GCP/RAF/271/FIN-TD/79(En) November 1997

LIMNOLOGY OF LAKE TANGANYIKA DURING LAKE-WIDE CRUISE
(28 August - 6 September, 1995)

by

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FINNISH INTERNATIONAL DEVELOPMENT AGENCY

FOOD AND AGRICULTURAL ORGANIZATION
OF THE UNITED NATIONS

Mpulungu, November 1997

PREFACE

The Research for the Management of the Fisheries on Lake Tanganyika project (LTR) became fully operational in January 1992. It is executed by the Food and Agriculture Organization of the United Nations (FAO) and funded by the Finnish International Development Agency (FINNIDA) and the Arab Gulf Program for the United Nations Development Organization (AGFUND).

LTR's objective is the determination of the biological basis for fish production on Lake Tanganyika, in order to permit the formulation of a coherent lake-wide fisheries management policy for the four riparian States (Burundi, Tanzania, Dem. Rep. of Congo and Zambia).

Particular attention is given to the reinforcement of the skills and physical facilities of the fisheries research units in all four beneficiary countries as well as to the build-up of effective coordination mechanisms to ensure full collaboration between the Governments concerned.

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For bibliographic purposes this document should be cited as follows:

V. Th. Langenberg, J-M. Tumba, K. Tshibangu, C. Lukwesa,
1997 L. Makassa, and D. Chitamwebwa. Limnology of Lake Tanganyika during lake-wide cruise (28 August - 6 September, 1995). FAO/FINNIDA Research for the Management of the Fisheries on Lake Tanganyika.
GCP/RAF/271/FIN-TD/79(En):26p.

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ACKNOWLEDGEMENTS

We thank the LTR coordinator, Dr. G. Hanek, as well as other LTR staff at Bujumbura, Kigoma and Mpulungu for their support.

We want to thank in Bujumbura E. Gahungu, E. Nikomeze, B. Ndimunzigo, C. Butoyi and also all other occasional assistants for helping us preparing and setting up the laboratories of the *R/V Tanganyika Explorer* for this cruise, and of course the complete crew of the *R/V Tanganyika Explorer*.

We wish to thank Dr. J. Kapetsky, Mr. M. Doeff and Mrs. D. Blessich for their assistance.

We would like to thank the Governments of Burundi, Tanzania, Democratic Republic of Congo and Zambia for their co-operation throughout this study.

Table of Contents

LIST OF FIGURES AND APPENDICES

Figure 10. Average concentrations of the upper 60m of water of Soluble Reactive Phosphate (SRP), chlorophyll *a*, Total Nitrogen (NH4-N, NO3-N and NO2-N) and silicate (SiO_2-Si) versus the latitude in Lake Tanganyika during 28 August-6 September 1995).

Figure 11. Average values/concentrations of the upper 5 m of water of Temperature, Chlorophyll *a*, Conductivity and Turbidity versus the latitude in Lake Tanganyika during the period of 28 August - 6 September 1995).

Appendix 1. Results of the horizontal sampling carried out at the stern of the *R/V Explorer* during cruise 3 (28 August - 6 September 1995). Exact location of the sampling sites are indicated by Lat (latitude) and Lon (Longitude). Temp = temperature (°C), Cond = conductivity (µS/cm), Turb = turbidity (NTU) Fluor = relative fluorescence and Chl a = Chlorophyll *a* concentration (mg/l) calculated with the relation found in figure 4. Results approx. represent mixed upper 5m of water column. Parameters shown are averages of two or three repetitive analyses.

Appendix 2. Results of the vertical sampling carried out from the *R/V Explorer* during cruise 3 (28 August - 6 September 1995). Exact location of the sampling sites are indicated by 'coordinates'. Start and End = Secchi disk depth resp. at the start and at the end of the sampling, Temp = temperature (°C), D.O. = dissolved oxygen concentration (mg/l), Cond = conductivity (µS/cm), Turb = turbidity (NTU), Fluor = relative fluorescence. Nutrient concentrations (SRP as soluble reactive phosphate, NH4-N as ammonia, NO3-N as nitrate and NO2-N as nitrite) are averages (mg/l) of two or three repetitive analyses on mixed water samples of the upper 60m of depth.

SUMMARY

Wind induced upwelling of nutrient rich cold water and mixing occurred in the Southern parts of the lake. Evidence consists of the appearance of isotherms in the South which are normally found much deeper into the water column and the more homogeneous distribution of most parameters measured. Coincident increased concentrations of chlorophyll *a* probably resulted from the upwelling of nutrients (especially phosphates) which are abundant in deep water.

This study showed that the upwelling event in the South and the related mixing events across a South to North down-tilted thermocline resulted in an increase of concentrations of phosphates and chlorophyll *a*, and values for conductivity and turbidity South from about 7°S Latitude (i.e., South of Moba, Democratic Republic of Congo) with the largest increase close to Mpulungu, Zambia.

It is suggested that Lake Tanganyika’s productivity system is merely wind driven, and upwelling rates of internal nutrient loading determines how much of the primary production is eventually channelled into secondary and fish production.

1. INTRODUCTION

One of the main objectives of the Lake Tanganyika Research project (LTR) is to investigate the trophic basis supporting the pelagic fish resource. An understanding of the factors affecting fish abundance, distribution and variability forms the foundation of building towards sustainable fisheries management.

The limnology component, as part of the Scientific Sampling Programme (SSP) was primarily concerned with describing the main physical processes in Lake Tanganyika and how these affect factors such as chlorophyll *a*, nutrient chemistry and fluxes, temperature distribution and light which in turn control primary production in the lake.

This report presents the results of limnological sampling carried out on board the *R/V Tanganyika Explorer* during the third scientific lake-wide cruise, which took place from 28 August to 6 September, 1995.

Its overall emphasis was to examine the physical and chemical structure of the pelagic ecosystem throughout the lake. During this cruise data was collected on the spatial distribution of primary production, chlorophyll *a* concentrations (relative fluorescence) and the abiotic composition (chemistry) of the epilimnic waters. Furthermore, zooplankton samples were taken to study their distribution and composition.

2. METHODOLOGY

This cruise aboard *R/V Tanganyika Explorer* took place from 28 August to 6 September 1995.

During this study the limnological parameters were measured by both horizontal and vertical sampling. During a vertical sampling, measurements of the following parameters were made; (a) water transparency (Secchi disk), water temperature, relative fluorescence, dissolved oxygen, conductivity, pH and Turbidity and (b) PO_4-P, NH_4-N, NO_3-N, NO_2-N and SiO_2-Si. The nutrient concentrations were determined, in duplo or triplo, on mixed water samples of the upper 60m of water.

During a horizontal sampling (normally when *R/V Tanganyika Explorer* was cruising between two vertical samplings) we measured temperature, conductivity, pH, turbidity and relative fluorescence. A schedule was made concerning the exact time when people on board the vessel were allowed to use kitchen and sanitary facilities, in order to prevent possible interference/contamination with the sampling. We estimated (through temperature measurements) that during a horizontal sampling the water samples, taken at the stern of the vessel for analyses, were mixed samples of approximately the upper 5m of water column.

A total of 37 horizontal and 16 vertical samplings were carried out. During 5 out of 16 vertical samplings 4h *in situ* radiocarbon incubations were carried out up to a depth of 60m and at 10m interval (C^{14} as sodium carbonate). During these incubations the measurements carried out during a regular vertical sampling as mentioned above were extended with measurements, in duplo, on the total and phenol alkalinity (which were like most nutrients determined on mixed water samples of the upper 60m of water) and measurements on the vertical PAR distribution (Photosynthetically Active Radiation up to 50m depth). Furthermore were all vertical samplings accompanied by CTD measurements (measuring conductivity, temperature and water density at an interval of 10cm). The CTD-12 probe (Micro systems Ltd.) was lowered, down to 300m depth were possible, at the start and end of each vertical sampling.

The sampling procedures followed were described by Plisnier (1993 and 1996). More information and details of the visits to the sampling sites are presented in Appendix 1 and 2.

The data on the primary production measurements are unreleased, and related parameters like underwater Par distribution and Alkalinity will therefore not be discussed in this report.

3. RESULTS

3.1. Vertical sampling

3.1.1. fluorescence and Chlorophyll *a*

Since time was a limiting factor during this cruise, fluorometry was used to determine chlorophyll a concentrations in the lake. *In vivo* fluorescence was measured by using a Turner Designs 10-au-005 model field fluorometer. This fluorometer works on the principle that chlorophyll a exhibits a measurable deep red fluorescence when excited by blue light. Although the sensitivity of the technique is much greater than that of any spectrophotometric method, there are a wide variety of sources of error. Chief sources of error are due to the presence of other pigments and other fluorescent substances (like degradation products of chlorophyll *a*, turbidity, etc.) present in the sample, and decomposition or growth of the sample prior to analysis. Fluorescence is also affected by different types and physiological state of the algae. Furthermore is it highly recommended that the apparatus must be calibrated for each type of alga or phytoplankton community of interest with reference to an absolute extractive spectrophotometric method. The extractive spectrophotometric method we used during our SSP is described by Salonen and Sarvala (1995) and Langenberg (1996). This method corrects for turbidity and interference of degradation products of chlorophyll a (phaeopigments) which can be substantial in Lake Tanganyika (see Figure 3). Figure 3 shows that especially in the upper water layers of the lake, large differences exists when correcting for phaeopigments or not. Thus, concerning the results of the chlorophyll analyses used to calibrate the field fluorometer, only the samples on which additional absorbance measurements of acidified pigments samples were carried out were used. Due to the fact that these time consuming extraction analyses were not possible on board, the fluorometer was calibrated by using the data of our regular SSP of the months April, May and August 1995. Figure 4 shows that during those months the chlorophyll a determinations by extraction method was in general 4.5 times higher than the fluorescence measured. A satisfactory relation was found (r^2=0.8), partly due to the exclusion of water samples collected between 12:00 and 16:00 (see Figure 2) when strong photoinhibition changes the fluorescence response of the algal community (Järvinen *et al*, 1996).

It can be expected that algal communities differ in depth and place and thus affect fluorescence readings. Nevertheless, the relation found in Figure 4 was used to recalculate all the fluorescence values found during this study into chlorophyll *a* concentrations.

Figures 5 and 10 shows the results of the vertical chlorophyll *a* distribution along the sampled transect. Figure 5 shows that during the cruise the water column in the Northern parts of the lake were different than those in the Southern parts of the lake. While in general concentrations of chlorophyll *a* decreased in depth, absolute chlorophyll *a* minima were encountered in much shallower waters in the North than in the South. Higher chlorophyll *a* concentrations were found much deeper into the water column in the South than in the North. Chlorophyll maxima were found especially in the Southern parts of the lake (maximum > 3.5 µg/l). Furthermore, there are some indications that, besides the Southern parts, chlorophyll *a* peaks between 30 and 50m of depth.

Figure 10 shows the average chlorophyll *a* values measured on mixed water samples of the upper 60m of water. The figure shows that chlorophyll *a* concentrations tend to increase towards the South of the lake.

3.1.2. Temperature

The results of the temperature measurements made are presented in Figures 6, 7 and 8. Figure 6 shows two example of temperature depth profiles measured by the CTD-12 probe, characteristic for the Southern and the Northern parts of the lake. The surface plot of temperature and depth is a repeat of Figure 7 with the difference that for Figure 7 only the CTD profiles were used and for the Figure 8 only the vertical temperature profiles measured by thermometers in the bottle and the temperature sensor attached to the oxygen sensor.

Examination of Figures 6 and 7 show that the thermal/density structure of lake Tanganyika was highly spatial, with a stronger developed thermocline between 60 -80 meters depth in the Northern part of the lake and a less well developed or absent thermocline in the Southern part of the lake. In the South the water column temperature was more uniform indicating greater mixing.

Furthermore, Figures 7 and 8 show that the temperature in water layers around and below 100m of depth are similar throughout the lake indicating that the 24°C isotherm demonstrates rather stable deeper water layers unaffected by the trade winds and mixing events during that period and that related currents are probably limited to the upper water layers of the lake.

In the South the upwards extension of the isotherms higher then 25 °c are clearly shown. The cruise data shows clear evidence of Southern epilimnion cooling and tilting of the isotherms which were inclined towards the Northern part of the lake. This tilting was probably to be due to the Northward migration of surface water forced by the South-east trade winds during July and August.

3.1.3. pH

The results of the pH measurements made during this cruise are presented in Figure 9 **B**. Throughout the lake pH values decreased with depth. The largest pH gradients were found in the Northern parts around the thermocline. In the Southern parts of the lake the vertical distribution of pH was the most uniform. Highest epilimnic pH values were found in the North.

3.1.4. Conductivity

The results of the conductivity measurements (in µS/cm) made during this cruise are presented in Figure 9 **A**. Conductivity values increased with increasing depth. The lowest and highest values of conductivity were encountered in the Northern parts of the lake with a strong gradient around the thermocline. The upper 100m of water in the Southern parts were characterised by a far more uniform distribution of conductivity with higher values than the epilimnic values of the Northern parts of the lake.

3.1.5. Turbidity

The results of the turbidity measurements (in NTU) are presented in Figure 9 **C**. While in general turbidity values decreased with depth, throughout most of the lake, the vertical distribution of turbidity in the Southern part of the lake was characterised by the high values of the upper 30m of depth and below 80m of depth. In the Northern parts of the lake, stronger gradients of turbidity were found around the thermocline.

3.1.6. Dissolved Oxygen

The results of the dissolved oxygen concentrations (mg/l) are presented in figure 8 **B**. Well oxygenated waters extended into depths far greater in the South than in the North. The water column in the North was characterised by the presence of an oxycline situated around the thermocline which were absent in the upper 100m of water in the South. Throughout the lake the vertical distribution of dissolved oxygen and temperature seemed to be closely linked.

3.1.7. Phosphate

Figure 10 (upper left corner) shows the average Soluble reactive phosphate concentrations (SRP in mg/l) measured on mixed water samples of the upper 60m of water. The figure shows that SRP concentrations tend to increase towards the South of the lake.

3.1.8. Total Nitrogen

Figure 10 (lower left corner) also shows the average Total nitrogen (NH_4-N, NO_3-N and NO_2-N in mg/l) concentration measured on mixed water samples of the upper 60m of water. The figure shows that chlorophyll a concentrations tend to increase towards the South of the lake and are merely dominated by the concentrations of NO_3-N while NH_4-N and NO_2-N are in most cases close to undetectable levels.

3.1.9. Silicate

Figure 10 (lower right corner) shows the average silicate concentration (SiO_2-Si in mg/l) measured on mixed water samples of the upper 60m of water. Although there is no clear relation between latitude and silicate concentrations, there is a trend for the lowest values of silicate to be found in the Southern part of the lake.

3.1.10. Chlorophyll *a*

Figure 10 (upper right corner) furthermore shows the average chlorophyll *a* concentration (µg/l) measured on water samples of the upper 60m of water. The Figure shows that higher chlorophyll *a* concentrations were found in the Southern parts of the lake.

3.2. Horizontal sampling

3.2.1. Temperature

Figure 11 (upper left corner) presents surface temperatures (°C) measured at the stern of the *R/V Tanganyika Explorer.* The figure shows that although there were fluctuations along the measured transect the surface temperatures decrease towards the South of the lake. The figure furthermore shows that in the South surface temperature of < 25 °C are not uncommon. These temperatures were encountered in the North only below the thermocline.

3.2.2. Conductivity

Figure 11 (lower left corner) presents surface measurements of conductivity (µS/cm) along the sampled transect. The figures shows that besides the spatial variation conductivity tended to increase towards the South of the lake.

3.2.3. Turbidity

Figure 11 (lower right corner) presents the surface measurements of turbidity (NTU). The figure shows that in general turbidity values had there largest increase towards the South of the lake. Lowest values were encountered around 4 to 6

°S, while values towards Bujumbura were slightly higher and were close to the overall average.

3.2.4. Chlorophyll *a*

Figure 11 (upper right corner) presents the chlorophyll *a* concentrations (µg/l) measured at the surface of the lake. The Figures show that on average concentrations were about 1 µg/l. Concentrations increased towards the South of the lake with the highest increase in the vicinity of Mpulungu, Zambia where concentrations of chlorophyll *a* tripled.

4. DISCUSSION AND CONCLUSION

This study showed that the vertical structure of the lake clearly had strong spatial patterns resulting in different chemical characteristics for water layers in the North and South. The results showed clear evidence of Southern epilimnion cooling and of tilting of the isotherms which were inclined towards the North; some of which reached the surface in the Southern part of the lake. This tilting was probably due to the Northward migration of surface water forced by the South-east trade winds during July and August (Kotilainen *et al*., 1995). Climatic forcing at the lake surface at the Southern end of the lake has been illustrated by Wedderburn numbers (Langenberg, 1996), which showed that during and just after the period of trade winds, clear upwelling and related mixing events across the thermocline could be expected in the South of the lake.

During this study, the thermal structure of water layers at and below 100m depth were similar throughout the lake. For example, the 24°C isotherm demonstrated a rather unaffected and stable hypolimnion, indicating that the Southern winds, mixing and related currents are probably limited to the upper water layers of the lake. Furthermore, there is some vertical disturbance at stations in the pelagic (note the wavy pattern of the 25 to 25.5°C isotherms in figure 7) which may be due to a distinct seiching pattern in the lake.

Nutrient concentrations were strongly related to water temperature. In general, higher concentrations, were found in deeper, cooler water layers as has been described for lake Tanganyika before (Beauchamp, 1939 and 1940; Kufferath, 1952; Coulter, 1988 and 1991; Hecky and Bugenyi, 1992, Plisnier *et al*., 1996; Langenberg, 1996). The water column of the epilimnion in the South of the lake had characteristics towards a hypolimnion found in Northern parts due to upwelling of deeper waters. As a result, a clear South-North distribution of several nutrients, chlorophyll *a* and most of the parameters measured was encountered during this sampling period.

In Lake Tanganyika and many other aquatic systems, water density differences separate the deep reservoir of nutrients from the surface waters. However, the difference with other aquatic systems is that in lakes like Tanganyika water becomes anoxic just below the thermocline which has, for example, important implications for the metabolism of nitrogen in the lake. Denitrification, an assumed loss of nitrogen, is most likely to happen at low oxygen concentrations. Denitrification could lead to nitrogen deficiency when internal loading of nitrogen is considered alone. This could eventually lead to the assumption that the availability of nitrogen is the limiting element determining the overall level of primary productivity of phytoplankton in Lake Tanganyika. Our results show that across the lake concentrations of total oxidised nitrogen (principally nitrate) in the photic zone show no clear North-South pattern indicating other fluxes of nitrogen into the productive water layers of the lake.

It is assumed that, owing to the North-South tilting of the thermocline and the upwelling in the Southern parts of the lake, the upward movement is greater in the South for this period of year. Nutrient loading into the photic zone largely determines the overall level of primary productivity of the phytoplankton in lakes. Earlier research showed that, in principal, the same hydrographical processes cause secondary upwelling in the Northern regions of the lake around November- December resulting in a clear increase of chlorophyll *a* concentrations (Dubois, 1958; Ferro, 1975; Hecky *et al*., 1981; Coulter, 1963; Crul, 1993; Plisnier et al, 1996; Langenberg, 1996).

It appeared that in Lake Tanganyika chlorophyll *a* concentrations and phytoplankton biomass were related to the increase of concentrations of phosphate (SRP) towards the South, while nitrogen compounds showed no clear gradients in South-North direction during this cruise, *i.e*., the concentrations of total oxidized nitrogen measured (0.03-0.09 mg/l) seemed sufficient to sustain higher concentrations of chlorophyll *a* and phytoplankton biomass in the South.

There was some evidence of lower values of silica in the South where mixing and upwelling during this time of year was likely to be greatest. This was probably due to the uptake by diatoms and may have led to deficiency in the diatom component of the phytoplankton during that period. While no lowering in concentrations of silicate suggests either less uptake or greater loading from deeper waters.

The vertical distribution of dissolved oxygen changed from North to South. In the Northern parts of the lake the dissolved oxygen (D.O.) gradient in depth was much steeper compared to Southern regions and on several occasions anoxic water layers were encountered within 100m of depth while the South showed a more gradual decrease in D.O. concentrations with depth towards water layers far deeper than 100m. The overall spatial D.O. distribution during this study showed no difference with earlier work (Degens *et al*., 1971; Plisnier *et al*., 1996), and showed that mainly processes like photosynthesis, respiration and surface mixing determine D.O. levels in the lake. Acidity (pH) throughout the lake showed similar patterns which was to be expected since it is mainly regulated by the same processes as D.O.

This study showed clear evidence of spatial variation in concentrations of chlorophyll *a*. Wind induced upwelling at windward side of Lake Tanganyika makes higher concentrations of chlorophyll a possible and the South of the lake more productive (Bootsma, 1993; Patterson and Kachinjika, 1995, Langenberg, 1996). The relation between elevated chlorophyll *a* concentrations and water column stratification changes has been observed earlier in other lakes such as Lake Victoria (Talling, 1966) and Lake Malawi (Patterson and Kachinjika, 1993). With Lake Tanganyika’s size and long residence time, the principal source of nutrients to phytoplankton is likely to be internal loading. Bootsma (1993), Hecky and Kling (1981 and 1987) already suggested the possible link between chlorophyll *a*, primary production and wind force. Less wind and therefore reduced mixing and nutrient loading results to lower rates of primary production.

It is interesting to mention that the chemical and physical structure of lake Malawi and Lake Tanganyika are different. In Lake Malawi, compared to Lake Tanganyika,
1) concentrations of substantial plant nutrients are situated far deeper in the water column; 2) the anoxic layers start much deeper in the water column; and 3) a three to four degrees Celsius drop in temperature over the thermocline suggests the existence of a stronger physical barrier between epi- and hypolimnion. Furthermore are there clear indications that Wedderburn numbers in Lake Malawi are in general higher than in Lake Tanganyika. This leads to the suggestion that in case of maximum upwelling in both lakes (trade wind period) the extent of nutrient influx in Lake Tanganyika is expected to be larger than in Lake Malawi (see also Edmond et *al*., 1993; Patterson and Kachinjika, 1995; Hecky and Kling, 1981).

There are indications that the waters of Lake Tanganyika can contain higher concentrations of chlorophyll *a* and phytoplankton biomass than the waters of lake Malawi (Langenberg, 1996; This report; Patterson and Kachinjika, 1995). This could eventually be one of the reasons why lake Tanganyika has a productive pelagic fishery and lake Malawi does not. (Turner, 1982; Allison *et al*, 1995).

Analyses of our SSP data carried out by Verburg *et al.* (1997) showed that over the period of 1993 to 1995 overall wind speeds on the lake decreased and water temperatures increased. A warming up of the water column combined with stronger stratification of the water column due to lower wind speeds, could have implications for the annual interchange of water and nutrients between the epilimnion and hypolimnion.

When it becomes clear that Lake Tanganyika’s productivity is merely wind driven, then wind force is the deciding factor in dictating the strength of the internal seiche (and upwelling) and therefore rates of internal loading of nutrients, which eventually determines how much of the primary production of the whole lake is channeled into secondary and fish production.

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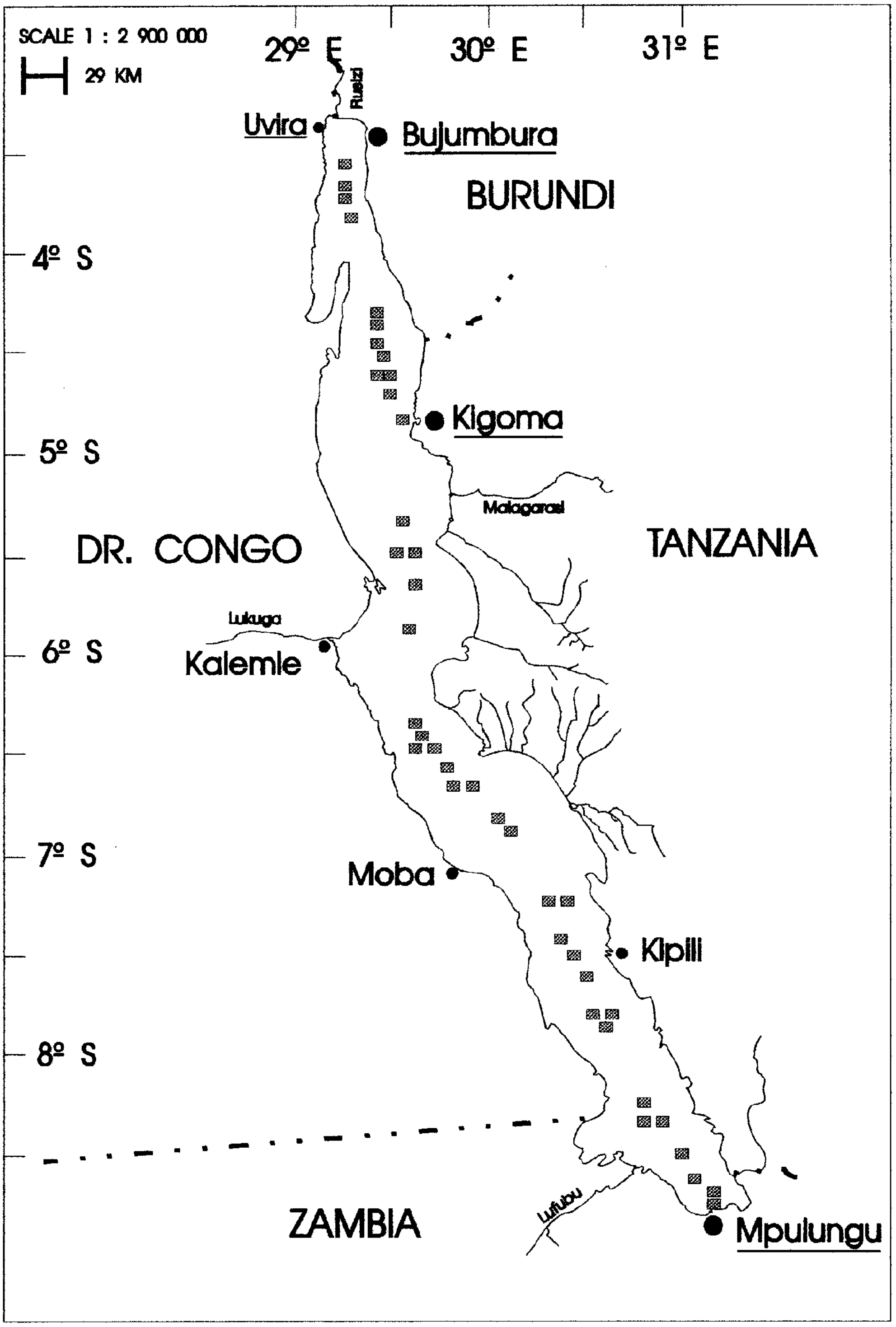


Figure 1. Map of Lake Tanganyika showing major limnological sampling sites during cruise 3, 28 August - 6 September 1995.

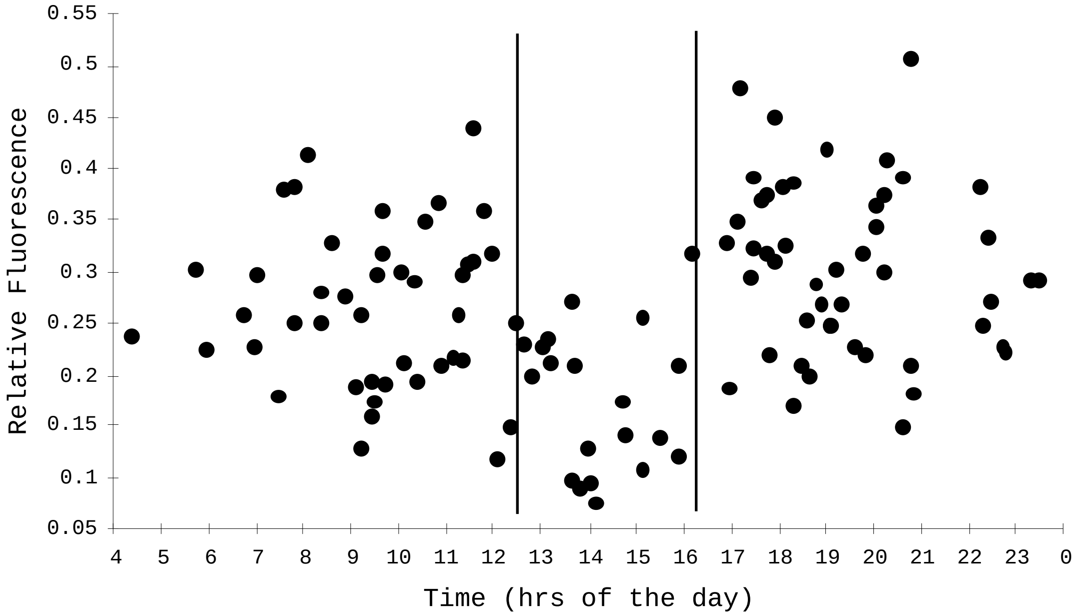


Figure 2. Relative Fluorescence versus time of the day. Data are from measurements made during April and May 1995 near Bujumbura, Burundi. Vertical lines in graph mark out a period of lower fluorescence.

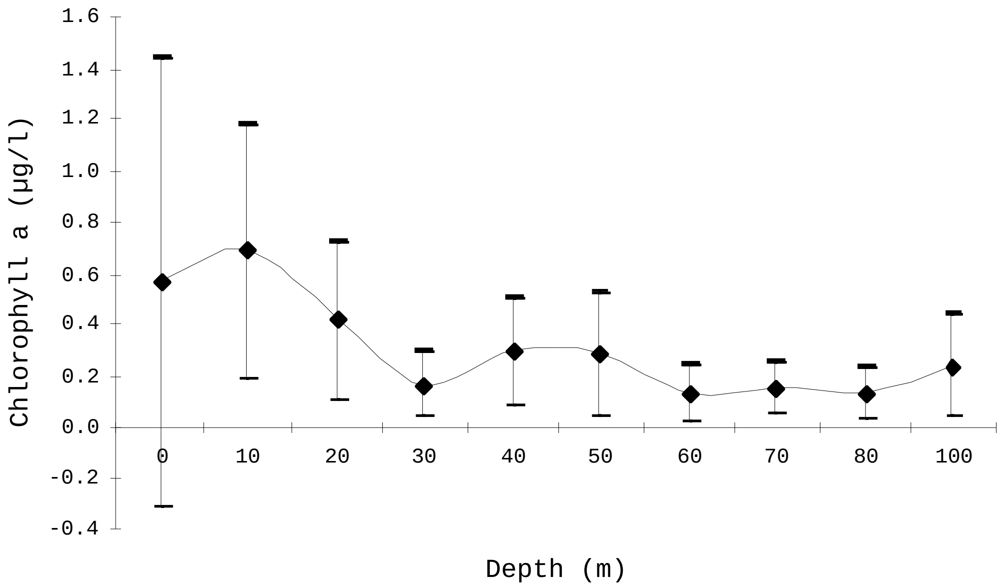


Figure 3. The difference between chlorophyll a concentrations of acidified samples minus non-acidified samples versus depth. Presented are averages and standard deviations. Data from measurements made during our SSP 2, August 1994- July 1995. See text.

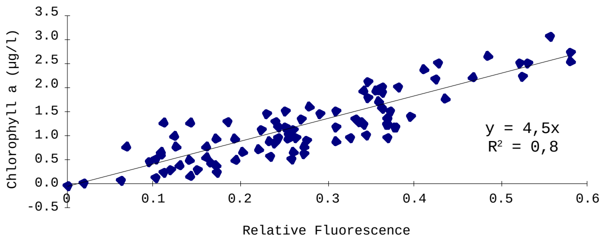
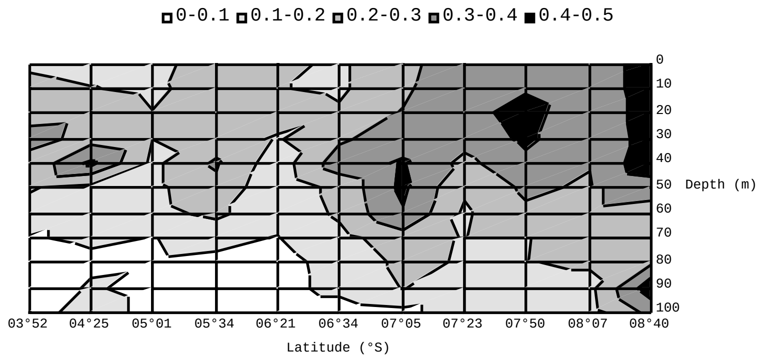


Figure 4. Chlorophyll a concentrations versus relative fluorescence on samples of our regular SSP during the period April, May and August 1995. Note that these chlorophyll a concentrations were determined on acidified extracted samples (see text). A trendline is given with y = 4,5x and R^2 = 0,8. This relation was used to recalculate surface plot **A** into surface plot **B** here below.



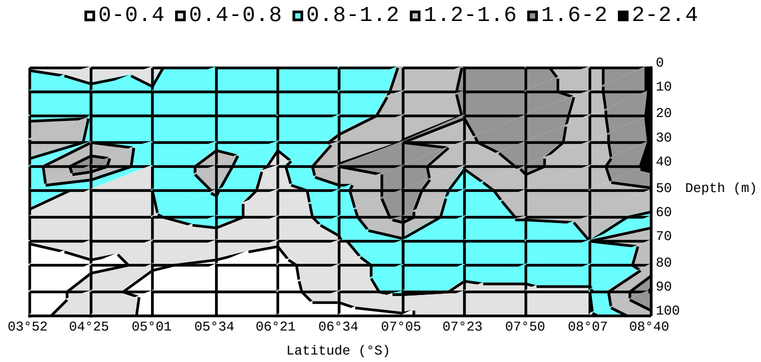


Figure 5. Surface plot **A** presents the vertical distribution of relative fluorescence along the sampled transect. Surface plot **B** presents the vertical distribution of chlorophyll a (µg/l). For surface plot **B** the relation found in Figure 4 was used.

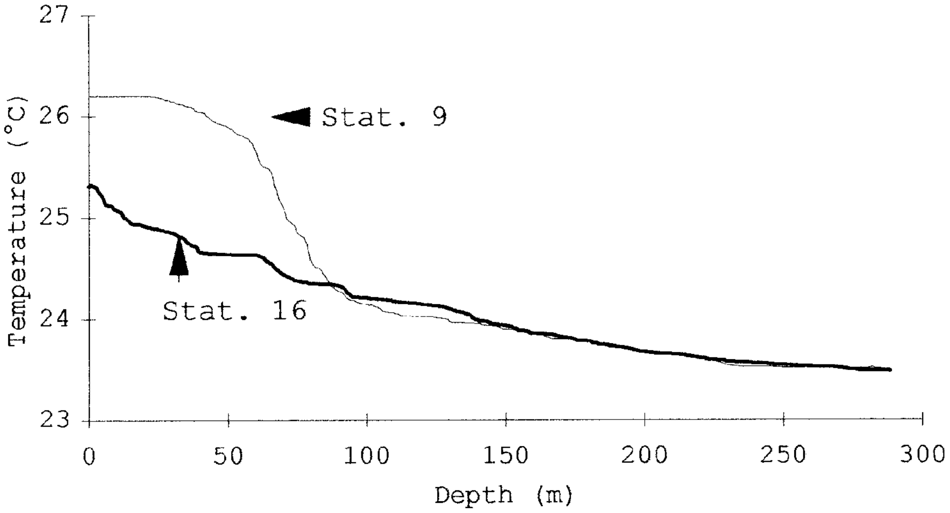


Figure 6. Two examples of Temperature depth profiles measured during this study by a CTD-12 probe. Note the difference in profiles in the upper 100m of depth between sampling station 16 (situated more South) and station 9 (North).

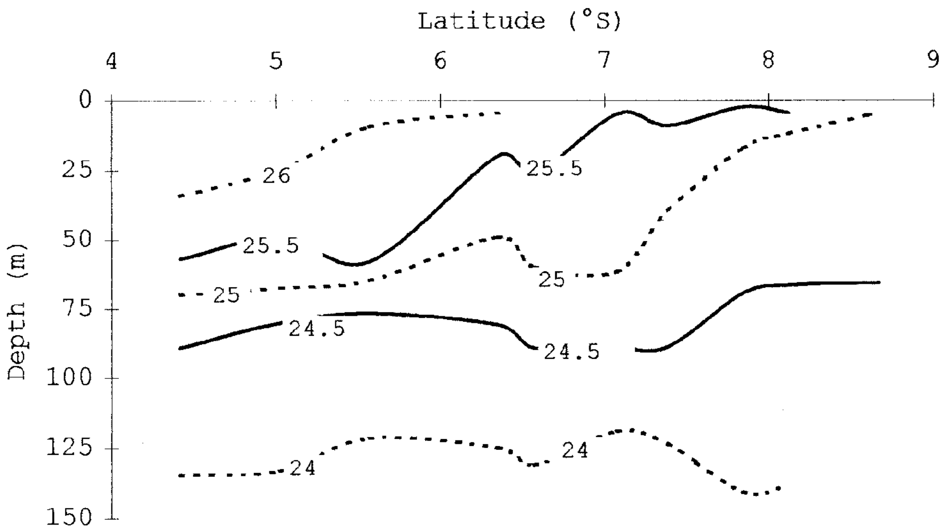


Figure 7. Depth-latitude plot of temperature. Graph is solely based on CTD measurements made during this study (28 August-6 September 1995). Indicated are isotherms.

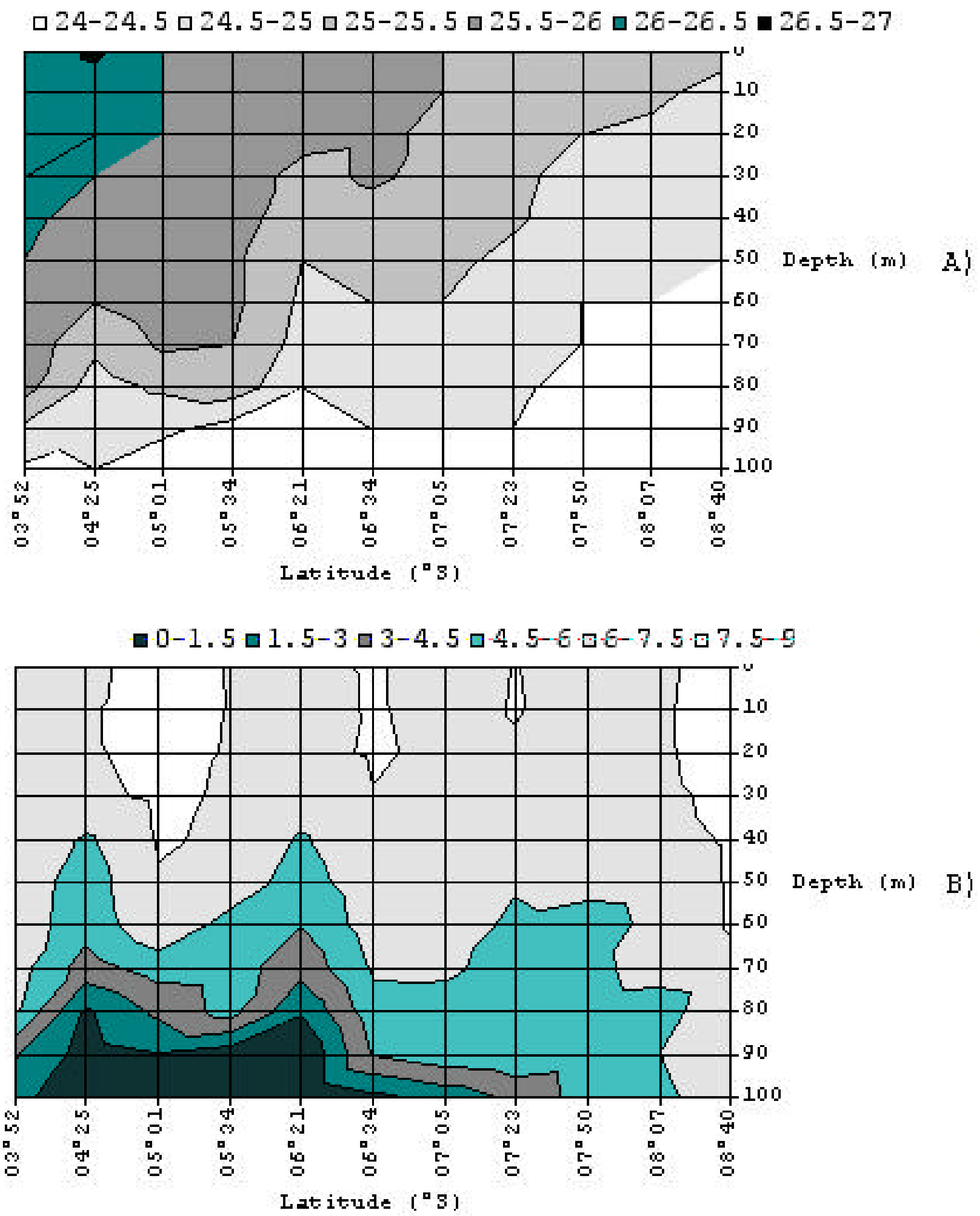


Figure 8. Surface plot **A** presents the vertical distribution of Temperature (°C) along the sampled transect. Surface plot **B** presents the vertical distribution of Dissolved oxygen (mg/l). Data from measurements made during 28 August-6 September 1995.

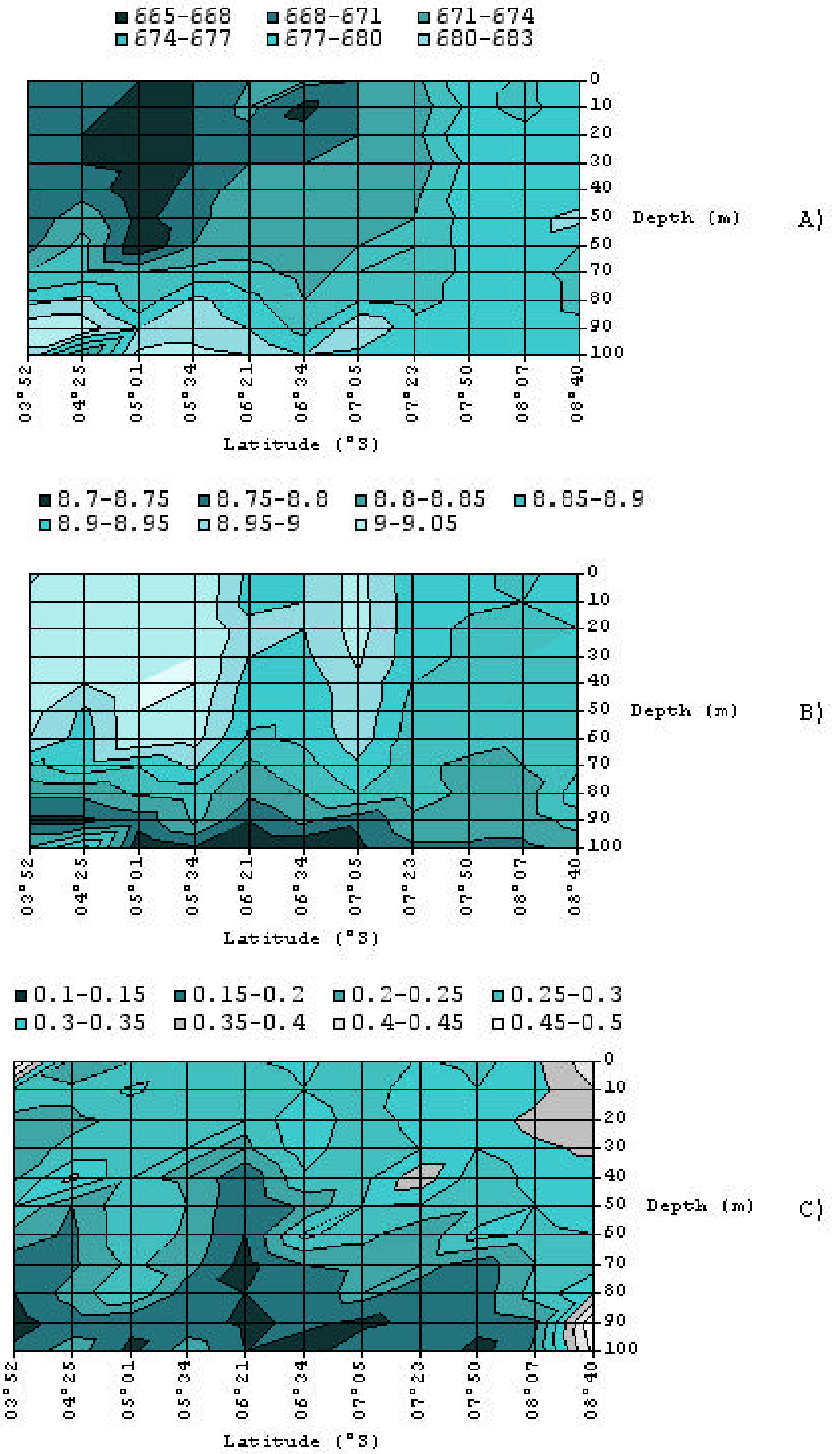


Figure 9. Surface plot **A** presents the vertical distribution of Conductivity (µS/cm) along the sampled transect. Surface plot **B** presents the vertical distribution of pH, and surface plot **C** presents the vertical distribution of Turbidity (NTU). Data from measurements made during 28 August-6 September 1995.

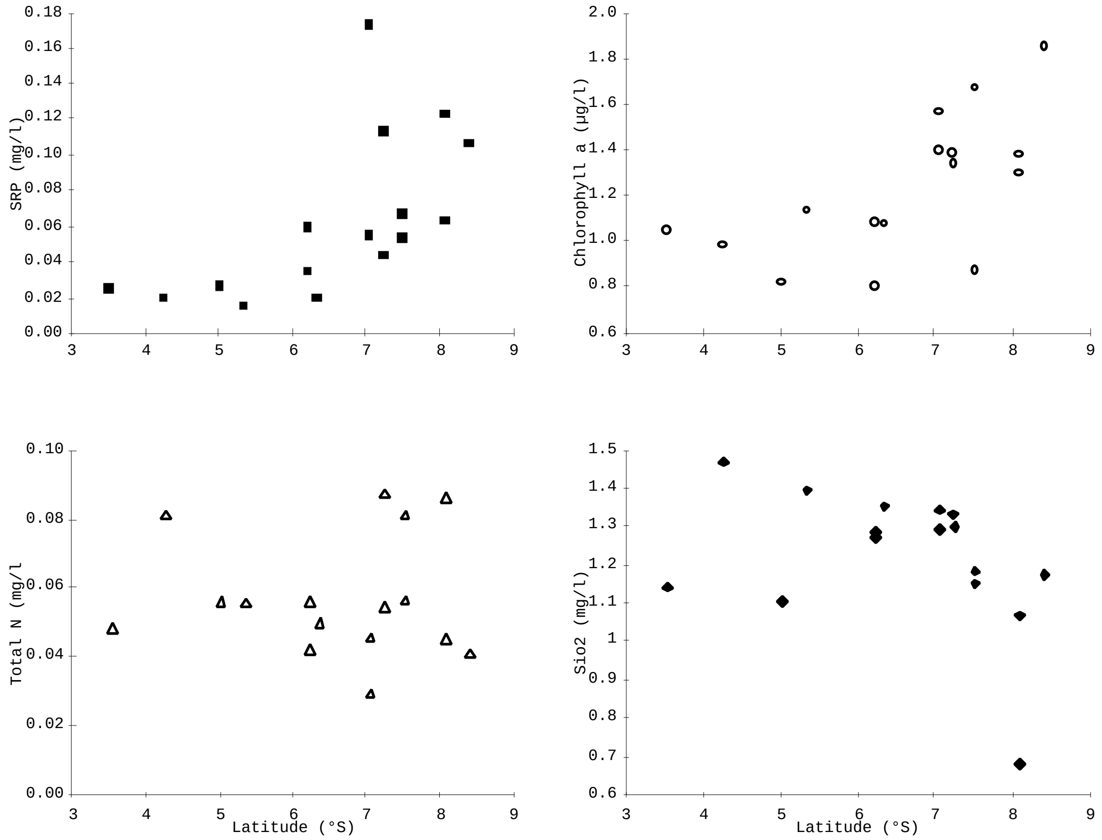


Figure 10. Average concentrations of the upper 60 m of water of Soluble Reactive Phosphate (SRP), Chlorophyll a, Total Nitrogen (NH4-N, NO3-N and NO2-N) and silicate (SiO_2-Si) versus the latitude in Lake Tanganyika during 28 August and 6 September 1995.

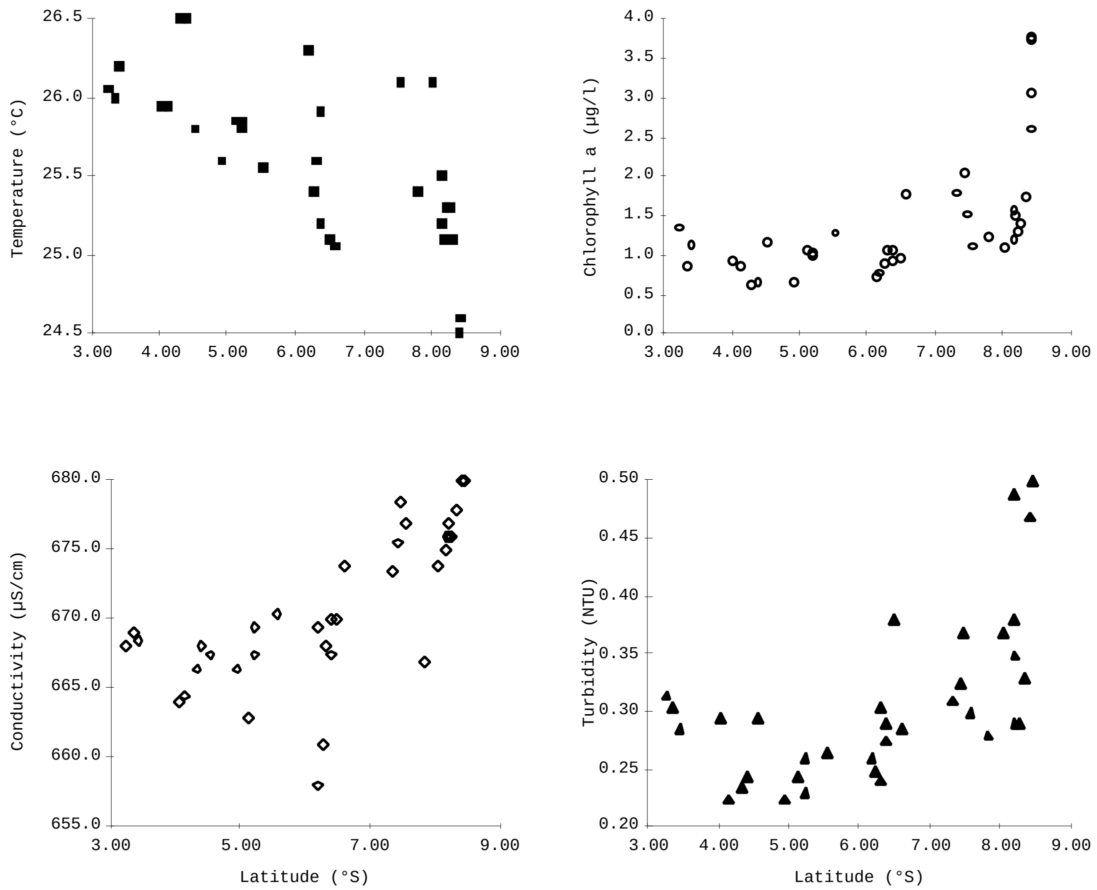


Figure 11. Average values/concentrations of the upper 5 m of water of Temperature, Chlorophyll a , Conductivity and Turbidity versus the latitude in Lake Tanganyika during the period of 28 August and 6 September 1995.

Appendix 1. Results of the horizontal sampling carried out at the stern of the *R/V Explorer* during cruise 3 (28 August - 6 September 1995). Exact location of the sampling sites are indicated by Lat (latitude) and Lon (Longitude). Temp = temperature (°C), Cond = conductivity (µS/cm), Turb = turbidity (NTU) Fluor = relative fluorescence and Chl a = Chlorophyll a concentration (mg/l) calculated with the relation found in figure 4. Results approx. represent mixed upper 5m of watercolumn. Parameters shown are averages of two or three repetitive analyses.

Date	**Time**	**Lat**	**Lon**	**Temp**	**Cond**	**pH**	**Turb**	**Fluor**	**Chl a**
8/30/95	19:00	6.26	29.39	25.4	661.0	9.09	0.24	0.196	0.88
8/31/95	18:18	7.80	30.23	25.4	667.0	8.89	0.28	0.269	1.21
9/1/95	16:37	7.54	30.40	26.1	677.0	8.86	0.30	0.246	1.11
9/1/95	17:40	8.03	30.44	26.1	674.0	8.89	0.37	0.239	1.08
9/1/95	22:00	8.17	30.51	25.2	676.0	8.98	0.49	0.266	1.20
9/1/95	23:00	8.25	30.56	25.3	676.0	8.94	0.29	0.313	1.41
9/1/95	23:59	8.34	31.01	25.1	678.0	8.88	0.33	0.387	1.74
9/2/95	01:00	8.42	31.06	24.5	680.0	8.86	0.47	0.578	2.60
9/3/95	1:20	8.44	31.60	24.6	680.0	8.85	0.50	0.678	3.05
9/3/95	1:15	8.43	31.50					0.828	3.73
9/3/95	1:17	8.42	31.55					0.838	3.77
9/2/95	18:55	8.20	30.45	25.1	676.0	8.88	0.35	0.329	1.48
9/2/95	19:48	8.16	30.50	25.5	675.0	8.89	0.38	0.345	1.55
9/2/95	21:00	8.20	30.06	25.3	677.0	8.87	0.29	0.290	1.31
9/3/95	14:00	7.46	30.37		678.5	8.92	0.37	0.338	1.52
9/3/95	15:45	7.42	30.33		675.5	8.94	0.33	0.453	2.04
9/3/95	17:43	7.32	30.27		673.5	8.97	0.31	0.397	1.78
9/4/95	2:00	6.58	30.09	25.1	674.0	8.99	0.29	0.392	1.76
9/4/95	3:23	6.48	29.59	25.1	670.0	8.94	0.38	0.214	0.96
9/4/95	5:06	6.36	29.48	25.2	667.5	9.01	0.28	0.234	1.05
9/4/95	6:06	6.29	29.42	25.6	668.0	8.99	0.31	0.236	1.06
9/4/95	15:08	6.20	29.36	26.3	658.0	9.02	0.25	0.169	0.76
9/4/95	16:37	6.15	29.35		669.5	9.07	0.26	0.158	0.71
9/4/95	17:54	6.38	29.36	25.9	670.0	9.05	0.29	0.204	0.92
9/4/95	20:00	5.54	29.36	25.6	670.5	9.06	0.27	0.286	1.29
9/5/95	0:12	5.21	29.37	25.9	669.5	9.08	0.23	0.227	1.02
9/5/95	1:12	5.12	29.35	25.9	663.0	9.09	0.25	0.236	1.06
9/5/95	2:18	5.21	29.32	25.8	667.5	9.09	0.26	0.220	0.99
9/5/95	3:26	4.53	29.35	25.8	667.5	9.07	0.30	0.257	1.15
9/5/95	13:00	4.92	29.28	25.6	666.5	9.01	0.23	0.140	0.63
9/5/95	14:14	4.40	29.27	26.5	668.0	9.00	0.25	0.140	0.63
9/5/95	15:30	4.31	29.26	26.5	666.5	9.04	0.24	0.136	0.61
9/6/95	4:55	4.13	29.26	26.0	664.5	9.06	0.23	0.191	0.86
9/6/95	6:22	4.03	29.22	26.0	664.0	9.04	0.30	0.202	0.91
9/6/95	10:42	3.42	29.16	26.2	668.5	9.07	0.29	0.250	1.12
9/6/95	11:51	3.33	29.15	26.0	669.0	9.05	0.31	0.190	0.86
9/6/95	12:55	3.24	29.15	26.1	668.0	9.04	0.32	0.297	1.34

Appendix 2. Results of the vertical sampling carried out from the *R/V Explorer* during cruise 3 (28 August - 6 September 1995). Exact location of the sampling sites are indicated by 'coordinates'. Start and End = Secchi disk depth resp. at the start and at the end of the sampling, Temp = temperature (°C), D.O. = dissolved oxygen concentration (mg/l), Cond = conductivity (µS/cm), Turb = turbidity (NTU), Fluor = relative fluorescence. Nutrient concentrations (SRP as soluble reactive phosphate, NH_4-N as ammonia, No_3-N as nitrate and NO_2-N as nitrite) are averages of two or three repetitive analyses on mixed water samples of the upper 60m of depth.

N°	date	time	coordinates		Depth	Start	End	Temp	D.O.	Cond	pH	Turb	SRP	NH4-N	NO3-N	NO2-N	SIO2	Fluor
1	29-08-95	14:13	05°01.41 S	29°34.35 E	0	11.4	13.7	26.0	7.92	668	9.02	0.25	0.027	0.02	0.033	0.003	1.106	0.163
1	29-08-95	14:13	05°01.41 S	29°34.35 E	10			26.0	8.10	667	9.03	0.31						0.182
1	29-08-95	14:13	05°01.41 S	29°34.35 E	20			26.0	7.88	667	9.04	0.26						0.204
1	29-08-95	14:13	05°01.41 S	29°34.35 E	30			26.0	7.72	667	9.04	0.26						0.202
1	29-08-95	14:13	05°01.41 S	29°34.35 E	40			25.9	7.61	666	9.08	0.26						0.177
1	29-08-95	14:13	05°01.41 S	29°34.35 E	50			25.9	7.39	667	9.08	0.29						0.177
1	29-08-95	14:13	05°01.41 S	29°34.35 E	60			25.8	7.13	665	9.11	0.29						0.168
1	29-08-95	14:13	05°01.41 S	29°34.35 E	70			25.6	5.19	674	8.90	0.26						0.098
1	29-08-95	14:13	05°01.41 S	29°34.35 E	80			25.1	3.29	675	8.86	0.30						0.093
1	29-08-95	14:13	05°01.41 S	29°34.35 E	90			24.6	1.44	680	8.77	0.16						0.070
1	29-08-95	14:13	05°01.41 S	29°34.35 E	100			24.2	0.00	684	8.71	0.14						0.068
2	30-08-95	7:44	06°21.17 S	29°36.25 E	0	14.4	15.3	25.8	7.41	671	8.94	0.29	0.060	0.00	0.053	0.003	1.291	0.193
2	30-08-95	7:44	06°21.17 S	29°36.25 E	10			25.7	7.35	672	8.93	0.25						0.189
2	30-08-95	7:44	06°21.17 S	29°36.25 E	20			25.7	7.31	670	8.97	0.26						0.345
2	30-08-95	7:44	06°21.17 S	29°36.25 E	30			25.3	6.80	671	8.95	0.24						0.354
2	30-08-95	7:44	06°21.17 S	29°36.25 E	40			25.1	5.81	673	8.93	0.16						0.206
2	30-08-95	7:44	06°21.17 S	29°36.25 E	50			25.0	5.34	673	8.92	0.15						0.198
2	30-08-95	7:44	06°21.17 S	29°36.25 E	60			24.9	4.52	673	8.89	0.15						0.199
2	30-08-95	7:44	06°21.17 S	29°36.25 E	70			24.8	3.50	675	8.84	0.13						0.153
2	30-08-95	7:44	06°21.17 S	29°36.25 E	80			24.5	1.68	678	8.81	0.15						0.130
2	30-08-95	7:44	06°21.17 S	29°36.25 E	90			24.3	0.00	680	8.75	0.14						0.098
2	30-08-95	7:44	06°21.17 S	29°36.25 E	100			24.2	0.00	683	8.67	0.15						0.098
3	30-08-95	20:38	06°34.32 S	29°48.88 E	0			25.7	7.54	672	8.95	0.32	0.020	0.01	0.040		1.356	0.184
3	30-08-95	20:38	06°34.32 S	29°48.88 E	10			25.7	7.54	667	8.95	0.30						0.186
3	30-08-95	20:38	06°34.32 S	29°48.88 E	20			25.6	7.57	669	8.95	0.34						0.210
3	30-08-95	20:38	06°34.32 S	29°48.88 E	30			25.6	7.48	671	8.94	0.33						0.284
3	30-08-95	20:38	06°34.32 S	29°48.88 E	40			25.2	7.32	671	8.92	0.29						0.359
3	30-08-95	20:38	06°34.32 S	29°48.88 E	50			25.1	6.91	671	8.91	0.21						0.233

3	30-08-95	20:38	06°34.32 S	29°48.88 E	60			25.0	6.79	672	8.91	0.31						0.218
3	30-08-95	20:38	06°34.32 S	29°48.88 E	70			24.8	6.21	673	8.88	0.20						0.168
3	30-08-95	20:38	06°34.32 S	29°48.88 E	80			24.7	5.43	674	8.85	0.17						0.136
3	30-08-95	20:38	06°34.32 S	29°48.88 E	90			24.5	4.63	676	8.81	0.16						0.133
3	30-08-95	20:38	06°34.32 S	29°48.88 E	100			24.3	1.03	680	8.65	0.13						0.048
4	31-08-95	7:48	07°04.63 S	30°16.91 E	0	12.7	14.3	25.4	7.31	671	8.89	0.26	0.173	0.00	0.023	0.003	1.292	0.262
4	31-08-95	7:48	07°04.63 S	30°16.91 E	10			25.3	7.30	671	8.89	0.28						0.330
4	31-08-95	7:48	07°04.63 S	30°16.91 E	20			25.3	7.26	671	8.90	0.28						0.319
4	31-08-95	7:48	07°04.63 S	30°16.91 E	30			25.2	7.21	671	8.89	0.27						0.330
4	31-08-95	7:48	07°04.63 S	30°16.91 E	40			25.2	7.19	671	8.89	0.27						0.328
4	31-08-95	7:48	07°04.63 S	30°16.91 E	50			25.1	7.09	672	8.88	0.29						0.348
4	31-08-95	7:48	07°04.63 S	30°16.91 E	60			25.0	6.81	673	8.87	0.25						0.268
4	31-08-95	7:48	07°04.63 S	30°16.91 E	70			24.9	6.46	673	8.86	0.35						0.226
4	31-08-95	7:48	07°04.63 S	30°16.91 E	80			24.7	5.55	673	8.85	0.20						0.224
4	31-08-95	7:48	07°04.63 S	30°16.91 E	90			24.6	5.10	674	8.81	0.15						0.197
4	31-08-95	7:48	07°04.63 S	30°16.91 E	100			24.4		675	8.79	0.17						0.234
5	8/31/95	20:08	07°23.24 S	30°27.72 E	0			25.4	7.51	673	8.91	0.31	0.043	0.01	0.050	0.000	1.301	0.360
5	8/31/95	20:08	07°23.24 S	30°27.72 E	10			25.4	7.52	672	8.92	0.35						0.364
5	8/31/95	20:08	07°23.24 S	30°27.72 E	20			25.3	7.46	673	8.92	0.32						0.358
5	8/31/95	20:08	07°23.24 S	30°27.72 E	30			25.2	7.34	672	8.92	0.30						0.336
5	8/31/95	20:08	07°23.24 S	30°27.72 E	40			25.1	6.92	673	8.90	0.39						0.272
5	8/31/95	20:08	07°23.24 S	30°27.72 E	50			24.8	6.18	674	8.88	0.29						0.216
5	8/31/95	20:08	07°23.24 S	30°27.72 E	60			24.7	5.63	675	8.87	0.21						0.185
5	8/31/95	20:08	07°23.24 S	30°27.72 E	70			24.6	5.38	674	8.87	0.22						0.196
5	8/31/95	20:08	07°23.24 S	30°27.72 E	80			24.6	5.37	676	8.87	0.17						0.192
5	8/31/95	20:08	07°23.24 S	30°27.72 E	90			24.5	5.69	678	8.84	0.16						0.170
5	8/31/95	20:08	07°23.24 S	30°27.72 E	100			24.3	3.34	680	8.79	0.19						0.164
6	9/1/95	7:45	07?50.51 S	30?36.11 E	0	11.2	11.9	25.3	8.03	677	8.88	0.29	0.067	0.01	0.070	0.002	1.151	0.208
6	9/1/95	7:45	07?50.51 S	30?36.11 E	10			25.3	8.02	677	8.82	0.30						0.268
6	9/1/95	7:45	07?50.51 S	30?36.11 E	20			24.9	7.81	676	8.82	0.19						0.258
6	9/1/95	7:45	07?50.51 S	30?36.11 E	30			24.6	6.06	677	8.82	0.18						0.187
6	9/1/95	7:45	07?50.51 S	30?36.11 E	40			24.5	5.87	677	8.83	0.16						0.130
6	9/1/95	7:45	07?50.51 S	30?36.11 E	50			24.5	5.72	677	8.81	0.24						0.134
6	9/1/95	7:45	07?50.51 S	30?36.11 E	60			24.5	5.94	678	8.82	0.17						0.177
6	9/1/95	7:45	07?50.51 S	30?36.11 E	70			24.4	6.49	678	8.82	0.18						0.176
6	9/1/95	7:45	07?50.51 S	30?36.11 E	80			24.3	6.11	678	8.80	0.14						0.151
6	9/1/95	7:45	07?50.51 S	30?36.11 E	90			24.3	6.10	678	8.79	0.13						0.146

6	9/1/95	7:45	07?50.51 S	30?36.11 E	100			24.3	6.08	678	8.76	0.15						0.080
7	9/1/95	18:45	08°07.19 S	30°45.04 E	0			25.4	7.40	676	8.90	0.31	0.123	0.01	0.075	0.002	1.071	0.318
7	9/1/95	18:45	08°07.19 S	30°45.04 E	10			25.2	7.40	678	8.89	0.26						0.299
7	9/1/95	18:45	08°07.19 S	30°45.04 E	20			24.8	7.35	677	8.88	0.35						0.342
7	9/1/95	18:45	08°07.19 S	30°45.04 E	30			24.8	7.29	678	8.86	0.26						0.302
7	9/1/95	18:45	08°07.19 S	30°45.04 E	40			24.7	6.70	678	8.86	0.25						0.274
7	9/1/95	18:45	08°07.19 S	30°45.04 E	50			24.6	6.43	678	8.86	0.27						0.267
7	9/1/95	18:45	08°07.19 S	30°45.04 E	60			24.5	6.62	678	8.85	0.23						0.225
7	9/1/95	18:45	08°07.19 S	30°45.04 E	70			24.4	6.36	679	8.85	0.26						0.230
7	9/1/95	18:45	08°07.19 S	30°45.04 E	80			24.3	6.07	679	8.83	0.21						0.224
7	9/1/95	18:45	08°07.19 S	30°45.04 E	90			24.3	5.83	678	8.83	0.17						0.182
7	9/1/95	18:45	08°07.19 S	30°45.04 E	100			24.2	6.16	677	8.80	0.22						0.131
8	9/2/95	15:00	08°40.17 S	31°09.23 E	0	7	7.7	25.3	8.19	680	8.92	0.43	0.107	0.00	0.04	0.001	1.177	0.455
8	9/2/95	15:00	08°40.17 S	31°09.23 E	10			24.7	8.28	679	8.91	0.40						0.453
8	9/2/95	15:00	08°40.17 S	31°09.23 E	20			24.6	8.17	679	8.90	0.38						0.454
8	9/2/95	15:00	08°40.17 S	31°09.23 E	30			24.6	7.81	679	8.90	0.36						0.451
8	9/2/95	15:00	08°40.17 S	31°09.23 E	40			24.5	7.61	678	8.89	0.32						0.473
8	9/2/95	15:00	08°40.17 S	31°09.23 E	50			24.5	7.60	681	8.88	0.32						0.342
8	9/2/95	15:00	08°40.17 S	31°09.23 E	60			24.5	7.62	677	8.88	0.30						0.254
8	9/2/95	15:00	08°40.17 S	31°09.23 E	70			24.5	7.00	676	8.89	0.28						0.283
8	9/2/95	15:00	08°40.17 S	31°09.23 E	80			24.4	7.29	676	8.93	0.35						0.289
8	9/2/95	15:00	08°40.17 S	31°09.23 E	90			24.4	7.09	678	8.87	0.55						0.456
8	9/2/95	15:00	08°40.17 S	31°09.23 E	100			24.3	6.77	679	8.81	0.47						0.330
9	9/2/95	22:50	08°07.10 S	30°44.83 E	0			25.3	7.23	676	8.89	0.34	0.063	0.00	0.043	0.002	0.683	0.326
9	9/2/95	22:50	08°07.10 S	30°44.83 E	10			25.2	7.30	676	8.90	0.33						0.324
9	9/2/95	22:50	08°07.10 S	30°44.83 E	20			24.8	7.29	678	8.89	0.37						0.316
9	9/2/95	22:50	08°07.10 S	30°44.83 E	30			24.8	7.21	678	8.90	0.34						0.309
9	9/2/95	22:50	08°07.10 S	30°44.83 E	40			24.8	7.17	679	8.88	0.32						0.307
9	9/2/95	22:50	08°07.10 S	30°44.83 E	50			24.7	6.85	679	8.87	0.30						0.286
9	9/2/95	22:50	08°07.10 S	30°44.83 E	60			24.5	6.59	679	8.86	0.29						0.287
9	9/2/95	22:50	08°07.10 S	30°44.83 E	70			24.5	6.54	678	8.85	0.25						0.267
9	9/2/95	22:50	08°07.10 S	30°44.83 E	80			24.4	5.28	679	8.82	0.27						0.211
9	9/2/95	22:50	08°07.10 S	30°44.83 E	90			24.2	5.98	679	8.82	0.19						0.172
9	9/2/95	22:50	08°07.10 S	30°44.83 E	100			24.1	5.71	678	8.79	0.21						0.156
10	9/3/95	7:12	07°50.41 S	30°36.16 E	0	10.5	10.0	25.0	7.35	680	8.91	0.28	0.053	0.01	0.045	0.002	1.185	0.373
10	9/3/95	7:12	07°50.41 S	30°36.16 E	10			25.0	7.33	678	8.91	0.30						0.385
10	9/3/95	7:12	07°50.41 S	30°36.16 E	20			25.0	7.31	680	8.89	0.32						0.444

10	9/3/95	7:12	07°50.41 S	30°36.16 E	30			24.7	6.96	678	8.89	0.30						0.421
10	9/3/95	7:12	07°50.41 S	30°36.16 E	40			24.7	6.88	679	8.89	0.26						0.374
10	9/3/95	7:12	07°50.41 S	30°36.16 E	50			24.6	6.77	678	8.88	0.26						0.319
10	9/3/95	7:12	07°50.41 S	30°36.16 E	60			24.5	5.10	678	8.88	0.32						0.284
10	9/3/95	7:12	07°50.41 S	30°36.16 E	70			24.5	5.65	678	8.83	0.17						0.196
10	9/3/95	7:12	07°50.41 S	30°36.16 E	80			24.3	5.46	678	8.84	0.17						0.197
10	9/3/95	7:12	07°50.41 S	30°36.16 E	90			24.1	5.34	678	8.84	0.17						0.171
10	9/3/95	7:12	07°50.41 S	30°36.16 E	100			24.0	5.23	678	8.79	0.13						0.154
11	9/3/95	18:57	07°22.78 S	30°27.52 E	0			25.5	7.23	672	8.99	0.34	0.113	0.03	0.055	0.003	1.334	0.357
11	9/3/95	18:57	07°22.78 S	30°27.52 E	10			25.2	7.22	672	9.01	0.31						0.341
11	9/3/95	18:57	07°22.78 S	30°27.52 E	20			25.2	7.15	673	8.99	0.34						0.357
11	9/3/95	18:57	07°22.78 S	30°27.52 E	30			25.2	7.09	672	8.98	0.30						0.351
11	9/3/95	18:57	07°22.78 S	30°27.52 E	40			25.1	7.02	672	8.96	0.28						0.340
11	9/3/95	18:57	07°22.78 S	30°27.52 E	50			25.1	6.90	673	8.95	0.24						0.241
11	9/3/95	18:57	07°22.78 S	30°27.52 E	60			24.9	6.23	675	8.91	0.20						0.177
11	9/3/95	18:57	07°22.78 S	30°27.52 E	70			24.7	5.30	676	8.90	0.16						0.151
11	9/3/95	18:57	07°22.78 S	30°27.52 E	80			24.5	4.73	678	8.80	0.14						0.117
11	9/3/95	18:57	07°22.78 S	30°27.52 E	90			24.3	3.20	679	8.78	0.16						0.116
11	9/3/95	18:57	07°22.78 S	30°27.52 E	100			24.1	1.96	681	8.77	0.19						0.121
12	9/3/95	23:00	07°04.58 S	30°16.63 E	0			25.5	7.35	671	9.02	0.25	0.055	0.01	0.040	0.001	1.346	0.274
12	9/3/95	23:00	07°04.58 S	30°16.63 E	10			25.5	7.36	671	9.02	0.25						0.284
12	9/3/95	23:00	07°04.58 S	30°16.63 E	20			25.4	7.37	671	9.02	0.27						0.305
12	9/3/95	23:00	07°04.58 S	30°16.63 E	30			25.3	7.30	672	9.01	0.26						0.356
12	9/3/95	23:00	07°04.58 S	30°16.63 E	40			25.3	7.24	673	8.99	0.28						0.410
12	9/3/95	23:00	07°04.58 S	30°16.63 E	50			25.2	7.15	674	8.99	0.30						0.420
12	9/3/95	23:00	07°04.58 S	30°16.63 E	60			25.0	6.97	674	8.98	0.27						0.391
12	9/3/95	23:00	07°04.58 S	30°16.63 E	70			24.9	6.26	675	8.94	0.21						0.258
12	9/3/95	23:00	07°04.58 S	30°16.63 E	80			24.6	5.39	677	8.90	0.22						0.221
12	9/3/95	23:00	07°04.58 S	30°16.63 E	90			24.5	5.44	683	8.76	0.14						0.202
12	9/3/95	23:00	07°04.58 S	30°16.63 E	100			24.2	2.07	679	8.74	0.18						0.069
13	04-09-95	8:24	06°21.00 S	29°36.19 E	0	17.8	18.1	25.9	7.38	670	9.04	0.26	0.035	0.00	0.040	0.003	1.275	0.220
13	04-09-95	8:24	06°21.00 S	29°36.19 E	10			25.8	7.37	670	9.04	0.30						0.204
13	04-09-95	8:24	06°21.00 S	29°36.19 E	20			25.5	7.06	668	9.02	0.27						0.250
13	04-09-95	8:24	06°21.00 S	29°36.19 E	30			25.3	6.83	668	9.01	0.22						0.192
13	04-09-95	8:24	06°21.00 S	29°36.19 E	40			25.2	6.76	670	9.01	0.19						0.148
13	04-09-95	8:24	06°21.00 S	29°36.19 E	50			25.1	6.50	672	9.00	0.19						0.125
13	04-09-95	8:24	06°21.00 S	29°36.19 E	60			25.0	5.70	674	8.95	0.18						0.123

13	04-09-95	8:24	06°21.00 S	29°36.19 E	70			24.6	5.48	676	8.90	0.15						0.096
13	04-09-95	8:24	06°21.00 S	29°36.19 E	80			24.5	3.09	680	8.80	0.15						0.070
13	04-09-95	8:24	06°21.00 S	29°36.19 E	90			24.2	0.26	683	8.71	0.12						0.063
13	04-09-95	8:24	06°21.00 S	29°36.19 E	100			24.2	0.22	684	8.67	0.17						0.028
14	04-09-95	21:30	05°34.19 S	29°40.00 E	0			25.9	7.44	668	9.08	0.28	0.015	0.01	0.045	0.001	1.398	0.256
14	04-09-95	21:30	05°34.19 S	29°40.00 E	10			25.9	7.47	668	9.09	0.27						0.243
14	04-09-95	21:30	05°34.19 S	29°40.00 E	20			25.8	7.43	668	9.09	0.26						0.238
14	04-09-95	21:30	05°34.19 S	29°40.00 E	30			25.8	7.38	668	9.09	0.26						0.234
14	04-09-95	21:30	05°34.19 S	29°40.00 E	40			25.8	7.32	669	9.07	0.24						0.312
14	04-09-95	21:30	05°34.19 S	29°40.00 E	50			25.6	6.81	670	9.03	0.25						0.274
14	04-09-95	21:30	05°34.19 S	29°40.00 E	60			25.6	5.47	671	9.02	0.24						0.222
14	04-09-95	21:30	05°34.19 S	29°40.00 E	70			25.5	5.29	675	8.96	0.22						0.122
14	04-09-95	21:30	05°34.19 S	29°40.00 E	80			25.3	5.12	681	8.87	0.17						0.081
14	04-09-95	21:30	05°34.19 S	29°40.00 E	90			24.3	0.72	682	8.86	0.17						0.080
14	04-09-95	21:30	05°34.19 S	29°40.00 E	100			24.2	0.19	684	8.74	0.23						0.044
15	05-09-95	17:30	04°24.87 S	29°36.33 E	0	17.2		26.6	7.28	670	9.06	0.22	0.020	0.00	0.080	0.002	1.470	0.119
15	05-09-95	17:30	04°24.87 S	29°36.33 E	10			26.2	7.32	669	9.06	0.26						0.204
15	05-09-95	17:30	04°24.87 S	29°36.33 E	20			26.1	7.34	688	9.06	0.24						0.262
15	05-09-95	17:30	04°24.87 S	29°36.33 E	30			26.0	7.20	668	9.06	0.26						0.252
15	05-09-95	17:30	04°24.87 S	29°36.33 E	40			25.8	5.80	670	9.00	0.36						0.420
15	05-09-95	17:30	04°24.87 S	29°36.33 E	50			25.7	5.30	673	8.94	0.20						0.162
15	05-09-95	17:30	04°24.87 S	29°36.33 E	60			25.5	5.13	675	8.93	0.19						0.116
15	05-09-95	17:30	04°24.87 S	29°36.33 E	70			25.1	3.82	675	8.93	0.19						0.114
15	05-09-95	17:30	04°24.87 S	29°36.33 E	80			24.8	1.34	681	8.81	0.22						0.082
15	05-09-95	17:30	04°24.87 S	29°36.33 E	90			24.6	0.87	685	8.74	0.17						0.110
15	05-09-95	17:30	04°24.87 S	29°36.33 E	100			24.5	0.09	670	8.96	0.23						0.148
16	9/6/95	7:35	03°52.46 S	29°18,83 E	0	16.2	15.1	26.10	7.17	669.00	8.99	0.81	0.025	0.00	0.045	0.004	1.144	0.167
16	9/6/95	7:35	03°52.46 S	29°18,83 E	10			26.10	7.21	668	9.02	0.28						0.265
16	9/6/95	7:35	03°52.46 S	29°18,83 E	20			26.10	7.19	668.00	9.02	0.24						0.239
16	9/6/95	7:35	03°52.46 S	29°18,83 E	30			26.10	7.17	668.00	9.02	0.23						0.359
16	9/6/95	7:35	03°52.46 S	29°18,83 E	40			26.10	7.06	668.00	9.02	0.24						0.222
16	9/6/95	7:35	03°52.46 S	29°18,83 E	50			26.00	6.87	669.00	9.02	0.30						0.210
16	9/6/95	7:35	03°52.46 S	29°18,83 E	60			25.90	6.83	670.00	9.00	0.23						0.168
16	9/6/95	7:35	03°52.46 S	29°18,83 E	70			25.80	6.71	674.00	8.89	0.17						0.093
16	9/6/95	7:35	03°52.46 S	29°18,83 E	80			25.70	6.23	679.00	8.81	0.15						0.057
16	9/6/95	7:35	03°52.46 S	29°18,83 E	90			24.90	3.19	686.00	8.74	0.13						0.052
16	9/6/95	7:35	03°52.46 S	29°18,83 E	100			24.40	2.16	682.00	8.86	0.16						0.054