	0.117	0.080	0.103	0.087	0.446	-0.252
bod	-0.092	0.049	0.054	0.022	0.059	0.363	-0.268
nitr	-0.125	0.255	0.106	-0.237	-0.027	0.154	-0.057
amo	-0.140	0.098	0.093	0.019	0.058	0.493	-0.395
phos	0.217	0.576	0.137	-0.289	-0.076	0.303	-0.261
total mc in water	-0.126	-0.098	0.039	-0.034	0.105	0.622	-0.333
water MC-RR	-0.110	-0.120	0.022	-0.082	0.081	0.488	-0.195
water MC-LR	-0.101	-0.048	0.054	-0.003	0.108	0.654	-0.422
water other MCs	-0.126	-0.101	0.036	-0.032	0.100	0.599	-0.315
Water volume	0.893	-0.034	0.283	-0.018	0.045	-0.147	-0.153

Centroids of env. variables							
	Axis 1	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**	**Axis 6**	**Axis 7**
dep	1.278	-0.140	0.309	-0.087	-0.058	-0.178	-0.107
temp	0.011	-0.063	0.031	-0.048	-0.023	0.033	0.039
cond	-0.366	0.465	0.110	-0.194	-0.085	0.160	-0.029
ph	0.005	-0.008	0.000	-0.075	-0.009	0.013	0.035
to_bac	0.455	0.092	-0.547	-0.179	0.348	0.919	-0.532
chlo	-0.277	0.009	0.185	0.054	0.210	1.151	-0.859
do	0.138	-0.188	-0.158	-0.166	-0.161	-0.236	0.010
secchi	0.956	-0.223	0.379	-0.131	0.195	-0.349	0.024
alk	-0.250	0.049	0.033	0.043	0.036	0.186	-0.105
bod	-0.294	0.157	0.174	0.069	0.189	1.164	-0.859
nitr	-0.223	0.455	0.189	-0.424	-0.049	0.275	-0.102
amo	-0.315	0.221	0.209	0.044	0.130	1.111	-0.889
phos	0.192	0.512	0.122	-0.257	-0.067	0.269	-0.231
total mc in water	-0.313	-0.243	0.097	-0.084	0.260	1.543	-0.824
water MC-RR	-0.404	-0.440	0.082	-0.302	0.297	1.793	-0.718
water MC-LR	-0.237	-0.113	0.125	-0.008	0.252	1.529	-0.986
water other MCs	-0.321	-0.258	0.090	-0.082	0.255	1.524	-0.800
Water volume	1.771	-0.066	0.562	-0.036	0.088	-0.292	-0.303

5) Carnonical correspondence analysis (CCA) for environmental factors of sediment, phytoplankton species composition and microcystins

Data file - E:\MVSP\PhD.dissertation\Dominant species.mvs
Analysing 21 variables x 29 cases
Environmental data file - E:\MVSP\PhD.dissertation\Sediment env. factors.mvs

Analysing 11 variables x 29 cases
Data log(e) transformed
Tolerance of eigenanalysis set at 1E-7

Scores scaled by species			
Variable	**Weighted mean**	**Weighted SD**	**Inflation Factor**
S pH	6.143	0.557	5.750
S total bacterial plat count (CFU/ml)	424269.971	1687150.215	3.469
S nitrate	0.431	0.673	2.604
S ammonium	1405.217	1203.808	16.998
S phosphate	300.333	330.471	1.926
%OM	5.176	3.864	9.510
%sand	42.388	22.138	400.043
%silt	18.382	10.806	114.606

Scores scaled by species (continued)

Variable	Weighted mean	Weighted SD	Inflation Factor
%clay	38.990	19.868	311.261
total mc in sed.	23.317	27.997	5.924
percent mc sorption	76.692	36.677	2.027

Eigenvalues

	Axis 1	Axis 2
Eigenvalues	0.419	0.389
Percentage	12.044	11.181
Cum. Percentage	12.044	23.225
Cum.Constr.Percentage	32.645	62.948
Spec.-env. correlations	0.944	0.909

CCA variable scores

	Axis 1	Axis 2
Total biovolume	0.004	0.118
Microcystis biovol	0.127	0.044
Cylindro raci biovol	-0.313	0.939

CCA variable scores

	Axis 1	Axis 2
Plankto lim biovol	0.062	1.049
Oscil sp1 biovol	-0.165	1.929
Trache obl biovol	0.276	-0.176
Peridiniop sp1	-0.458	1.022
Crypto sp	-0.513	-0.055
Peridiniop sp2 biovol	-0.250	0.069
Stauro cra biovol	-1.492	-1.206
Peridini sp1 biovol	-1.617	-1.369
Staura gra biovol	-1.380	-0.985
Cylin phil biovol	-1.538	-1.224
Staura smi biovol	-1.649	-1.001
Cos sp1 biovol	-1.649	-1.001
Staura man biovol	-1.244	-1.036
Staura cha biovol	-1.216	-0.918

CCA variable scores (continued)		
	Axis 1	**Axis 2**
Cos sp2 biovol	-1.216	-0.918
Spi pla biovol	1.338	-0.842
Diato sp biovol	1.332	-0.981
Oscil sp2 biovol	1.333	-0.771

CCA case scores		
	Axis 1	**Axis 2**
FPR1	0.150	0.975
FPR2	0.155	0.209
FPC1	0.156	0.208
FPC2	0.156	0.208
FPS1	0.156	0.208
FPS2	0.156	0.208
HYrR1	-0.307	1.697
HYrR2	-0.451	1.489
HYrC1	-0.447	1.483
HYrC2	-0.019	0.730
HYrS1	-0.106	1.556
HYrS2	0.047	1.164
HYsR1	-0.261	2.135
HYsR2	-0.203	1.045
HYsC1	-0.036	-0.057
HYsC2	0.094	0.031
HYsS1	0.327	-0.039
MKR1	-1.854	-1.132
MKR2	-1.966	-1.621
MKC1	-1.650	-1.251
MKC2	-0.644	-0.575
MKS1	-1.920	-1.675
MKS2	-0.468	-0.576
SKR1	1.395	-0.881
SKR2	1.431	-0.806
SKC1	1.492	-0.981
SKC2	1.406	-0.787
SKS1	1.411	-0.791
SKS2	1.372	-0.765

Site scores, constrained by env. data		
	Axis 1	**Axis 2**
FPR1	0.155	0.887
FPR2	0.618	0.602
FPC1	0.194	0.039
FPC2	0.129	0.207
FPS1	-0.255	0.458
FPS2	0.124	0.171
HYrR1	-0.833	0.728
HYrR2	-0.431	0.384
HYrC1	-0.488	1.635
HYrC2	-0.186	0.641
HYrS1	0.000	1.297
HYrS2	0.749	1.187
HYsR1	-0.165	1.929
HYsR2	-0.168	1.323
HYsC1	0.206	0.977
HYsC2	-0.250	0.069
HYsS1	-0.210	0.825
MKR1	-1.617	-1.369
MKR2	-1.538	-1.224
MKC1	-1.649	-1.001
MKC2	-1.269	-1.141
MKS1	-1.216	-0.918
MKS2	-0.967	-0.561
SKR1	1.471	1.302
SKR2	1.323	-0.388
SKC1	1.233	-0.754
SKC2	1.716	-0.967
SKS1	0.952	-0.733
SKS2	1.323	-0.949

Canonical coefficients		
	Spec. Axis 1	**Spec. Axis 2**
S pH	0.262	0.523
S total bacterial plat count (CFU/ml)	0.010	-0.128
S nitrate	-0.113	0.275
S ammonium	0.466	0.596
S phosphate	0.160	0.061
%OM	-0.402	-0.495
%sand	-0.548	-2.470

Canonical coefficients (continued)		
	Spec. Axis 1	Spec. Axis 2
%silt	-0.343	-1.002
%clay	-1.059	-1.644
total mc in sed.	-0.208	0.240
percent mc sorption	-0.308	-0.037

Interset correlations between env. variables and site scores		
	Envi. Axis 1	Envi. Axis 2
S pH	0.520	0.646
S total bacterial plat count (CFU/ml)	0.023	0.065
S nitrate	-0.079	0.700
S ammonium	0.001	0.306
S phosphate	0.508	-0.026
%OM	-0.286	0.105
%sand	0.783	-0.443
%silt	-0.027	0.726
%clay	-0.859	0.096
total mc in sed.	0.226	0.223
percent mc sorption	-0.517	0.105

Intraset correlations between env. variables and constrained site scores		
	Envi. Axis 1	Envi. Axis 2
S pH	0.551	0.710
S total bacterial plat count (CFU/ml)	0.025	0.072
S nitrate	-0.084	0.770
S ammonium	0.001	0.337
S phosphate	0.538	-0.029
%OM	-0.303	0.115
%sand	0.829	-0.488
%silt	-0.029	0.799
%clay	-0.910	0.106
total mc in sed.	0.240	0.245
percent mc sorption	-0.547	0.115

Biplot scores for env. variables		
	Axis 1	**Axis 2**
S pH	0.551	0.710
S total bacterial plat count (CFU/ml)	0.025	0.072
S nitrate	-0.084	0.770
S ammonium	0.001	0.337
S phosphate	0.538	-0.029
%OM	-0.303	0.115
%sand	0.829	-0.488
%silt	-0.029	0.799
%clay	-0.910	0.106
total mc in sed.	0.240	0.245
percent mc sorption	-0.547	0.115

Centroids of env. variables		
	Axis 1	**Axis 2**
S pH	0.050	0.064
S total bacterial plat count (CFU/ml)	0.098	0.284
S nitrate	-0.131	1.203
S ammonium	0.001	0.288
S phosphate	0.592	-0.032
%OM	-0.226	0.086
%sand	0.433	-0.255
%silt	-0.017	0.470
%clay	-0.464	0.054
total mc in sed.	0.288	0.294
percent mc sorption	-0.262	0.055

CURRICULUM VITAE

Name	Rattapoom Prommana
Date of Birth	4th December 1976
Home address	45/1, M. 2, T. Nhong-Nham, Muang Lamphun, Lamphun 51000, Thailand
Present Institution	Department of Biology, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand
Tel:	66-53-941950
Fax:	66-53-892259
Cell phone No:	66-9-8527676
E-mail address:	smartrattapoom@yahoo.com

Short Scientific Biography:

Education

1999-2001 M.Sc. (Biology), Chiang Mai University, Chiang Mai, Thailand

- Distribution of Toxic Algae and Water Quality in Kwan Phayao, Phayao Province in 1999-2000

1995-1998 B.Sc. (Microbiology), Chiang Mai University, Chiang Mai, Thailand

- Comparison of Methods for Chitinase Assay

Field of Specialization

- Morphological taxonomy of algae
- Cyanobacterial toxin analysis
- Assessment of water quality using freshwater phytoplankton as biological indicator

● Freshwater ecology

Scholarship

2002-2004 PhD. thesis funded by the Royal Golden Jubilee PhD. Program and the Thailand Research Fund

Workshop in field specialization

April 2004 The International Workshop on New Methods for Microcystin Detection by Chiang Mai University, Thailand and the National Institute for Environmental Study, Japan at Medical Science Research Equipment Center, Faculty of Medicine, Chiang Mai Universtiy, Chiang Mai, THAILAND

February 2001 Workshop on eutrophication and water quality management in some water resources in Thailand by Water Research Center (WRC) at Biology Department, Faculty of Science, Chiang Mai University, Chiang Mai, THAILAND

Attended Conference

28-30 April 2005 Oral presentation in "Analysis of Microcystin Toxins in Sediments and Overlaying Water in Scottish and Thai Waterbodies" in RGJ-PhD Congress VI. at Royal Jomtien Palm Beach resort, Pattaya, Chonburi, THAILAND

23-25 March 2005 Oral presentation in "Blue-Green algae and Microcystins in Different Kinds of Water Bodies in Northern and North-Eastern Thailand" in the Second National Conference on Algae and Plankton at Holiday Garden Hotel, Chiang Mai, THAILAND

5-7 January 2005 Oral presentation in "Analysis of microcystin toxins in sediments and overlaying water in Scottish and Thai waterbodies" in the British Phycological Society 53rd Annual Winter Meeting at Birmingham University, Birmingham, the UNITED KINGDOM

26-28 November 2004 Attended in CYNONET: a Global Network for the Hazard Management of Cyanobacterial Blooms and Toxins in Water Resources at the West Park Center, University of Dundee, Dundee, the UNITED KINGDOM

3-5 September 2004 Attended in "Toxic" meeting (European Community Programme): Barriers Against Cyanotoxins in Drinking Water at the West Park Center, Universtiy of Dundee, the UNITED KINGDOM

6-8 November 2003 Oral presentation in "Interviews with people regarding toxic cyanobacteria in Kwan Phayao, a lake in Phayao province, Thailand" in the 2003 International Symposium on Environmental Management: Policy, Research and Education at Lotus Pang Suan Kaew Hotel, Chiang Mai, THAILAND

25-29 March 2003 Oral presentation "Distribution of toxic algae and water quality in Kwan Phayao, Phayao province, Thailand in 1999-2000" in the International Conference on Water Resources Management for Safe Drinking Water at Novotel hotel, Chiang Mai, THAILAND

30-31 October 2002 Oral presentation "Strategies on toxic algae prevention and suggested methods to improve water treatment in Thailand" in the 2nd International Toxic Algae Control Symposium at Tsukuba International Congress Center, Tsukuba, JAPAN

30 January – 1 February 2000 Poster presentation "Two species of filamentous cyanobacteria, Anabaena spp. and water quality in Kwan Phayao, Phayao province, Thailand in 1999-2002" in the Third Asian Microscopy Conference-2002 and Nineteenth Annual Conference

of EMST at Lotus Pang Suan Kaew Hotel, Chiang Mai, THAILAND

16 – 20 July 2001 Poster presentation "Distribution of toxic cyanobacteria and water quality in Kwan Phayao, Phayao province, Thailand in 1999-2000" in the Fifth International Conference on Toxic Cyanobacteria at Noosa Lake resort, Queensland, AUSTRALIA

3-6 July 2000 Poster presentation "The investigation of toxic algae in the Kwan Phayao reservoir, Phayao, Thailand" in the Forth Asia-Pacific Conference on Algae Biotechnology at Hong Kong Convention and Exhibition Centre. HONG KONG

Publication

Prommana, R., Peerapornpisal, Y., Whangchai, N., Morrison, L.F., Metcalf, J.S., Ruangyuttikarn, W., Towprom, A. and Codd, G.A. 2006. Microcystins in cyanobacterial blooms from two freshwater prawn (*Macrobrachium rosenbergii*) ponds in northern Thailand. *ScienceAsia*, 32(4): in press.

Prommana, R., Morrison, L.F., Reilly, M., Metcalf, J.S. and Codd, G.A. 2005. Analysis of microcystin toxins in sediments and overlaying water in Scottish and Thai waterbodies. *The Phycologist*, 68(Spring): 25-26 (abstract).

Prommana, R., Peerapornpisal, Y. and Lipigorngoson, S. 2003. Distribution of toxic algae and water quality in Kwan Phayao, Phayao province, Thailand in 1999-2000. *Journal of the Science Faculty of Chiang Mai University*, 30(3): 203-209.

Peerapornpisal, Y., Sonthichai, W., Sukchotiratana, M., Lipigorngoson, S., Ruangyuttikarn, W., Ruangrit, K., Pekkoh, J., **Prommana, R.**, Panuvanitchakorn, N., Ngearnpat, N., Kiatpradab, S. and Promkutkaew, S. 2002. Survey and mornitoring of toxic cyanobacteria in water resources for water supplies and fisheries in Thailand. *Chiang Mai Journal of Science*, 29(2): 71-79.