AFGEHANDELD

waterloopkundig laboratorium
delft hydraulics laboratory

mathematical simulation of algae blooms by the model BLOOM II

addendum

report on investigations

R 1310-7

July 1982

mathematical simulation of algae blooms by the model BLOOM II

addendum

report on investigations

R 1310-7

July 1982

CONTENTS

ADDENDUM

A.1 GENERAL INFORMATION

For practical reasons several tables and graphs of the BLOOM II report have been put into a separate volume consisting of two major parts:

1. A summary of the main equations and the values of (almost) all coefficients.
2. A graphical presentation of the results.

Literature references of the addendum are included in the list of references of the main volume.

A.2 UNIVERSAL INPUTS

In this section we shall give a summary of all the universal inputs (model parameters) of BLOOM II and the way they are computed. Species dependent symbols are written with a subscript j, which was not always the case in the main report. Symbol definitions of the main report are not repeated here.

Maximum gross production

$$Pnmax(T,V_j) = 1.0729 * EXP(0.0639T-0.16) * V_j \qquad [1/day]$$

$$Pgmax(T,V_j) = Pnmax(T,V_j) + R(T)_j \qquad [1/day]$$

Respiration

$$R(T)_j = EXP\ (A_j*T - B_j) \qquad [1/day]$$

Minimum mortality

$$Mmin(T) = EXP\ (0.098T - 3.219) \qquad [1/day]$$

Grazing

$$G = \frac{ZG.z\ (Xe - Xmin)}{(ZK + Xe - Xmin).Xe} \qquad [1/day]$$

Remineralization of nutrients

Nitrogen: 0.006 / day °C
Phosphor: 0.006 / day °C
Silicon : 0.025 / day

Elimination effect dead chlorophyll on extinction

$$v = EXP(0.0296*T - 1.897)$$

Transmitted radiation

It is difficult to estimate the fraction of incident solar radiation which actually penetrates the water, because this depends on:

- The angle between the water surface and the light beam, hence on season, time of day and wave pattern. As the angle comes closer to 90°, the fraction of transmitted radiation increases.
- Scattering by the sky (clouding; the more scattering, the more light is transmitted).

According to Wetzel [1975] the average fraction of transmitted radiation varies from about 0.95 in summer to 0.90 in winter. This difference is so small, because winter tends to be more cloudy than summer; in BLOOM II transmission varies between these limits. An important reason not to assume a higher reflection in winter is the observations that energy tends to be limiting in relatively dark (=cloudy) periods of the year.

Table A.1

Species coefficients to calculate $Pgmax(T,V_j)$ and $R(T)_j$.

Species	Average volume	Respiration Coefficients A	B
Asterionella	500	0.0916	3.0275
Centric diatoms	500	0.0916	3.0275
Cryptomonas	500	0.0916	3.0275
Volvox	500	0.0916	3.0275
Scenedesmus	1000	0.0916	3.0751
Ceratium	20000	0.0639	2.1721
Anabaena	80000	0.0916	4.3827
Aphanizomenon	80000	0.0916	4.3827
Microcystis	80000	0.0916	4.3827
Oscillatoria	80000	0.0916	4.3827

Notice that for several species such as Volvox we have not used the actual volume, but the same value as for some related species, to prevent that (small) differences in volume determine dominance within one phytoplankton group. The same is true for the respiration coefficients A_j and B_j. Hence the same values for Pgmax(T,V_j) and $R(T)_j$ are used for all four species of blue-green algae.

Table A.2

Species coefficients for extinction, buoyancy control, zooplankton preference and dry weight to chlorophyll conversion.

Species	Spec Ext	Rmix	Pref	C/CHL	DRY/C
Asterionella	7.00D-05	1.0	1.0	25	3.0
Centric diatoms	7.00D-05	1.0	1.0	25	3.0
Cryptomonas	5.21D-05	1.0	1.0	30	2.3
Volvox	3.86D-05	1.0	1.0	30	2.3
Scenedesmus	5.21D-05	1.0	1.0	30	2.3
Ceratium	6.00D-05	0.275	0.0	30	2.3
Anabaena	2.66D-04	0.275	0.0	30	2.5
Aphanizomenon	2.35D-04	0.275	0.0	30	2.5
Microcystis	9.60D-05	0.275	0.0	40	2.5
Oscillatoria	1.90D-04	0.275	0.0	40	2.5

The values for the specific extinction coefficients (K_j) are *mainly based upon the theoretical works by Kirk [1975a; 1975b;* 1976], which we found in good agreement to values obtained from linear regressions of chlorophyll and dry weight to both total extinction and Secchi discs in Grote Rug. However, for Aphanizomenon we arrived at a higher, and for Oscillatoria at a lower specific extinction than suggested by Kirk. As the difference was significant we have used the Grote Rug estimates.

Table A.3

Stochiometric constants ($a_{i,j}$) of species in BLOOM II.

Species	Nitrogen	Phosphor	Silicon
Asterionella	0.024	0.0032	0.22
Centric diatoms	0.040	0.0046	0.13
Cryptomonas	0.072	0.0046	0.0007
Volvox	0.076	0.0070	0.0007
Scenedesmus	0.058	0.0052	0.0007
Ceratium	0.064	0.0046	0.0007
Anabaena	0.070	0.0057	0.0007
Aphanizomenon	0.068	0.0043	0.0007
Microcystis	0.053	0.0057	0.0007
Oscillatoria	0.063	0.0046	0.0007

As with respiration and volume, for some species the same stochiometric coefficient values have been used when observed numbers were not clearly distinct. Thus other, more obvious differences determine which species becomes dominant.

A.3 LAKE-SPECIFIC INPUTS

Table A.4

Lake specific inputs, which are either constant for each week or for which no weekly data are included in this report. The column for C/CHL indicates whether the nominal species specific values (Table A.2) are used (yes) or lake specific adjustments (no).

Case	Year	Kb	Depth	Nom?
Grote Rug Ring 2	1975	0.75	4.74-5.63	Yes
Grote Rug Ring 3	1975	0.89	4.74-5.63	Yes
Grote Rug Ring 1	1976	1.07	3.63-5.08	Yes
Grote Rug Ring 2	1976	0.82	3.63-5.08	Yes
Grote Rug Ring 3	1976	0.98	3.63-5.08	Yes
Grote Rug Ring 2	1977	0.66	3.77-5.09	Yes
Grote Rug Ring 3	1977	1.01	3.77-5.09	Yes
Grote Rug	1977	1.05	3.77-5.09	Yes
Grote Rug Ring 2	1978	0.81	4.41-5.63	Yes
Lake Veluwe	1975	4.5	1.2	Yes
Lake Veluwe	1976	4.5	1.2	Yes
Lake Wolderwijd	1975	2.5	1.5	No
Lake Wolderwijd	1976	2.5	1.5	No
Lake IJssel	1976	1.75	4.5	Yes

All weekly lake specific inputs for the cases discussed in this report are given in the Tables A.7 through A.20.

Table A.5

Units for lake specific inputs.

coefficient	Unit
Temperature	° C
Solar (1975, 1976)	Joules / cm^2 / week (total radiation)
Solar (1977, 1978)	Joules / cm^2 / week (400-700nm)
N, P and Si	mg / m^3

Available silicon was estimated in Grote Rug as observed dissolved silicon plus the estimated amount in live and dead diatoms. The latter was computed as the percentage diatoms in the RID species counts multiplied by the total biomass in units chlorophyll or total dry weight and the stochiometric coefficients for silicon.

In all other cases no estimates of diatom biomass were available. Available silicon was then put equal to the maximum value for periods when a diatom bloom most likely would have occurred (weeks 1 through 12) and for the rest of the year, we have assumed there were no diatoms, thus dissolved silicon is all that is available. Probably this procedure gives an occasional overestimation of the available amount of silicon.

All data for Grote Rug are from the (weekly) data base of the Delta Department, those for the 'PAWN' lakes from the 'WAKWAL' data base. *These are averages from several stations, sampled either* two-weekly (Lakes Veluwe and Wolderwijd) or monthly (Lake IJssel).

A.4 GRAPHICAL RESULTS

Of all results produced by the model we have only included the most important ones in the report:

- Total chlorophyll.
- Species dominance.
- Nutrient concentrations and related to this limiting factors.

For chlorophyll and species dominance we can make a direct comparison between the results of the model and observations. For nutrient concentrations or limiting factors this is, however, impossible. The computed nutrient fractions do not correspond to any observed fraction (at least not always). Furthermore there are no observations on limiting factors. A low observed value for the dissolved fraction of a nutrient is a necessary, but insufficient condition to prove that it is limiting. For an energy limitation there is only indirect observational evidence: if the dissolved fractions of all nutrients are consistently high, energy must be limiting.

Usually three figures are presented for each case: two for the nutrients N and P and one for phytoplankton; all variables are plotted with respect to time.
Nutrients: in BLOOM II two fractions are distinguished: (1) 'planktonic' (drawn lines), which are all nutrients currently associated to live and dead phytoplankton and zooplankton and (2) 'rest' (dashed lines), which are all other fractions. 'Rest' is in fact the nutrient 'slack' e_i of the optimum LP solution of BLOOM II [Section 2.2.2; Dantzig, 1963]. These fractions are not (always) identical to some measured number, although they can be: if the particulate inorganic fraction is small, as may be the case during a bloom, then 'planktonic' corresponds to the observed total particulate fraction and 'rest' to the observed dissolved fraction of this nutrient. If the last two numbers are both zero, we may indeed conclude that this nutrient is limiting the phytoplankton biomass in the model and in the observations.

Phytoplankton: BLOOM II's main outputs for each case are shown in one figure, giving

1. Predicted (histograms) and observed (drawn lines) total biomass in mg chlorophyll per m^3.
2. Predicted and observed relative species dominance for major periods.
3. Limiting factors abbreviated as:
   Pho = phosphorus, Sil = silicon, Nit = nitrogen and E = energy. A drawn line is plotted for each factor that is limiting to the bloom in a time period.

Because the dry weight to chlorophyll conversion of BLOOM II depends on the dominant species, there are sometimes variations in predicted chlorophyll which correspond to a change in composition rather than a change in computed dry weight. For instance, the three extremely high values for the Lake Wolderwijd after week 40 in 1975 are caused by an erroneous but temporary shift from blue-greens to dinoflagellates; the variation in dry weight over this period is much smaller.

As an alternative to the current indication of species dominance, we have considered drawing the concentrations of all ten species in one figure. However, this would not look very informative because the computed blooms may be fairly stable in composition, even if none of the time-dependent options of the model are operational, but large, unrealistic variations can occur between weeks [Section 5.5].

Therefore it seems unjustified to plot each shift in composition. As an alternative we calculate the average species composition over a period of several weeks, based upon variations in total biomass (computed and observed) and (major) changes in composition during a year. Usually there is one period prior to the spring bloom, one for the actual spring bloom, one for the first half of summer etc. Typically we distinguish between five and ten annual periods.

Species are given in descending order of importance, separated by a comma if the difference in their dry weight concentrations is small (less than 10 percent) and by a semicolon, if the difference is larger. We have included all species which were present in reasonable quantities: about 10 or more percent of the total biomass in a period. Obviously there is some arbitrariness in the selection of periods, commas and semicolons, but the overall picture is a fair reproduction of observations and model results.

Table A.6

Names of groups and species of BLOOM II and the abbreviations used in the figures.

Group name	Species name	Abbreviation
diatoms	Asterionella	D1
diatoms	Centric diatoms	D2
flagellates	Cryptomonas	F1
flagellates	Volvox	F2
greens	Scenedesmus	G1
dinoflagellates	Ceratium	I1
blue-greens	Anabaena	B1
blue-greens	Aphanizomenon	B2
blue-greens	Microcystis	B3
blue-greens	Oscillatoria	B4

In case a species was observed which is not included in the model, it is indicated by the abbreviation of its group and the letter 'M' for miscellaneous; thus for example the diatom Melosira and the flagellate Rhodomonas are shown as DM, respectively FM.

Table A.7

Case: Grote Rug Ring 2. Year: 1975. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	4.5	1244	2.97	0.032	1.54
2	4.5	1722	2.97	0.032	1.54
3	4.5	1430	3.32	0.040	1.48
4	4.5	1745	3.35	0.033	1.52
5	3.8	2812	3.38	0.025	1.56
6	3.1	3930	3.34	0.030	1.40
7	3.1	3357	3.35	0.064	1.31
8	3.5	5824	3.37	0.022	1.46
9	4.0	5113	3.30	0.017	1.09
10	4.9	3378	3.27	0.037	1.19
11	5.0	4130	3.29	0.033	0.97
12	4.9	5967	3.45	0.051	0.79
13	4.7	5680	3.33	0.033	0.64
14	4.7	6507	3.23	0.049	0.48
15	5.8	6679	3.09	0.073	0.32
16	10.0	8382	3.01	0.055	0.17
17	9.8	8255	2.97	0.041	0.12
18	10.7	12057	2.87	0.059	0.06
19	12.3	9576	2.66	0.026	0.18
20	14.2	12750	2.56	0.033	0.30
21	13.3	13984	2.47	0.042	0.36
22	13.5	12588	2.45	0.029	0.42
23	15.4	17441	2.37	0.019	0.36
24	16.7	14423	2.44	0.039	0.35
25	18.1	14073	2.30	0.051	0.32
26	17.0	15899	2.45	0.054	0.46
27	18.3	12619	2.46	0.033	0.53
28	20.0	13823	2.46	0.030	0.60
29	20.6	11568	2.34	0.028	0.57
30	21.3	12938	2.21	0.028	0.54
31	21.9	15257	2.09	0.025	0.51
32	21.2	12714	2.08	0.031	0.24
33	21.0	8705	1.88	0.062	0.34
34	19.8	9871	1.79	0.028	0.58
35	19.8	10478	1.62	0.022	0.63
36	18.7	8173	1.60	0.053	0.75
37	17.0	6717	1.59	0.085	0.87
38	17.4	8465	1.50	0.055	0.75
39	15.7	5755	1.60	0.043	0.34
40	14.6	4876	1.70	0.031	0.68
41	11.5	5194	1.53	0.064	0.45
42	10.6	4350	1.70	0.047	0.28
43	9.7	2816	1.86	0.050	0.47
44	9.2	3048	1.73	0.039	0.29
45	7.8	2270	1.74	0.049	0.20
46	6.7	1747	1.89	0.033	0.28
47	5.6	2188	1.85	0.047	0.34
48	5.0	1362	1.78	0.063	0.50
49	5.2	1545	1.69	0.062	0.50
50	4.7	1646	1.78	0.060	0.51
51	4.1	1210	2.02	0.063	0.55
52	3.6	672	2.09	0.063	0.70

Table A.8

Case: Grote Rug Ring 3. Year: 1975. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	4.5	1244	3.35	0.102	2.13
2	4.5	1722	3.35	0.102	2.13
3	4.8	1430	3.70	0.125	2.10
4	4.4	1745	3.73	0.114	2.10
5	3.8	2812	3.76	0.103	2.07
6	3.1	3930	3.68	0.107	2.02
7	3.0	3357	3.73	0.105	1.98
8	3.5	5824	3.75	0.083	1.93
9	4.0	5113	3.66	0.075	1.75
10	5.0	3378	3.54	0.095	2.26
11	5.0	4130	3.57	0.087	1.63
12	4.7	5967	3.71	0.100	1.50
13	4.5	5680	3.68	0.065	0.14
14	4.8	6507	3.50	0.089	0.06
15	5.8	6679	3.43	0.121	0.08
16	9.8	8382	3.00	0.061	0.15
17	10.0	8255	3.43	0.080	0.22
18	10.6	12057	3.32	0.115	0.29
19	12.3	9576	3.15	0.075	0.37
20	14.2	12750	2.86	0.080	0.59
21	13.3	13984	2.77	0.065	0.62
22	13.5	12588	2.82	0.067	0.80
23	14.9	17441	2.78	0.049	0.73
24	16.6	14423	2.69	0.060	0.72
25	18.2	14073	2.58	0.065	0.69
26	17.0	15899	2.55	0.077	0.74
27	18.2	12619	2.59	0.049	0.74
28	20.3	13823	2.71	0.060	0.64
29	20.6	11568	2.58	0.053	0.65
30	21.0	12938	2.45	0.046	0.66
31	21.3	15257	2.32	0.039	0.67
32	21.5	12714	2.33	0.043	0.67
33	20.9	8705	2.17	0.076	0.98
34	19.6	9871	2.04	0.051	1.45
35	20.0	10478	1.93	0.046	1.36
36	18.8	8173	1.92	0.062	1.30
37	16.7	6717	1.91	0.079	1.23
38	17.1	8465	1.90	0.076	1.12
39	15.7	5755	2.24	0.085	1.12
40	14.6	4876	2.11	0.040	1.10
41	11.6	5194	1.93	0.083	0.93
42	10.6	4350	2.09	0.073	0.76
43	9.7	2816	1.88	0.053	0.63
44	9.1	3048	1.81	0.067	0.30
45	7.8	2270	1.93	0.069	0.21
46	6.7	1747	1.93	0.047	0.29
47	5.6	2188	1.90	0.070	0.34
48	4.9	1362	1.85	0.073	0.40
49	5.2	1545	2.24	0.073	0.45
50	4.6	1646	1.92	0.073	0.49
51	4.1	1210	2.06	0.083	0.58
52	3.5	672	1.94	0.083	0.58

Table A.9

Case: Grote Rug Ring 1. Year: 1976. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	4.7	1314	3.01	0.103	1.66
2	5.8	1056	2.91	0.103	1.66
3	5.7	1820	2.84	0.097	1.68
4	5.6	2720	2.76	0.113	1.69
5	0.4	2341	2.85	0.116	1.79
6	0.4	2613	2.94	0.119	1.88
7	0.4	2405	3.03	0.122	1.98
8	3.4	4011	3.29	0.129	2.07
9	4.5	6120	3.15	0.125	2.14
10	2.8	6613	3.13	0.091	2.80
11	4.5	3872	3.09	0.065	2.80
12	4.2	8986	2.70	0.047	2.58
13	6.0	6669	2.54	0.037	0.58
14	7.7	9290	2.51	0.036	0.22
15	8.8	11493	2.55	0.032	0.08
16	11.6	11811	2.29	0.050	0.13
17	10.2	13985	2.44	0.042	0.19
18	10.8	11815	2.54	0.056	0.27
19	13.0	14506	2.48	0.100	0.18
20	15.2	15824	2.41	0.036	0.24
21	16.2	14201	2.44	0.053	0.23
22	15.0	9438	2.35	0.048	0.34
23	17.9	16722	2.29	0.071	0.09
24	20.0	17145	1.97	0.054	0.18
25	18.6	14556	2.12	0.043	0.26
26	23.5	18161	2.45	0.046	0.23
27	23.4	18590	2.59	0.053	0.26
28	22.7	15670	2.87	0.085	0.66
29	22.4	10494	2.37	0.108	1.01
30	20.1	12495	2.32	0.075	1.41
31	17.8	11447	2.61	0.093	1.67
32	18.9	15042	2.59	0.060	1.25
33	20.0	12374	2.37	0.081	1.52
34	19.3	13845	2.69	0.086	0.72
35	19.7	9043	2.63	0.057	0.78
36	17.3	9447	2.53	0.054	0.68
37	14.0	5714	2.39	0.062	0.85
38	16.7	6945	2.90	0.080	0.94
39	16.1	4957	2.68	0.087	1.10
40	16.0	4097	2.78	0.056	1.12
41	15.0	3572	3.07	0.052	1.23
42	12.7	4168	3.06	0.049	1.50
43	12.4	2734	3.09	0.033	1.52
44	10.7	2794	3.48	0.049	1.65
45	9.5	2479	3.46	0.065	1.66
46	7.8	1670	3.48	0.041	1.69
47	8.0	1243	3.84	0.049	1.74
48	7.5	1185	3.95	0.057	1.91
49	5.0	2190	3.96	0.075	1.91
50	4.7	1469	4.03	0.068	1.99
51	2.0	921	4.45	0.068	2.06
52	2.0	1979	4.45	0.068	2.06

Table A.10

Case: Grote Rug Ring 2. Year: 1976. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	4.7	1314	2.34	0.077	0.85
2	5.8	1056	2.21	0.077	1.03
3	5.6	1820	2.02	0.076	0.32
4	5.4	2720	1.86	0.093	0.10
5	0.4	2341	2.16	0.098	0.39
6	0.4	2613	2.46	0.103	0.68
7	0.4	2405	2.76	0.108	0.97
8	3.4	4011	2.99	0.114	1.18
9	4.5	6120	2.84	0.107	1.19
10	2.8	6613	2.77	0.095	2.49
11	4.4	3872	2.67	0.064	1.36
12	4.2	8986	2.28	0.048	0.67
13	5.9	6669	2.20	0.045	0.09
14	7.6	9290	2.18	0.049	0.19
15	8.8	11493	2.18	0.046	0.13
16	11.6	11811	2.06	0.078	0.26
17	10.2	13985	2.27	0.064	0.41
18	10.6	11815	2.24	0.046	0.47
19	14.7	14506	2.18	0.075	0.47
20	15.5	15824	2.13	0.034	0.49
21	15.3	14201	1.97	0.055	0.46
22	15.0	9438	1.90	0.039	0.34
23	18.0	16722	2.09	0.059	0.40
24	20.3	17145	1.84	0.033	0.40
25	18.6	14556	1.91	0.046	0.41
26	23.4	18161	1.92	0.037	0.31
27	23.4	18590	2.15	0.051	0.25
28	22.5	15670	2.59	0.097	0.55
29	22.3	10494	1.47	0.130	0.77
30	20.0	12495	2.03	0.083	0.97
31	17.7	11447	2.17	0.099	1.17
32	18.8	15042	1.96	0.075	0.77
33	19.9	12374	1.81	0.083	0.62
34	19.3	13845	2.49	0.129	0.63
35	19.3	9043	2.48	0.139	0.64
36	17.2	9447	2.22	0.115	0.73
37	13.7	5714	2.46	0.089	0.78
38	15.0	6945	2.63	0.068	0.91
39	16.0	4957	2.20	0.124	1.03
40	15.8	4097	1.99	0.061	0.97
41	14.4	3572	2.28	0.073	1.08
42	12.5	4168	2.41	0.058	1.18
43	12.2	2734	2.52	0.040	1.20
44	10.7	2794	2.84	0.047	1.30
45	9.4	2479	2.83	0.049	1.34
46	7.8	1670	2.97	0.053	1.41
47	8.0	1243	3.26	0.059	1.45
48	7.5	1185	3.25	0.064	1.62
49	6.1	2190	3.24	0.071	1.64
50	4.7	1469	3.61	0.056	1.81
51	2.0	921	3.79	0.052	1.73
52	2.0	1979	3.79	0.052	1.72

Table A.11

Case: Grote Rug Ring 3. Year: 1976. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	4.6	1314	2.05	0.083	0.77
2	5.7	1056	2.04	0.083	0.77
3	5.7	1820	1.94	0.097	0.83
4	5.6	2720	1.90	0.094	0.83
5	0.4	2341	2.00	0.103	0.96
6	0.4	2613	2.11	0.112	1.10
7	0.4	2405	2.21	0.121	1.23
8	3.4	4011	2.41	0.104	1.34
9	4.5	6120	2.46	0.093	1.41
10	2.8	6613	2.30	0.097	1.69
11	4.4	3872	2.24	0.075	2.77
12	4.1	8986	1.93	0.050	1.99
13	5.7	6669	1.79	0.041	0.12
14	7.7	9290	1.87	0.047	0.16
15	9.0	11493	2.04	0.061	0.13
16	11.6	11811	1.96	0.085	0.11
17	10.2	13985	2.10	0.063	0.19
18	10.6	11815	2.11	0.056	0.24
19	14.1	14506	2.32	0.105	0.32
20	14.5	15824	2.24	0.069	0.25
21	15.9	14201	1.95	0.067	0.32
22	15.0	9438	1.97	0.047	0.49
23	17.7	16722	2.08	0.081	0.46
24	20.3	17145	1.68	0.058	0.57
25	18.7	14556	1.65	0.082	0.67
26	23.5	18161	1.68	0.068	0.56
27	23.5	18590	1.65	0.064	0.39
28	22.4	15670	2.38	0.088	0.22
29	22.0	10494	1.94	0.267	0.78
30	20.0	12495	2.33	0.334	1.29
31	17.6	11447	2.55	0.267	1.65
32	18.3	15042	2.39	0.259	1.26
33	19.6	12374	1.88	0.293	1.55
34	19.2	13845	2.90	0.354	2.42
35	19.3	9043	3.20	0.261	2.50
36	17.2	9447	2.55	0.326	2.79
37	13.6	5714	2.40	0.350	2.86
38	14.7	6945	2.45	0.285	2.91
39	16.0	4957	2.06	0.321	3.14
40	15.8	4097	2.09	0.321	2.82
41	14.3	3572	3.12	0.420	2.86
42	12.5	4168	2.43	0.349	3.28
43	12.2	2734	2.51	0.337	3.36
44	10.7	2794	2.56	0.302	3.47
45	9.2	2479	2.53	0.303	3.38
46	7.8	1670	2.67	0.317	3.46
47	8.0	1243	3.01	0.282	3.35
48	7.5	1185	2.88	0.269	3.36
49	5.0	2190	3.09	0.303	3.59
50	4.7	1469	3.45	0.265	3.79
51	2.0	921	3.71	0.234	3.53
52	2.0	1979	3.71	0.213	3.53

Table A.12

Case: Grote Rug Ring 2. Year: 1977. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	2.0	337	3.80	0.047	1.71
2	2.0	367	3.72	0.046	1.76
3	1.7	501	3.98	0.048	1.81
4	2.3	495	4.02	0.041	1.85
5	3.5	1081	4.01	0.038	1.75
6	4.0	839	4.07	0.038	1.70
7	5.0	965	4.18	0.031	1.43
8	5.5	1268	4.18	0.034	1.41
9	5.5	1928	3.87	0.028	1.36
10	6.5	2227	3.98	0.029	1.29
11	8.0	2423	3.97	0.025	1.23
12	8.5	1705	4.04	0.034	1.13
13	8.0	2832	3.87	0.035	1.35
14	7.0	2705	3.77	0.052	0.97
15	7.0	3456	3.86	0.046	0.72
16	8.0	3709	3.80	0.053	0.47
17	9.4	3637	3.71	0.052	0.23
18	11.0	3025	3.25	0.070	0.12
19	12.0	3035	3.23	0.072	0.10
20	12.5	4850	2.95	0.067	0.20
21	13.8	5882	3.00	0.095	0.26
22	15.0	5017	2.85	0.097	0.32
23	15.4	3271	2.90	0.088	0.27
24	18.0	4174	3.17	0.103	0.31
25	16.6	2674	2.72	0.060	0.34
26	17.9	3501	2.87	0.046	0.44
27	19.9	5409	2.66	0.042	0.44
28	21.0	4837	2.97	0.039	0.48
29	18.9	3557	3.09	0.036	0.54
30	18.3	2550	2.91	0.029	0.56
31	18.0	4071	3.00	0.040	0.58
32	19.5	2702	3.00	0.029	0.60
33	19.4	2916	3.07	0.031	0.55
34	18.4	2746	2.81	0.035	0.53
35	18.0	3395	3.08	0.033	0.53
36	18.5	2870	2.97	0.035	0.48
37	16.8	2646	2.85	0.040	0.41
38	15.4	2573	2.77	0.032	0.26
39	14.6	1913	2.66	0.030	0.14
40	13.0	1828	2.66	0.037	0.13
41	13.6	1834	2.83	0.039	0.24
42	12.5	1778	3.12	0.044	0.35
43	13.1	961	3.41	0.056	0.49
44	12.0	983	3.31	0.048	0.65
45	10.8	906	3.53	0.064	0.75
46	9.3	802	3.70	0.084	0.90
47	6.4	528	3.74	0.081	1.06
48	4.5	605	3.85	0.074	1.35
49	2.4	595	3.89	0.074	1.46
50	3.2	272	4.00	0.076	1.63
51	4.3	393	4.10	0.063	1.66
52	5.8	368	4.14	0.074	1.74

Table A.13

Case: Grote Rug Ring 3. Year: 1977. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	1.0	337	3.70	0.241	3.56
2	2.0	367	3.80	0.240	3.61
3	1.7	501	3.95	0.252	3.54
4	2.3	495	4.12	0.258	3.52
5	3.5	1081	4.17	0.240	3.62
6	4.0	839	4.36	0.225	3.51
7	5.0	965	4.52	0.209	3.42
8	5.5	1268	4.43	0.187	3.31
9	5.5	1928	4.17	0.161	3.19
10	6.5	2227	4.16	0.152	3.11
11	8.0	2423	3.97	0.128	2.87
12	8.5	1705	3.94	0.124	2.71
13	8.0	2832	3.75	0.111	1.81
14	7.0	2705	3.66	0.125	1.05
15	7.0	3456	3.93	0.116	0.81
16	8.0	3709	3.91	0.117	0.76
17	9.4	3637	3.69	0.113	0.72
18	11.0	3025	3.48	0.110	0.68
19	12.0	3035	3.26	0.113	0.70
20	12.5	4850	3.12	0.098	0.73
21	13.8	5882	3.17	0.084	0.65
22	15.0	5017	2.77	0.050	0.10
23	15.4	3271	2.86	0.061	0.22
24	17.6	4174	2.76	0.065	0.30
25	16.8	2674	2.80	0.050	0.38
26	17.0	3501	2.88	0.060	0.45
27	19.4	5409	2.85	0.082	0.54
28	20.8	4837	2.91	0.069	0.48
29	18.9	3557	2.97	0.070	0.50
30	18.3	2550	2.99	0.078	0.55
31	18.0	4071	3.11	0.109	0.57
32	19.5	2702	3.02	0.107	0.53
33	19.4	2916	3.05	0.105	0.59
34	18.4	2746	2.86	0.100	0.69
35	18.0	3395	3.02	0.091	0.71
36	18.5	2870	2.79	0.070	0.75
37	16.8	2646	2.66	0.055	0.89
38	15.4	2573	2.57	0.051	0.93
39	14.6	1913	2.53	0.057	0.99
40	13.0	1828	2.54	0.057	1.01
41	13.6	1834	2.65	0.064	1.15
42	12.5	1778	2.92	0.124	1.23
43	13.1	961	3.26	0.145	1.26
44	12.0	983	3.32	0.164	1.41
45	10.7	906	3.64	0.167	1.51
46	9.3	802	3.93	0.174	1.64
47	6.4	528	3.97	0.183	1.80
48	4.5	605	4.16	0.190	2.07
49	2.4	595	4.20	0.211	2.15
50	3.2	272	4.38	0.201	2.24
51	4.3	393	4.54	0.205	2.34
52	5.8	368	4.50	0.208	2.47

Table A.14

Case: Grote Rug. Year: 1977. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	1.0	337	3.47	0.058	1.22
2	2.0	367	3.34	0.064	1.28
3	1.8	501	3.68	0.068	1.38
4	2.4	495	4.45	0.081	1.56
5	3.5	1081	4.02	0.068	1.55
6	4.0	839	4.06	0.055	1.68
7	5.5	965	3.88	0.052	1.74
8	6.0	1268	3.84	0.053	2.39
9	5.5	1928	3.79	0.045	1.72
10	6.5	2227	3.74	0.056	1.90
11	8.0	2423	3.79	0.038	1.05
12	8.5	1705	3.77	0.057	1.04
13	8.0	2832	3.59	0.041	1.18
14	7.0	2705	3.54	0.042	1.06
15	7.0	3456	3.67	0.061	0.72
16	8.0	3709	3.49	0.041	0.30
17	9.5	3637	3.45	0.057	0.44
18	11.2	3025	3.51	0.068	0.24
19	12.0	3035	2.80	0.074	0.26
20	13.0	4850	2.83	0.060	0.43
21	13.7	5882	2.71	0.042	0.21
22	15.9	5017	2.54	0.035	0.22
23	15.4	3271	2.71	0.061	0.42
24	17.6	4174	2.65	0.052	0.50
25	16.8	2674	3.26	0.044	0.71
26	17.3	3501	2.59	0.044	0.63
27	20.0	5409	2.56	0.050	0.72
28	21.6	4837	2.24	0.037	0.21
29	18.9	3557	2.36	0.050	0.66
30	18.3	2550	2.29	0.049	0.40
31	18.0	4071	2.10	0.051	0.37
32	19.7	2702	1.98	0.044	0.33
33	19.7	2916	1.93	0.034	0.27
34	18.4	2746	1.71	0.030	0.43
35	18.0	3395	1.89	0.035	0.55
36	18.6	2870	1.85	0.037	0.67
37	16.7	2646	1.73	0.041	0.82
38	15.4	2573	1.84	0.033	0.79
39	14.6	1913	2.04	0.040	0.81
40	13.0	1828	1.73	0.028	0.86
41	13.7	1834	2.10	0.042	0.95
42	12.5	1778	2.40	0.041	0.99
43	13.1	961	2.70	0.041	1.08
44	11.8	983	2.49	0.038	1.26
45	10.7	906	2.86	0.042	1.17
46	9.3	802	3.09	0.058	1.35
47	6.3	528	3.17	0.044	1.43
48	4.5	605	3.50	0.058	1.78
49	2.4	595	3.44	0.049	1.79
50	3.4	272	3.44	0.060	1.94
51	4.4	393	3.74	0.047	2.01
52	5.8	368	3.74	0.047	2.04

Table A.15

Case: Grote Rug Ring 2. Year: 1978. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	5.0	371	4.06	0.066	1.80
2	3.5	492	3.94	0.074	1.90
3	3.3	527	4.16	0.072	1.98
4	2.9	513	4.01	0.065	2.06
5	3.3	571	4.00	0.058	2.10
6	2.7	823	4.08	0.064	2.13
7	0.6	1225	4.15	0.048	2.09
8	0.6	1281	4.28	0.058	2.09
9	2.9	1577	4.08	0.068	2.09
10	4.7	1507	4.12	0.062	2.09
11	6.3	1545	4.29	0.064	1.90
12	6.0	2303	4.05	0.064	1.75
13	6.7	2230	3.98	0.060	1.50
14	8.5	3290	4.07	0.052	1.00
15	8.3	2923	4.02	0.052	0.50
16	7.5	3931	3.68	0.046	0.30
17	10.1	3798	3.66	0.048	0.30
18	12.4	2556	3.50	0.046	0.30
19	13.5	3999	3.48	0.044	0.30
20	13.3	4121	3.40	0.020	0.30
21	14.6	3134	3.39	0.008	0.30
22	15.8	5523	3.24	0.026	0.31
23	20.6	3563	3.20	0.026	0.43
24	17.6	4136	3.19	0.042	0.44
25	17.9	4123	3.23	0.034	0.44
26	16.4	2377	3.08	0.032	0.44
27	16.0	2567	2.96	0.054	0.44
28	15.4	3653	2.92	0.056	0.44
29	16.5	4145	2.80	0.038	0.45
30	18.5	5501	2.79	0.038	0.45
31	22.8	3533	2.67	0.034	0.45
32	18.7	3981	2.68	0.050	0.45
33	18.1	5440	2.57	0.044	0.45
34	19.6	4273	2.32	0.060	0.45
35	17.8	3282	2.33	0.054	0.45
36	16.7	3371	2.32	0.046	0.45
37	17.4	2842	2.24	0.060	0.45
38	16.2	2465	2.10	0.060	0.45
39	15.7	1397	1.99	0.052	0.45
40	13.3	1781	1.88	0.040	0.45
41	13.6	1686	1.99	0.084	0.45
42	13.7	1070	1.99	0.056	0.45
43	12.2	895	2.14	0.066	0.45
44	11.8	659	2.18	0.070	0.54
45	11.1	628	2.36	0.086	0.64
46	8.8	829	2.54	0.086	0.77
47	8.6	567	2.47	0.068	0.83
48	7.8	687	2.54	0.070	0.84
49	4.2	502	2.68	0.074	0.86
50	3.0	407	2.90	0.078	1.09
51	3.4	321	3.24	0.071	1.31
52	2.5	294	3.53	0.061	1.48

Table A.16

Case: Lake Veluwe. Year: 1975. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	5.0	1244	4.07	0.280	4.55
2	5.0	1722	4.07	0.280	4.55
3	4.6	1430	4.25	0.315	4.58
4	4.1	1745	4.43	0.350	4.62
5	3.3	2812	4.11	0.320	4.50
6	2.5	3930	3.80	0.290	4.38
7	3.2	3357	4.06	0.270	4.31
8	4.0	5824	4.33	0.250	4.25
9	5.1	5113	3.94	0.260	4.25
10	6.3	3378	3.54	0.270	4.25
11	4.8	4130	3.62	0.320	4.25
12	3.3	5967	3.70	0.370	4.25
13	4.5	5680	3.48	0.380	2.00
14	5.6	6507	3.27	0.390	0.25
15	7.1	6679	3.43	0.355	0.18
16	8.5	8382	3.58	0.320	0.12
17	10.3	8255	4.48	0.375	0.12
18	12.1	12057	5.38	0.430	0.12
19	12.6	9576	5.45	0.460	0.29
20	13.1	12750	5.52	0.490	0.47
21	13.6	13984	5.58	0.520	0.65
22	14.1	12588	5.65	0.550	0.82
23	12.0	17441	5.82	0.620	0.75
24	16.9	14423	5.85	0.610	1.20
25	21.8	14073	5.88	0.600	1.65
26	18.1	15899	5.65	0.620	3.12
27	18.2	12619	5.82	0.650	3.17
28	18.3	13823	5.98	0.680	3.21
29	18.3	11568	6.15	0.710	3.26
30	19.8	12938	6.31	0.740	3.30
31	21.3	15257	6.48	0.770	3.35
32	20.9	12714	6.27	0.745	3.63
33	20.6	8705	6.06	0.720	3.92
34	20.2	9871	5.86	0.695	4.20
35	19.8	10478	5.65	0.670	4.48
36	19.1	8173	5.30	0.675	4.25
37	18.3	6717	4.95	0.680	4.02
38	16.2	8465	5.18	0.652	4.16
39	14.1	5755	5.40	0.624	4.30
40	12.0	4876	5.63	0.596	4.44
41	9.9	5194	5.85	0.568	4.58
42	7.8	4350	6.08	0.540	4.72
43	7.6	2816	6.23	0.520	4.53
44	7.3	3048	6.38	0.500	4.35
45	6.1	2270	6.15	0.495	4.95
46	4.8	1747	5.92	0.490	5.55
47	4.1	2188	4.54	0.480	5.01
48	3.5	1362	3.16	0.470	4.48
49	4.1	1545	5.93	0.440	4.25
50	1.5	1646	4.53	0.410	4.45
51	2.5	1210	4.80	0.430	4.45
52	4.0	672	5.22	0.380	4.33

Table A.17

Case: Lake Veluwe. Year: 1976. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	5.6	1314	5.64	0.330	4.20
2	7.1	1056	6.06	0.280	4.08
3	6.7	1820	5.28	0.215	4.10
4	6.2	2720	4.51	0.150	4.13
5	5.7	2341	4.32	0.163	4.13
6	5.3	2613	4.13	0.175	4.13
7	4.8	2405	3.93	0.188	4.13
8	4.3	4011	3.74	0.200	4.13
9	4.0	6120	3.32	0.210	4.13
10	3.6	6613	2.90	0.220	4.13
11	2.9	3872	2.60	0.200	4.13
12	2.1	8986	2.30	0.180	4.13
13	5.3	6669	2.35	0.193	2.00
14	8.4	9290	2.40	0.207	0.12
15	11.5	11493	2.45	0.220	0.14
16	10.5	11811	2.25	0.255	0.16
17	9.6	13985	2.05	0.290	0.18
18	13.0	11815	2.23	0.335	0.30
19	16.3	14506	2.42	0.380	0.42
20	16.5	15824	2.90	0.375	0.87
21	16.6	14201	3.38	0.370	1.32
22	18.5	9438	3.31	0.370	1.62
23	20.3	16722	3.25	0.370	1.92
24	20.8	17145	3.60	0.450	2.33
25	21.3	14556	3.95	0.530	2.75
26	21.3	18161	4.05	0.553	3.21
27	21.3	18590	4.15	0.577	3.66
28	21.3	15670	4.25	0.600	4.12
29	20.3	10494	4.97	0.575	4.39
30	19.3	12495	5.68	0.550	4.65
31	19.9	11447	5.22	0.490	4.80
32	20.5	15042	4.75	0.430	4.95
33	20.2	12374	3.98	0.425	4.83
34	20.0	13845	3.22	0.420	4.72
35	18.2	9043	3.27	0.400	4.62
36	16.5	9447	3.32	0.380	4.52
37	15.5	5714	3.53	0.360	4.45
38	14.5	6945	3.75	0.340	4.38
39	14.1	4957	3.89	0.337	4.38
40	13.8	4097	4.04	0.333	4.38
41	13.4	3572	4.18	0.330	4.38
42	11.5	4168	4.41	0.340	4.33
43	9.5	2734	4.65	0.350	4.28
44	8.4	2794	4.44	0.320	4.18
45	7.3	2479	4.22	0.290	4.08
46	6.3	1670	4.21	0.295	4.01
47	5.2	1243	4.20	0.300	3.95
48	4.4	1185	4.27	0.320	3.90
49	3.6	2190	4.33	0.340	3.85
50	2.4	1469	4.18	0.315	3.86
51	1.1	921	4.03	0.290	3.88
52	1.1	1979	4.04	0.277	3.76

Table A.18

Case: Lake Wolderwijd. Year: 1975. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	5.3	1244	2.90	0.200	3.98
2	5.3	1722	2.90	0.200	3.98
3	4.8	1430	3.16	0.205	4.11
4	4.3	1745	3.43	0.210	4.25
5	3.6	2812	3.31	0.215	4.11
6	3.0	3930	3.20	0.220	3.98
7	3.5	3357	3.35	0.180	3.76
8	4.0	5824	3.50	0.140	3.55
9	5.0	5113	3.23	0.140	3.55
10	6.0	3378	2.96	0.140	3.55
11	4.7	4130	2.86	0.160	3.55
12	3.5	5967	2.77	0.180	3.55
13	4.3	5680	2.53	0.185	2.00
14	5.1	6507	2.30	0.190	0.50
15	6.6	6679	2.64	0.185	0.05
16	8.1	8382	2.98	0.180	0.06
17	10.1	8255	3.20	0.190	0.06
18	12.0	12057	3.42	0.200	0.06
19	12.6	9576	3.47	0.210	0.21
20	13.1	12750	3.52	0.220	0.37
21	13.7	13984	3.57	0.230	0.52
22	14.3	12588	3.62	0.240	0.68
23	12.1	17441	3.48	0.330	0.68
24	17.7	14423	3.45	0.330	1.17
25	23.3	14073	3.42	0.330	1.65
26	18.8	15899	3.35	0.420	2.62
27	18.8	12619	3.60	0.454	2.79
28	18.7	13823	3.84	0.488	2.96
29	18.6	11568	4.09	0.522	3.14
30	20.4	12938	4.33	0.556	3.31
31	22.1	15257	4.58	0.590	3.48
32	21.6	12714	4.52	0.548	3.68
33	21.1	8705	4.45	0.505	3.88
34	20.5	9871	4.39	0.462	4.08
35	20.0	10478	4.32	0.420	4.28
36	19.1	8173	4.30	0.430	5.08
37	18.1	6717	4.28	0.440	5.88
38	16.0	8465	4.41	0.412	5.71
39	13.9	5755	4.54	0.384	5.54
40	11.7	4876	4.66	0.356	5.36
41	9.6	5194	4.79	0.328	5.19
42	7.5	4350	4.92	0.300	5.02
43	7.6	2816	4.37	0.280	4.70
44	7.6	3048	3.82	0.260	4.38
45	6.1	2270	3.72	0.245	5.06
46	4.5	1747	3.62	0.230	5.75
47	3.8	2188	2.98	0.220	5.14
48	3.1	1362	2.34	0.210	4.53
49	4.1	1545	3.70	0.220	4.35
50	0.8	1646	2.87	0.200	4.75
51	2.1	1210	2.84	0.190	4.62
52	3.8	672	2.69	0.170	4.52

Table A.19

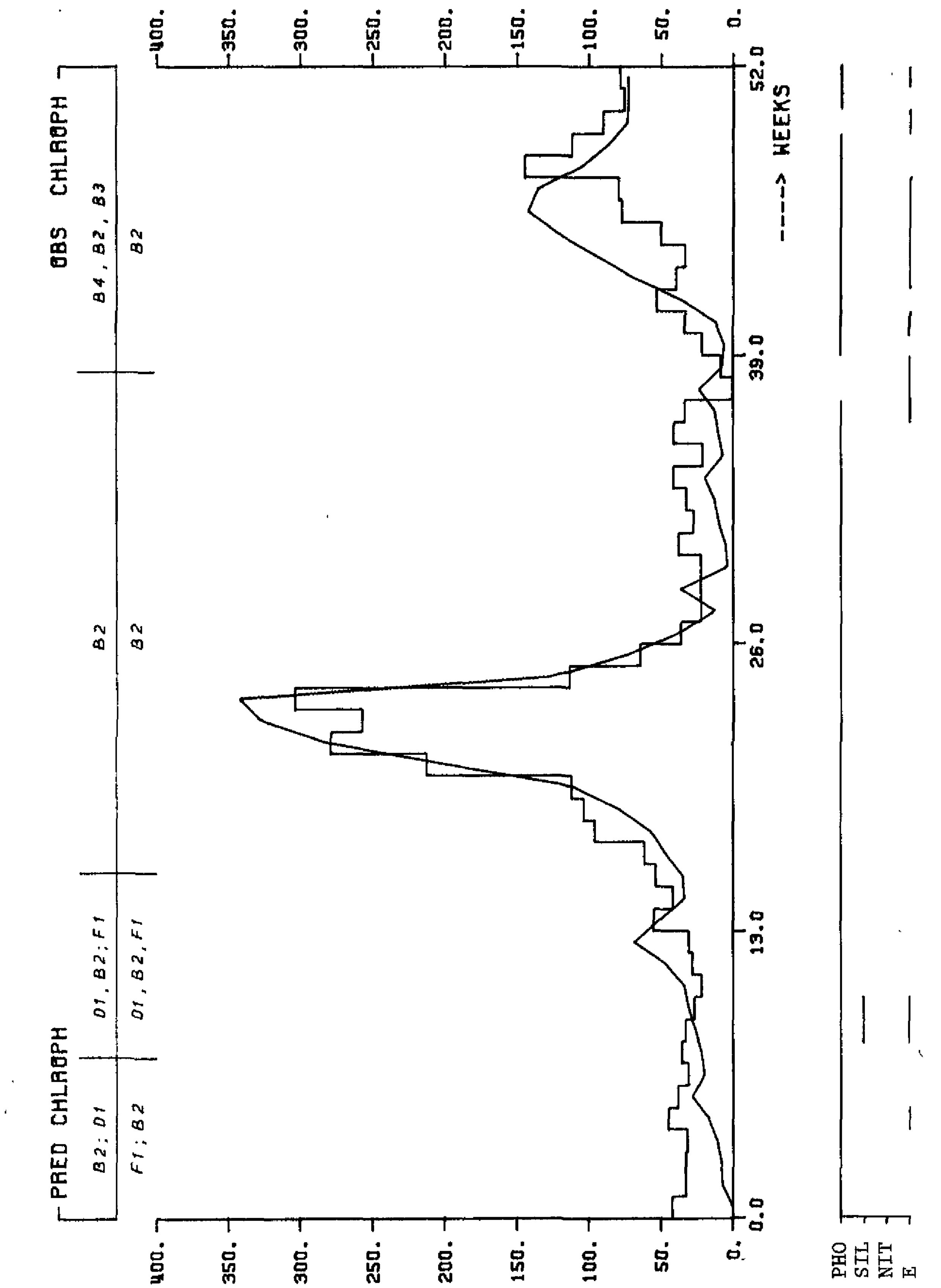
Case: Lake Wolderwijd. Year: 1976. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	5.5	1314	2.55	0.150	4.42
2	7.1	1056	2.40	0.130	4.32
3	6.6	1820	3.15	0.110	4.44
4	6.1	2720	3.90	0.090	4.55
5	5.6	2341	3.66	0.098	4.44
6	5.0	2613	3.41	0.105	4.33
7	4.5	2405	3.17	0.113	4.23
8	4.0	4011	2.93	0.120	4.12
9	2.7	6120	2.48	0.105	4.12
10	1.5	6613	2.03	0.090	4.12
11	1.9	3872	1.65	0.090	4.12
12	2.3	8986	1.27	0.090	4.12
13	5.4	6669	1.36	0.090	2.00
14	8.4	9290	1.46	0.090	0.50
15	11.5	11493	1.55	0.090	0.10
16	10.6	11811	1.46	0.105	0.11
17	9.7	13985	1.37	0.120	0.12
18	13.1	11815	1.26	0.155	0.25
19	16.5	14506	1.15	0.190	0.38
20	16.3	15824	1.53	0.195	0.50
21	16.1	14201	1.92	0.200	0.62
22	18.6	9438	1.98	0.225	0.80
23	21.1	16722	2.05	0.250	0.98
24	21.4	17145	2.50	0.265	1.33
25	21.6	14556	2.95	0.280	1.68
26	21.6	18161	3.24	0.290	1.96
27	21.5	18590	3.53	0.300	2.24
28	21.4	15670	3.82	0.310	2.52
29	20.3	10494	3.59	0.305	2.72
30	19.1	12495	3.35	0.300	2.92
31	19.5	11447	3.91	0.335	2.99
32	19.8	15042	4.48	0.370	3.05
33	20.1	12374	3.75	0.395	3.17
34	20.5	13845	3.02	0.420	3.28
35	18.2	9043	3.07	0.385	3.36
36	16.0	9447	3.12	0.350	3.45
37	15.2	5714	3.14	0.310	3.35
38	14.5	6945	3.15	0.270	3.25
39	14.2	4957	3.15	0.253	3.28
40	13.9	4097	3.15	0.237	3.32
41	13.6	3572	3.15	0.220	3.35
42	11.6	4168	3.11	0.200	3.35
43	9.6	2734	3.08	0.180	3.35
44	8.4	2794	2.95	0.165	3.28
45	7.2	2479	2.83	0.150	3.22
46	6.2	1670	2.81	0.160	3.17
47	5.2	1243	2.78	0.170	3.12
48	4.5	1185	2.81	0.160	3.10
49	3.8	2190	2.84	0.150	3.08
50	2.4	1469	2.71	0.145	3.11
51	1.1	921	2.58	0.140	3.15
52	1.0	1979	2.70	0.137	3.12

Table A.20

Case: Lake IJssel. Year: 1976. Weekly lake specific inputs.

Week	Temp	Solar	N	P	Si
1	4.9	1314	4.13	0.170	0.74
2	5.9	1056	4.66	0.185	0.98
3	6.9	1820	5.18	0.200	1.22
4	6.5	2720	5.28	0.202	1.10
5	6.1	2341	5.38	0.205	0.98
6	5.8	2613	5.48	0.208	0.86
7	5.4	2405	5.57	0.210	0.74
8	5.0	4011	5.67	0.212	0.63
9	4.6	6120	5.77	0.215	0.51
10	4.3	6613	5.87	0.217	0.39
11	3.9	3872	5.97	0.220	0.27
12	5.1	8986	5.83	0.220	0.23
13	6.4	6669	5.69	0.220	0.19
14	7.6	9290	5.55	0.220	0.15
15	8.8	11493	5.41	0.220	0.11
16	10.1	11811	5.27	0.220	0.07
17	11.3	13985	4.90	0.210	0.12
18	12.5	11815	4.52	0.200	0.18
19	13.6	14506	4.15	0.190	0.23
20	14.5	15824	3.78	0.180	0.24
21	15.4	14201	3.40	0.170	0.25
22	16.3	9438	3.03	0.160	0.26
23	17.1	16722	2.66	0.150	0.27
24	17.5	17145	2.59	0.170	0.44
25	17.9	14556	2.52	0.190	0.61
26	18.3	18161	2.44	0.210	0.77
27	18.7	18590	2.37	0.230	0.94
28	19.1	15670	2.30	0.250	1.11
29	19.5	10494	2.23	0.270	1.28
30	19.5	12495	2.33	0.270	1.15
31	19.5	11447	2.44	0.270	1.02
32	19.5	15042	2.54	0.270	0.90
33	19.5	12374	2.64	0.270	0.77
34	18.5	13845	2.66	0.258	0.64
35	17.5	9043	2.69	0.245	0.51
36	16.5	9447	2.71	0.232	0.38
37	15.6	5714	2.73	0.220	0.25
38	14.6	6945	2.74	0.206	0.22
39	13.7	4957	2.75	0.192	0.18
40	12.8	4097	2.77	0.178	0.15
41	11.8	3572	2.78	0.164	0.11
42	10.9	4168	2.79	0.150	0.08
43	9.7	2734	2.77	0.143	0.11
44	8.5	2794	2.75	0.135	0.14
45	7.4	2479	2.73	0.128	0.17
46	6.2	1670	2.71	0.120	0.20
47	5.4	1243	2.81	0.113	0.29
48	4.6	1185	2.90	0.105	0.39
49	3.8	2190	3.00	0.098	0.49
50	3.0	1469	3.10	0.090	0.58
51	2.4	921	3.28	0.112	0.73
52	1.8	1979	3.46	0.134	0.88

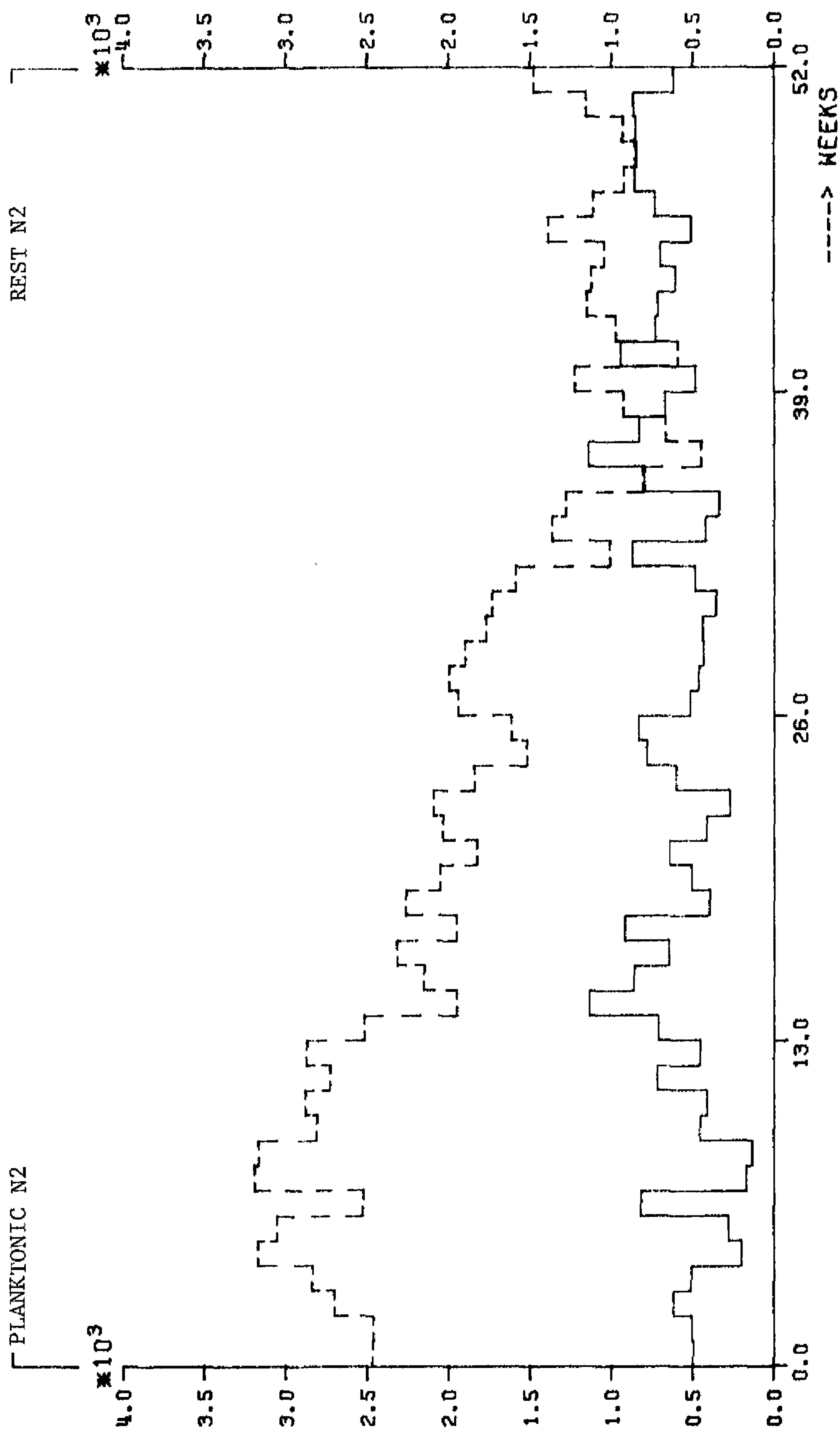


GROTE RUG, RING 2 1977. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. CALIBRATION RUN WITH 'OBSERVED' MORTALITY RATES.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-1.1

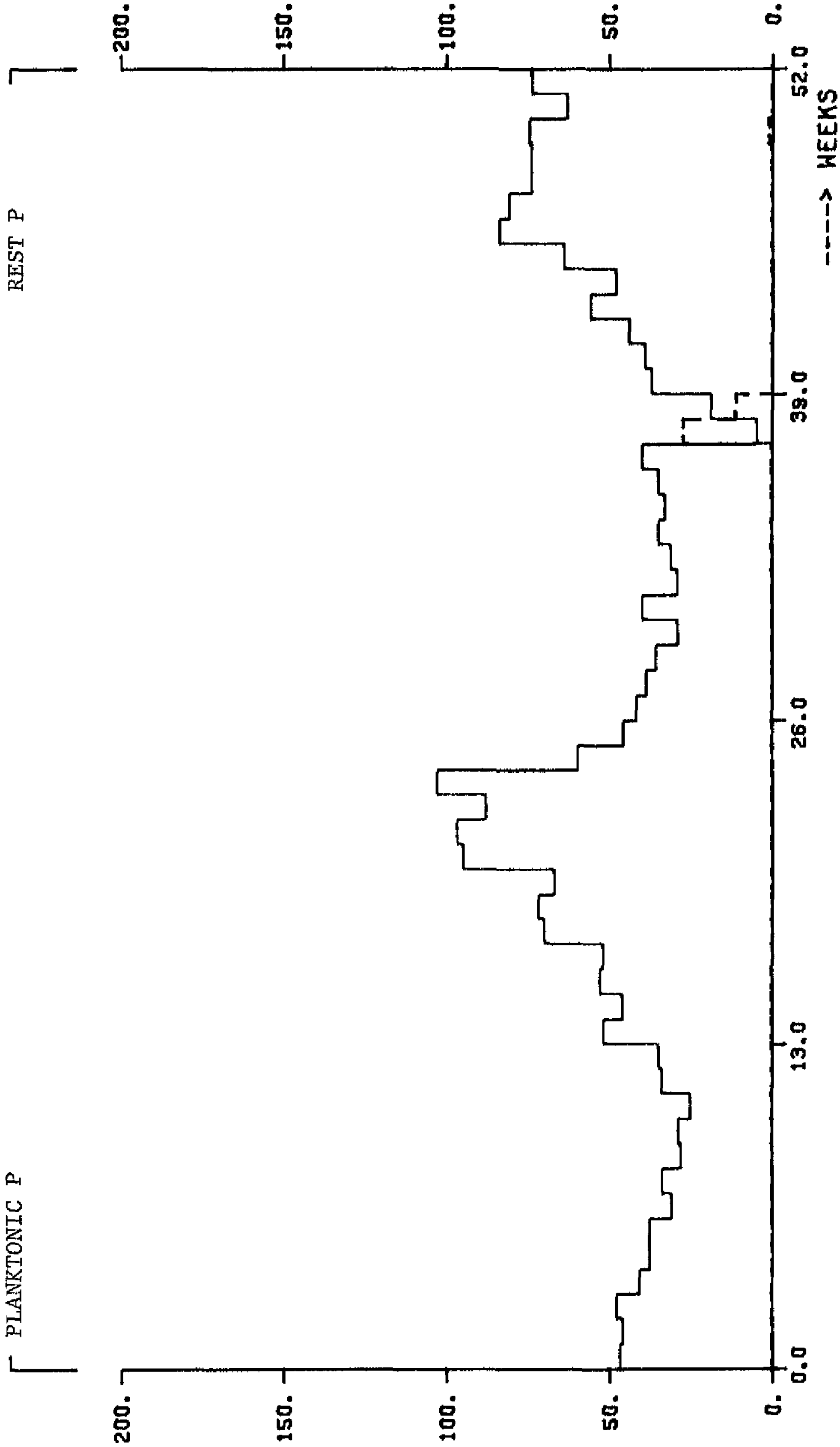


GROTE RUG, RING 2 1975. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-4.3

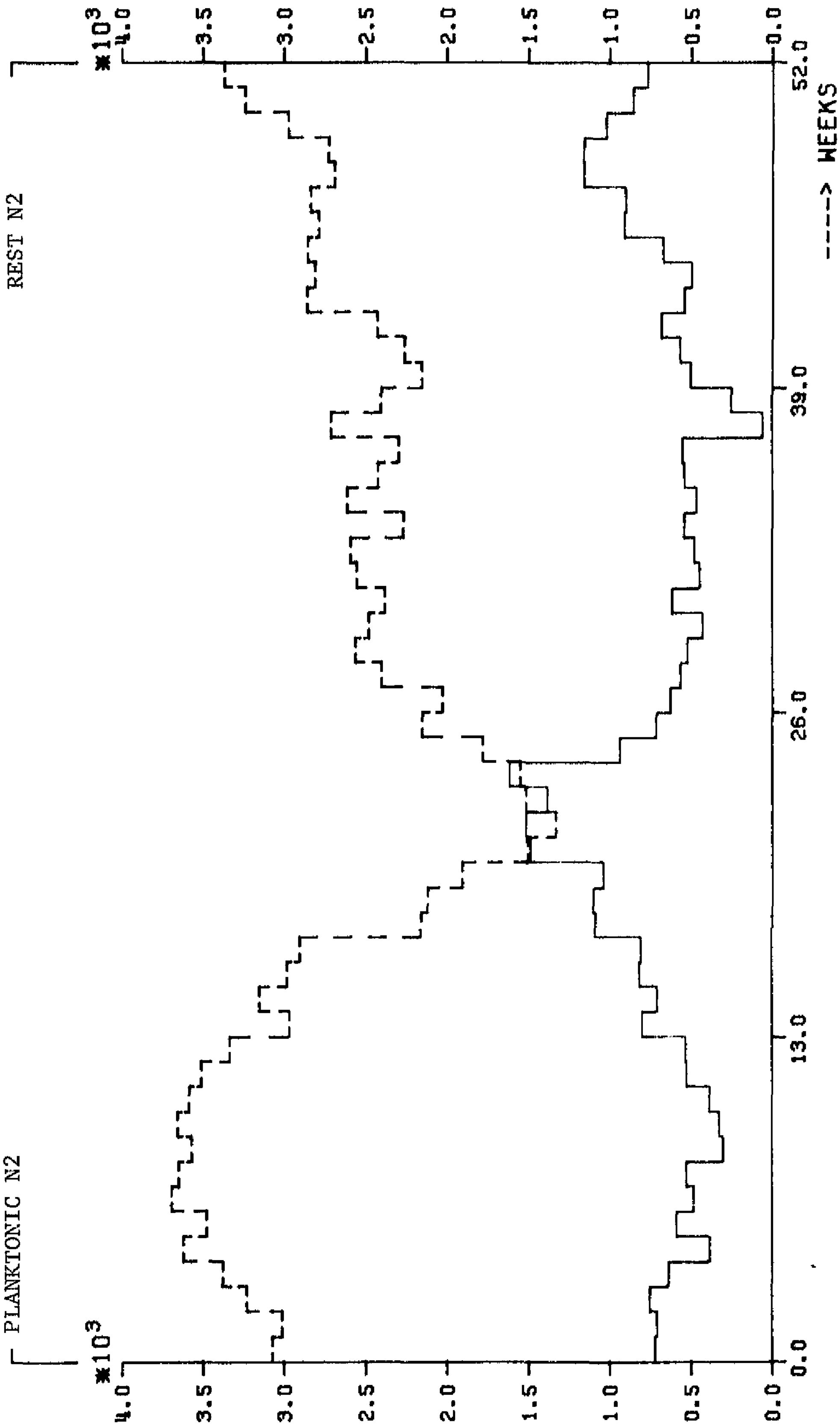


GROTE RUG, RING 2 1977. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. CALIBRATION RUN.

A4

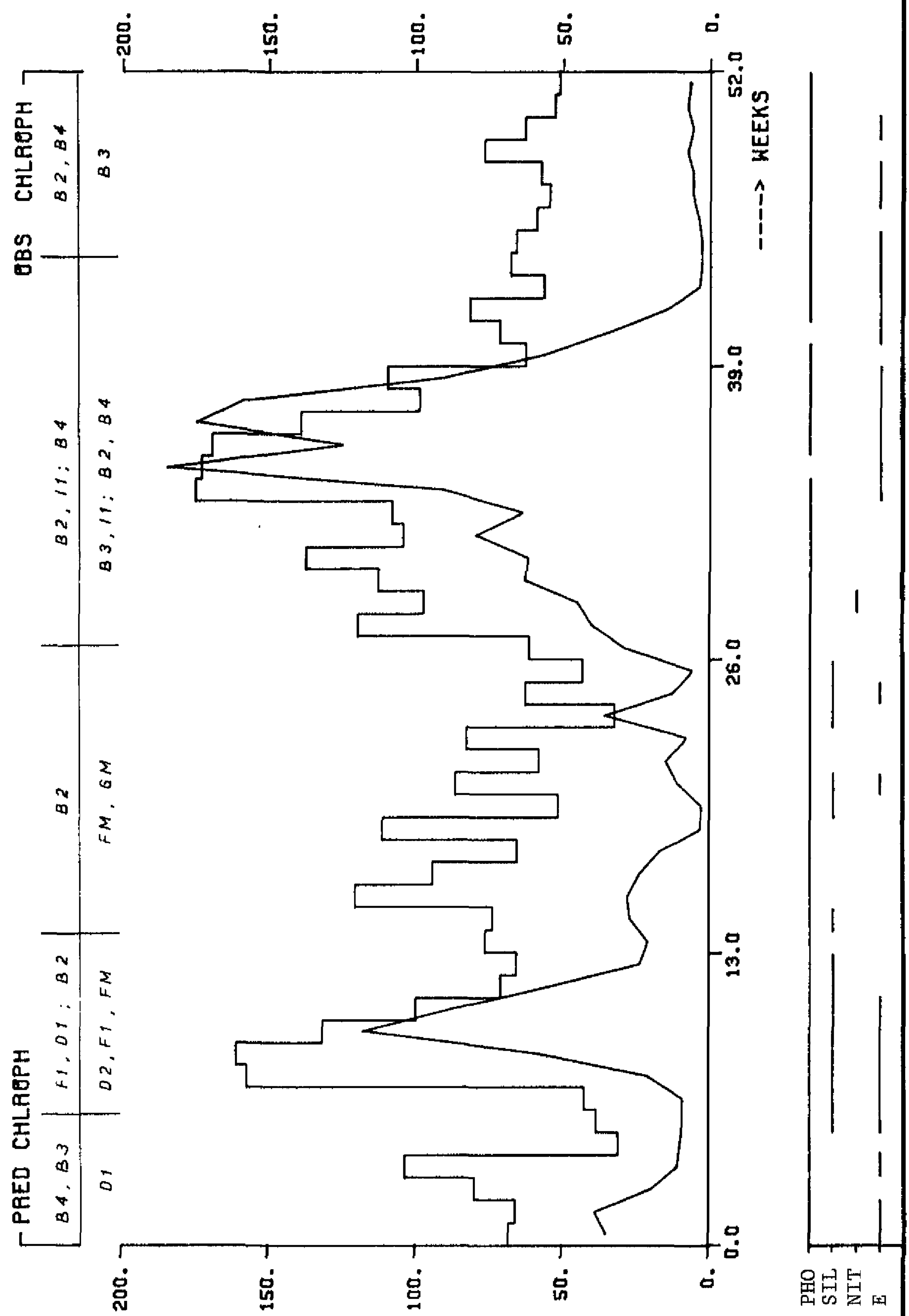
DELFT HYDRAULICS LABORATORY

Fig. A-1.2



GROTE RUG, RING 2 1977. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. CALIBRATION RUN.

DELFT HYDRAULICS LABORATORY	Fig. A-1.3	A4

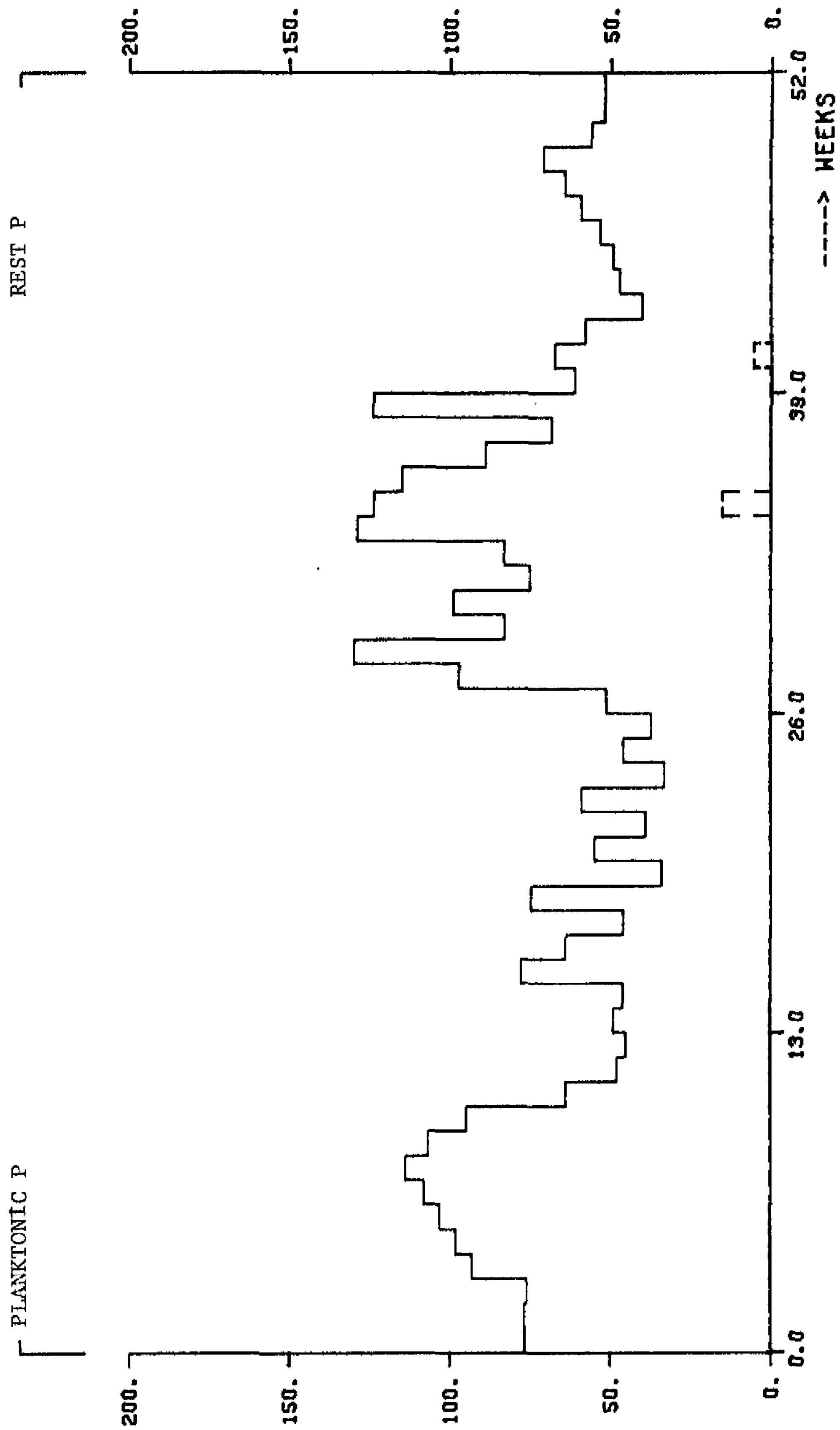


GROTE RUG, RING 2 1976. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-2.1

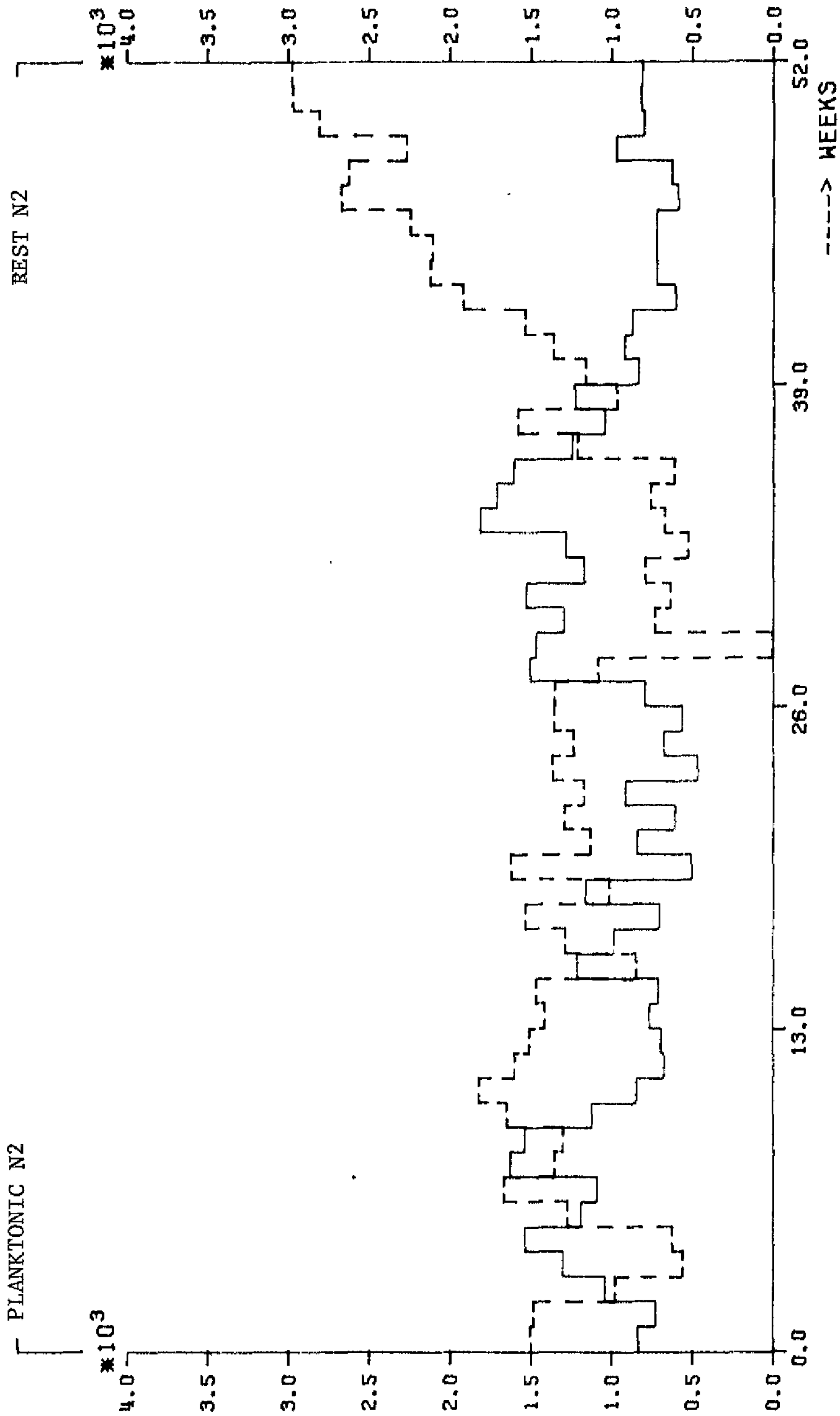


GROTE RUG, RING 2 1976. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-2.2

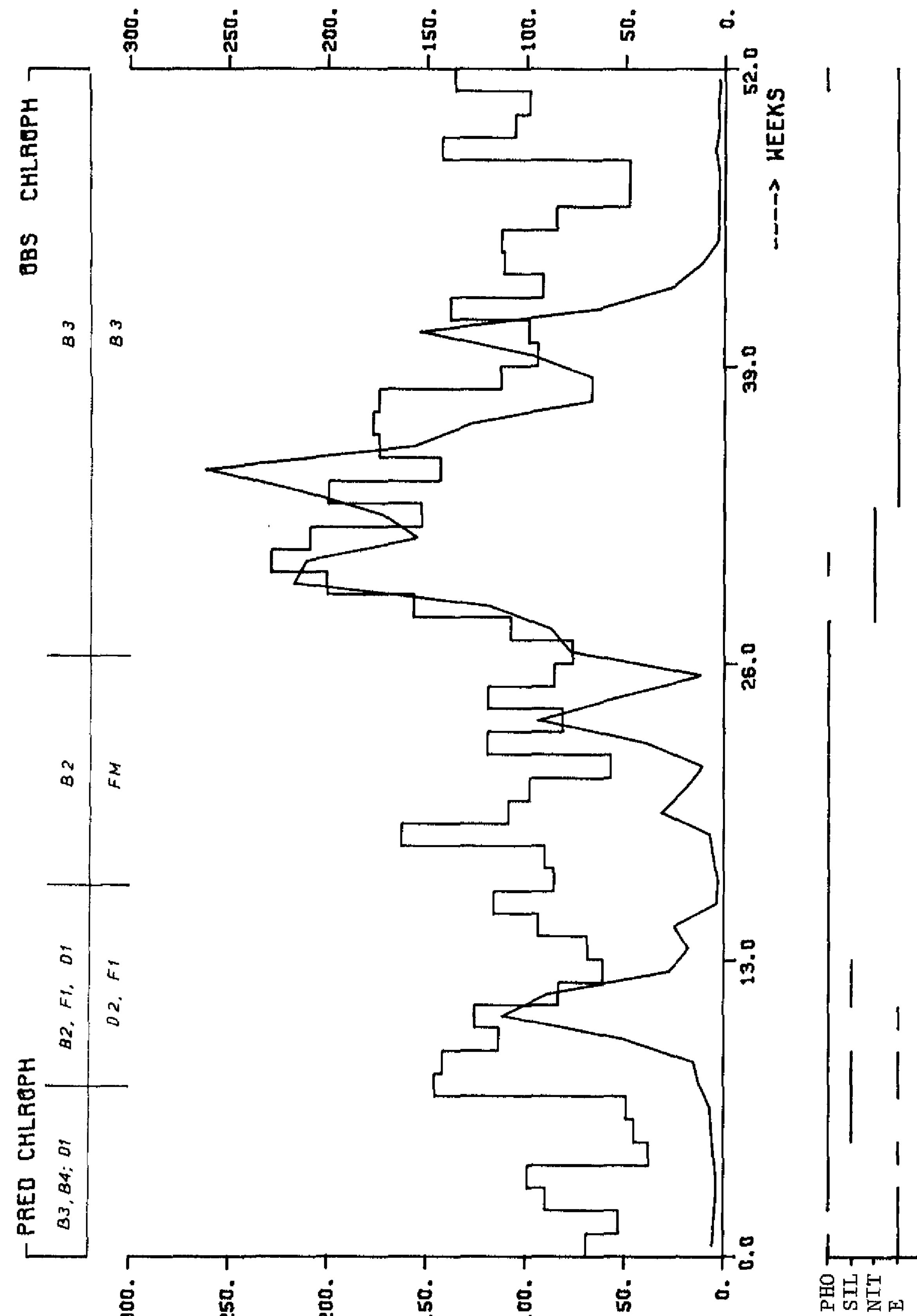


GROTE RUG, RING 2 1976. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-2.3

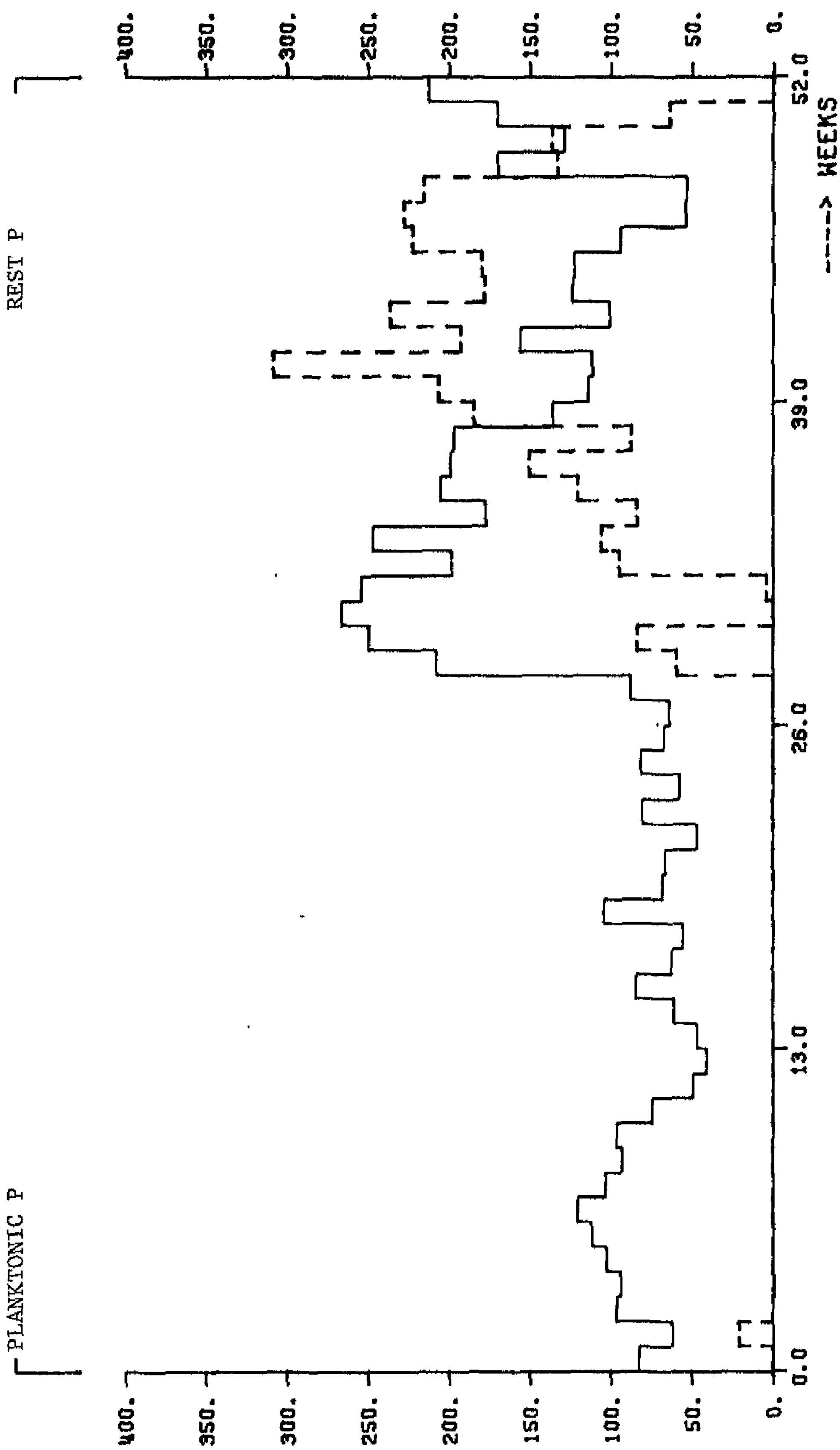


GROTE RUG, RING 3 1976. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. NOMINAL RUN.

	A4

DELFT HYDRAULICS LABORATORY

Fig. A-3.1

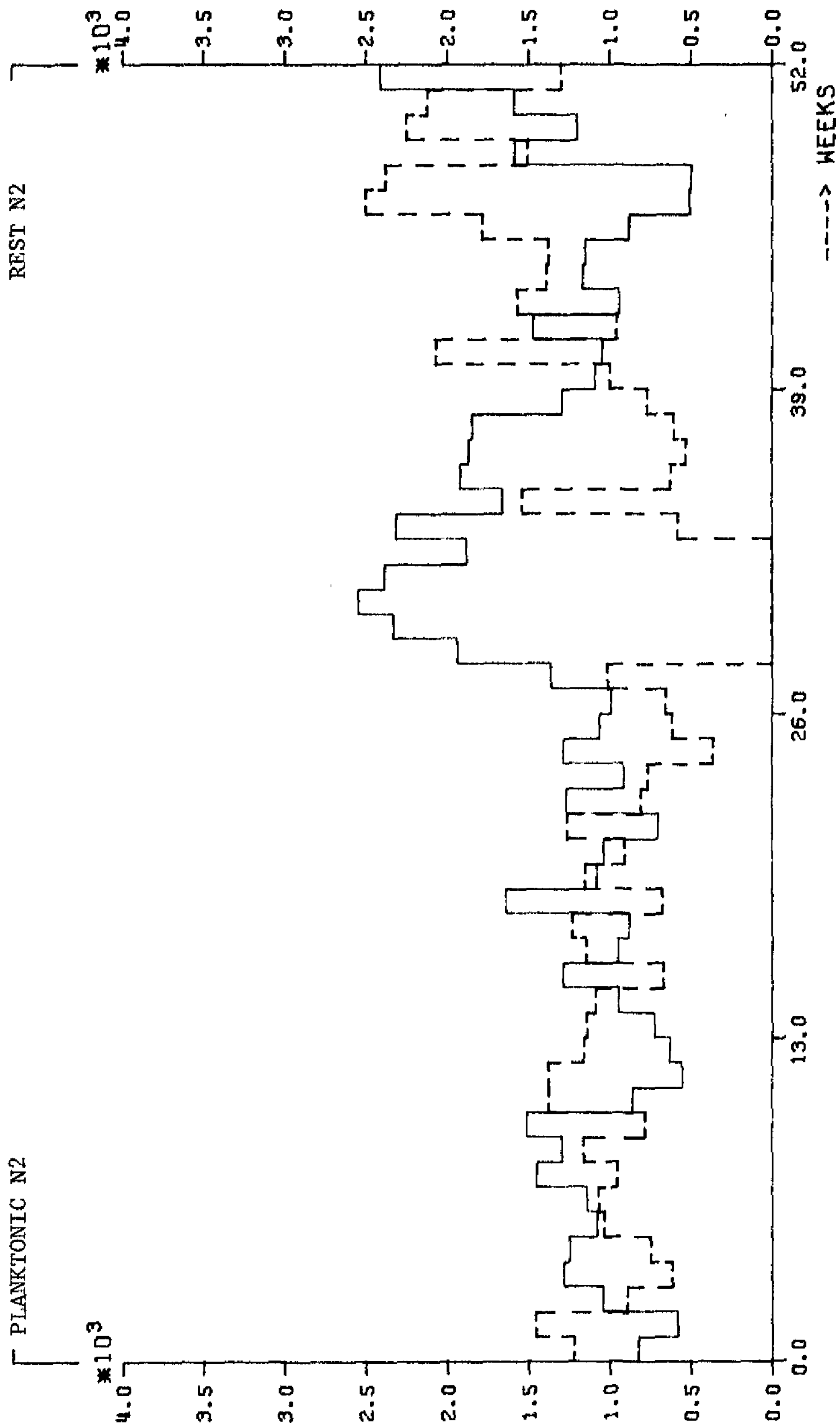


GROTE RUG, RING 3 1976. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-3.2

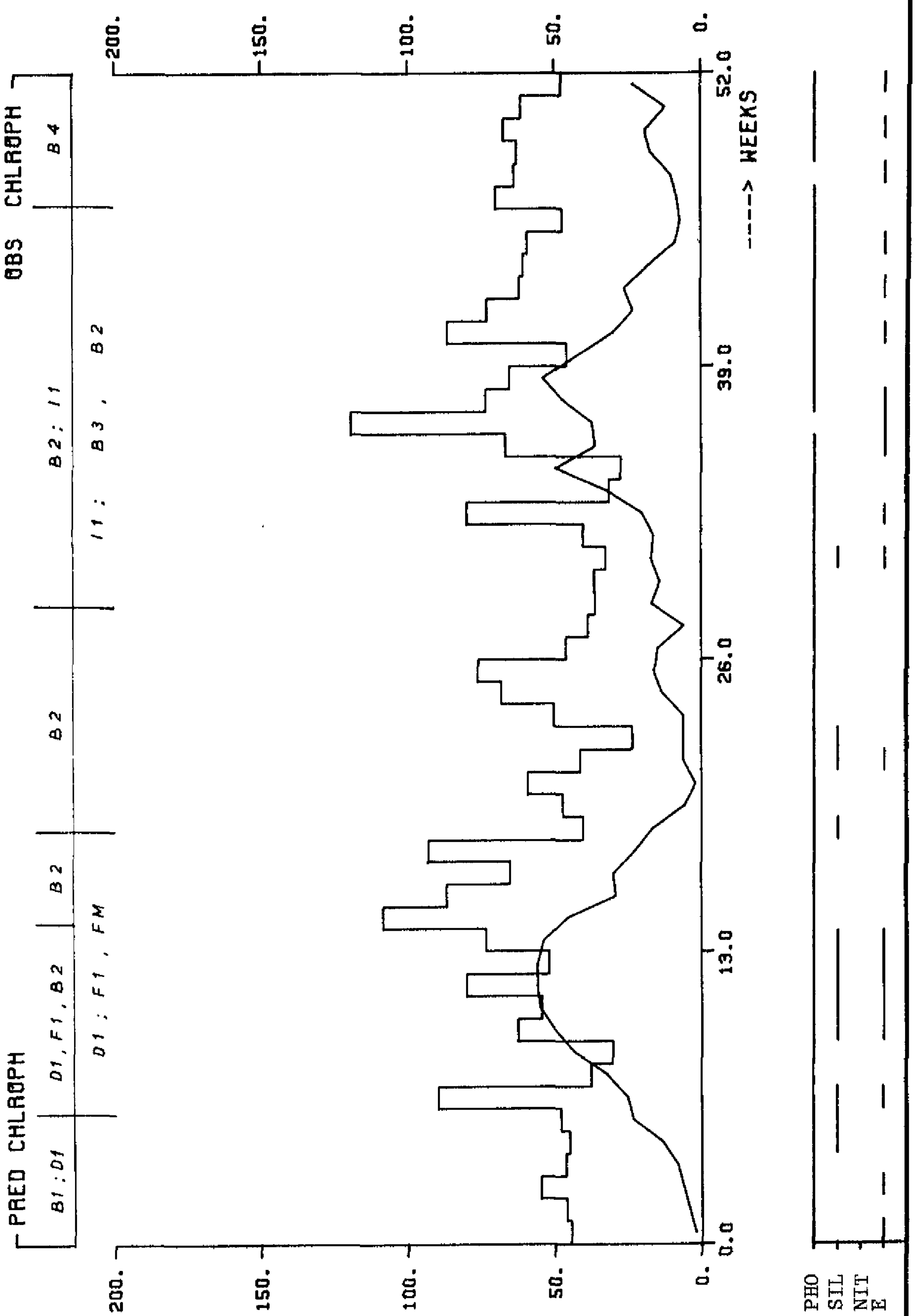


GROTE RUG, RING 3 1976. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-3.3

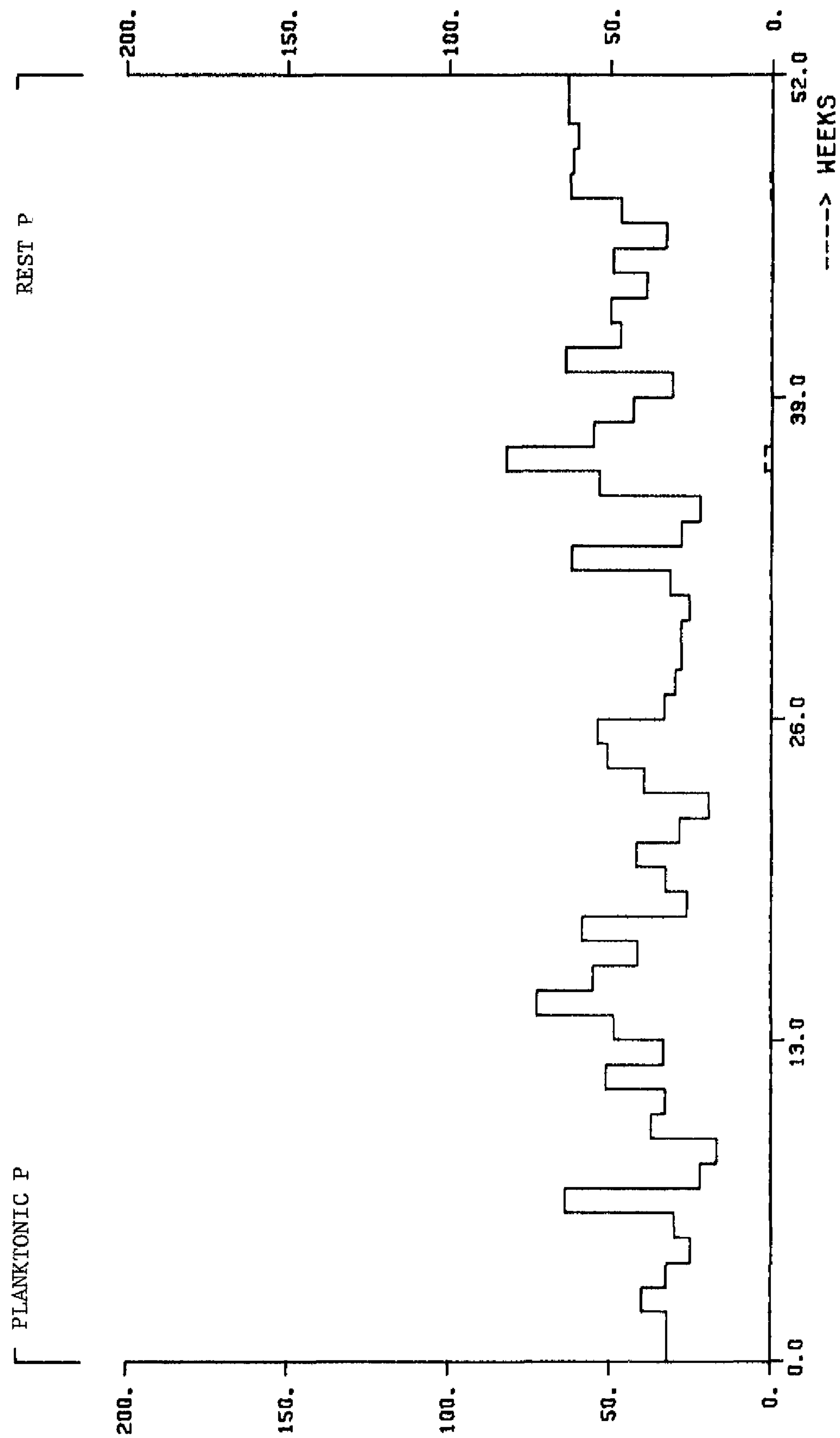


GROTE RUG, RING 2 1975. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. NOMINAL RUN.

	A4

DELFT HYDRAULICS LABORATORY

Fig. A-4.1

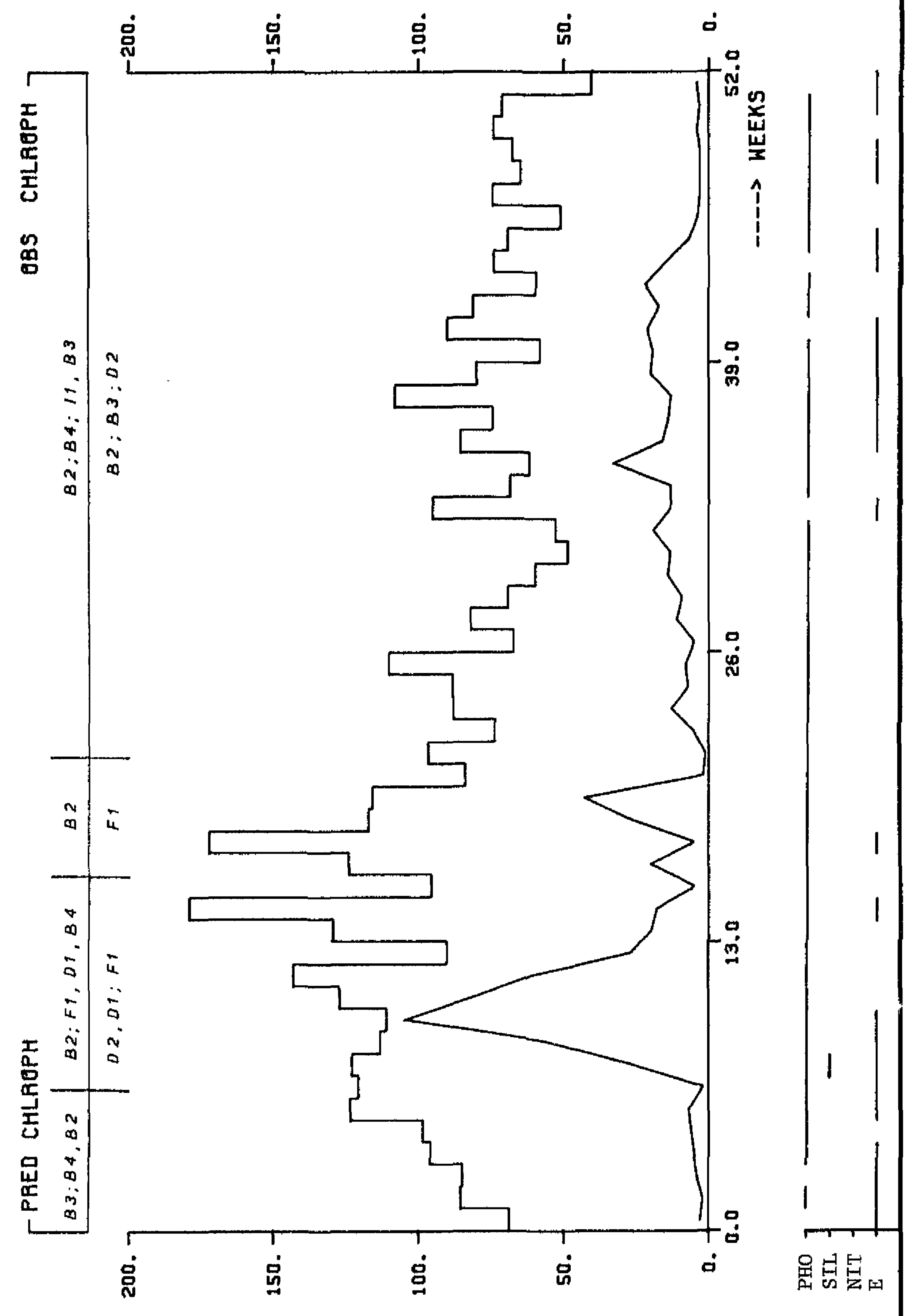


GROTE RUG, RING 2 1975. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-4.2

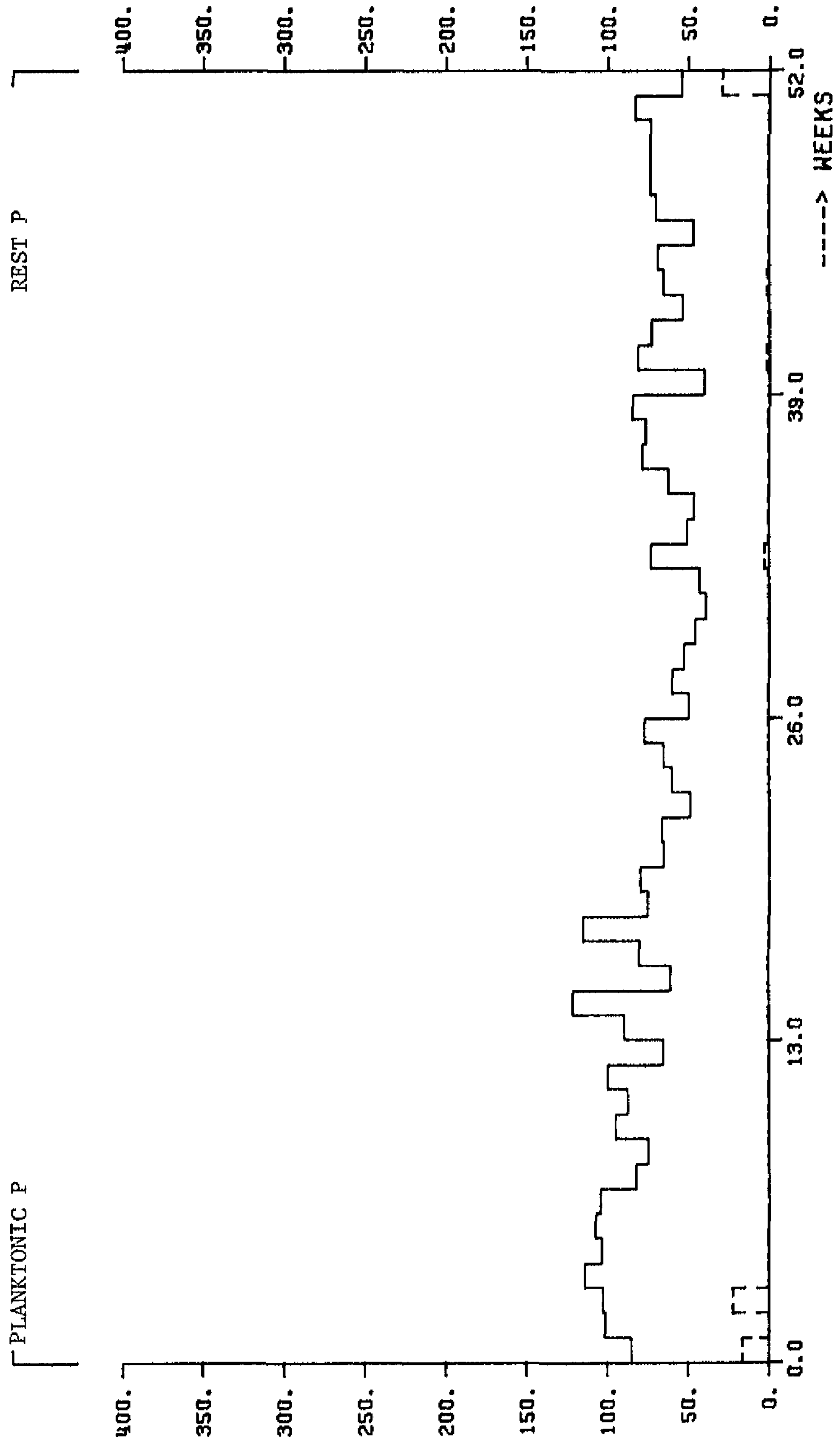


GROTE RUG, RING 3 1975. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-5.1

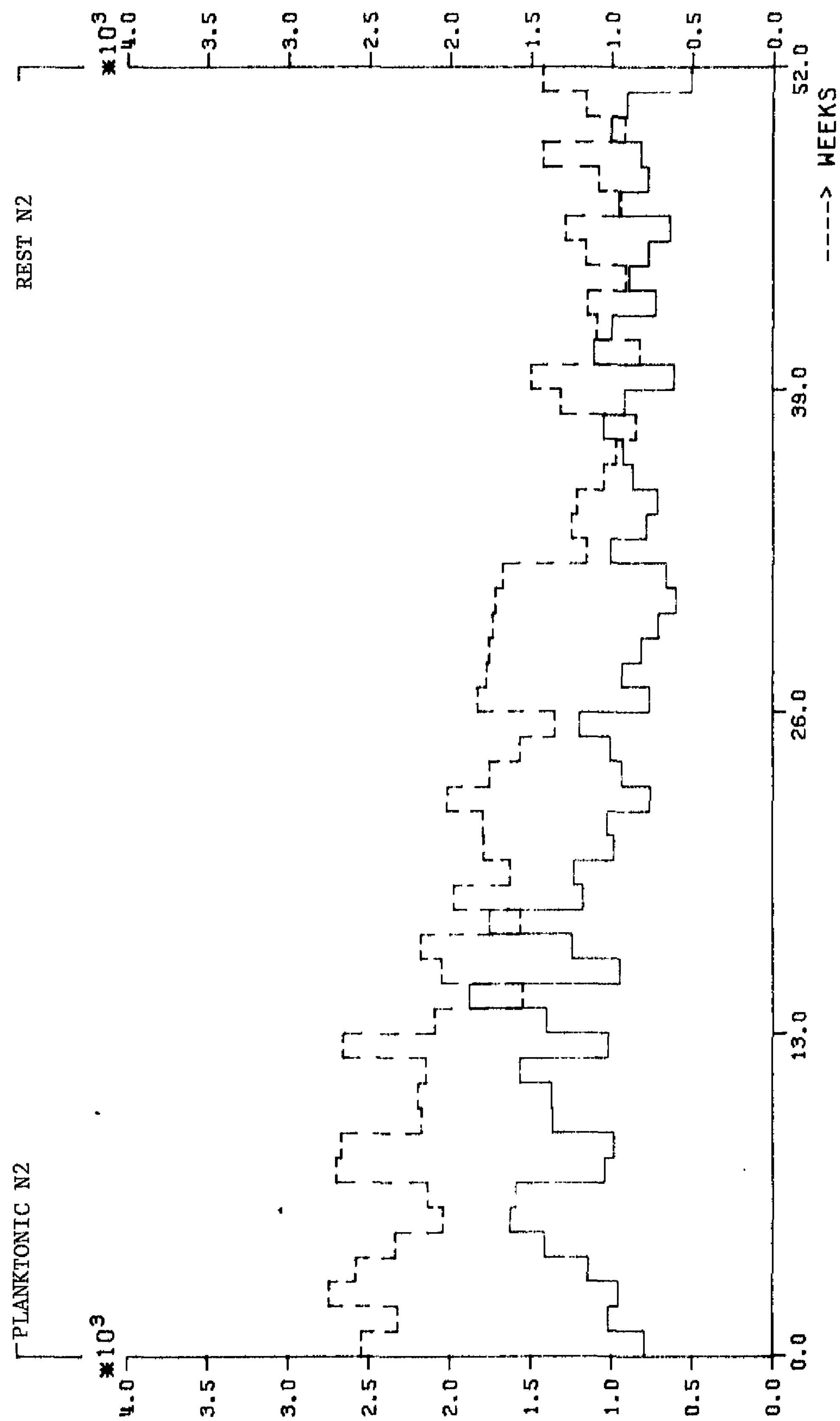


GROTE RUG, RING 3 1975. P IN PHYTOPLANKTON,
ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE
SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L.
NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-5.2

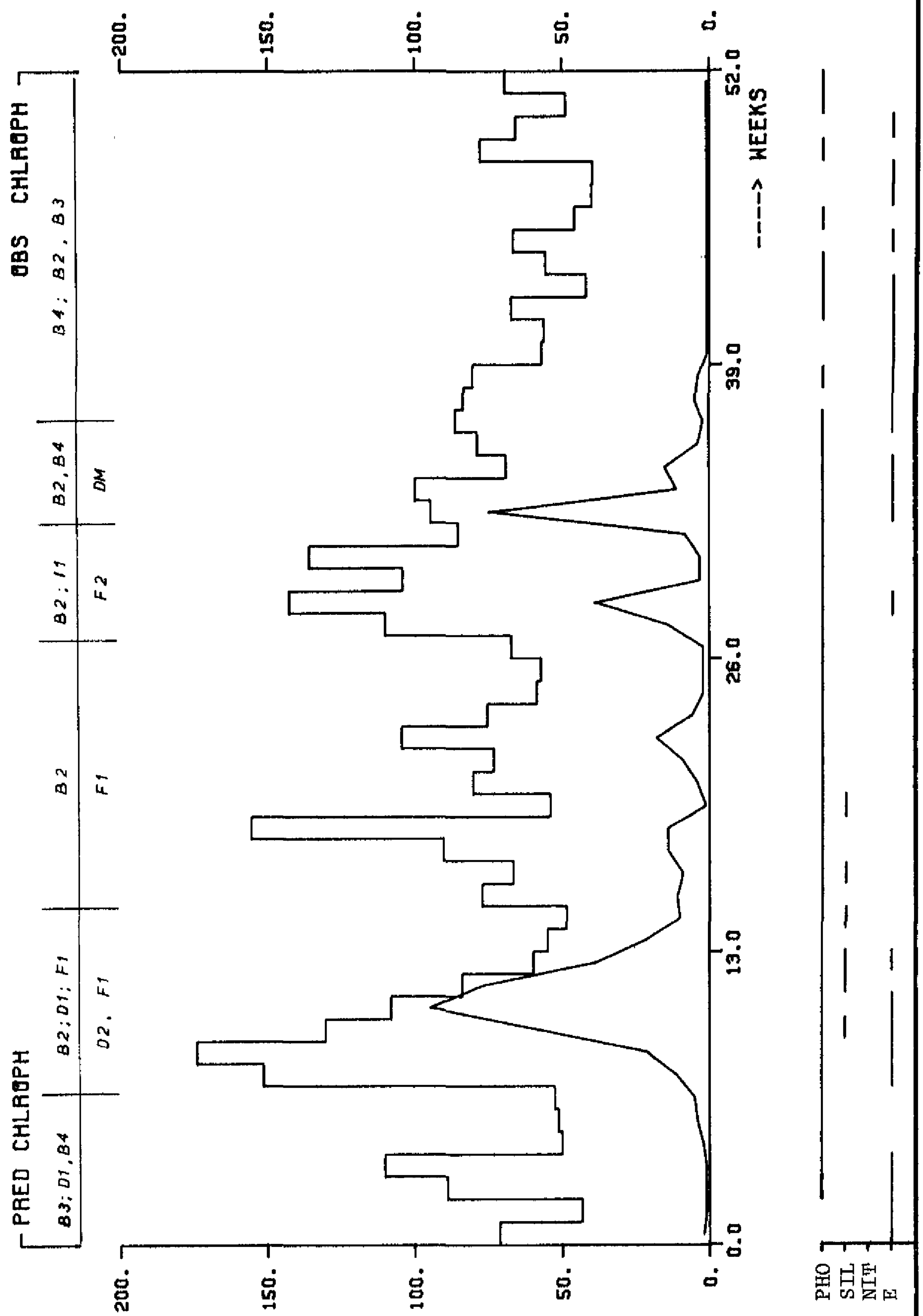


GROTE RUG, RING 3 1975. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-5.3

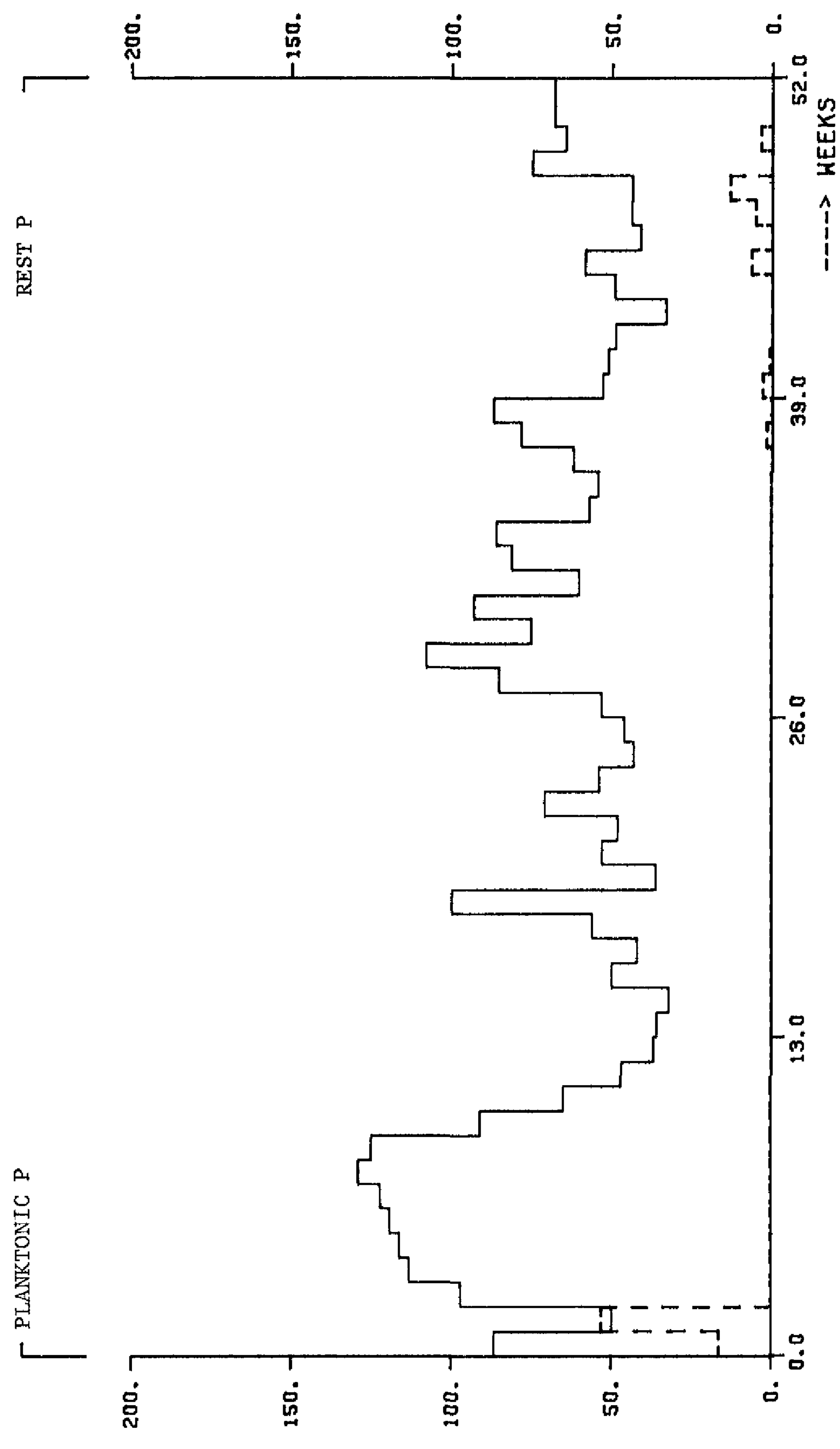


GROTE RUG, RING 1 1976. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-6.1

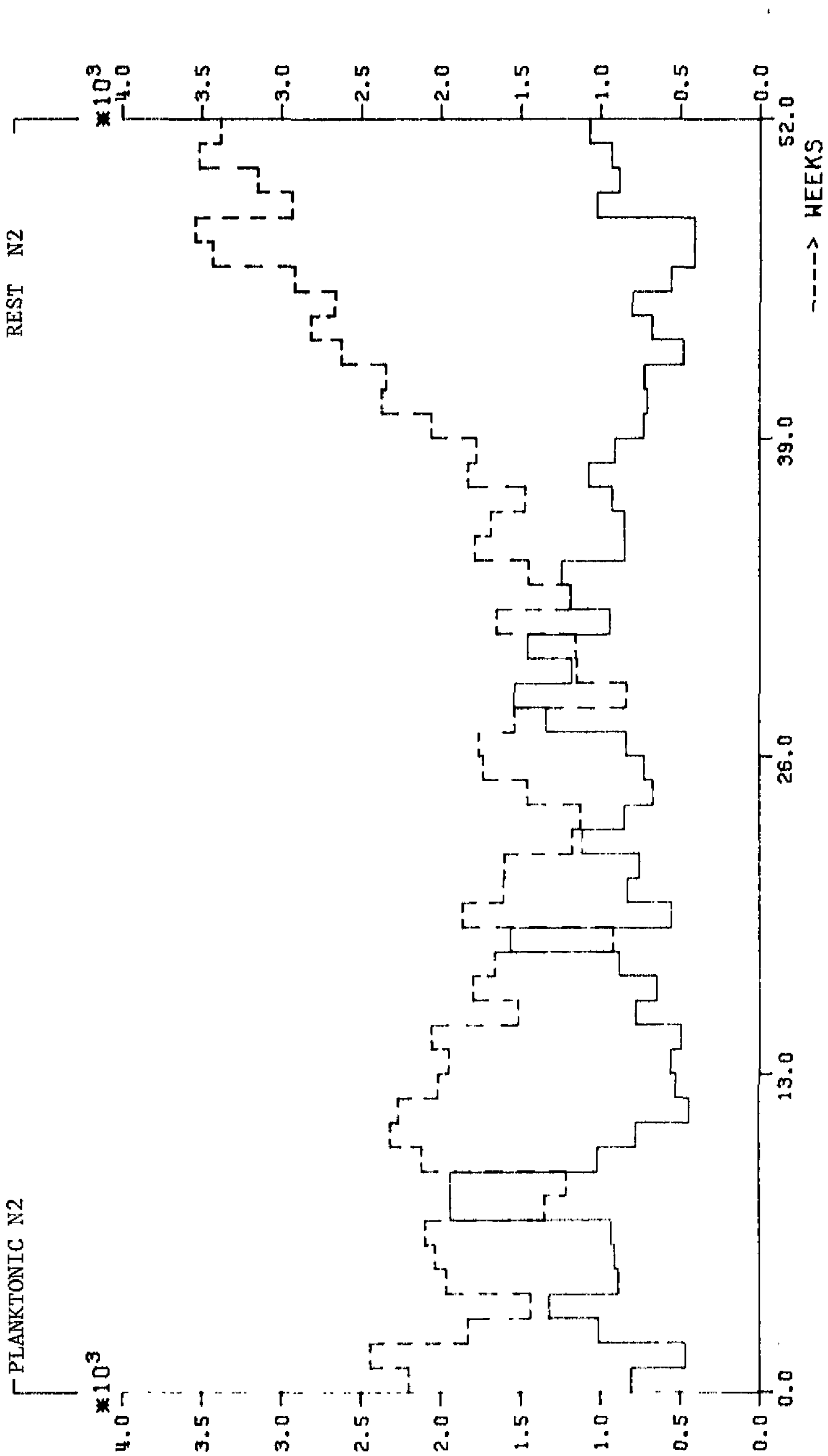


GROTE RUG, RING 1 1976. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-6.2

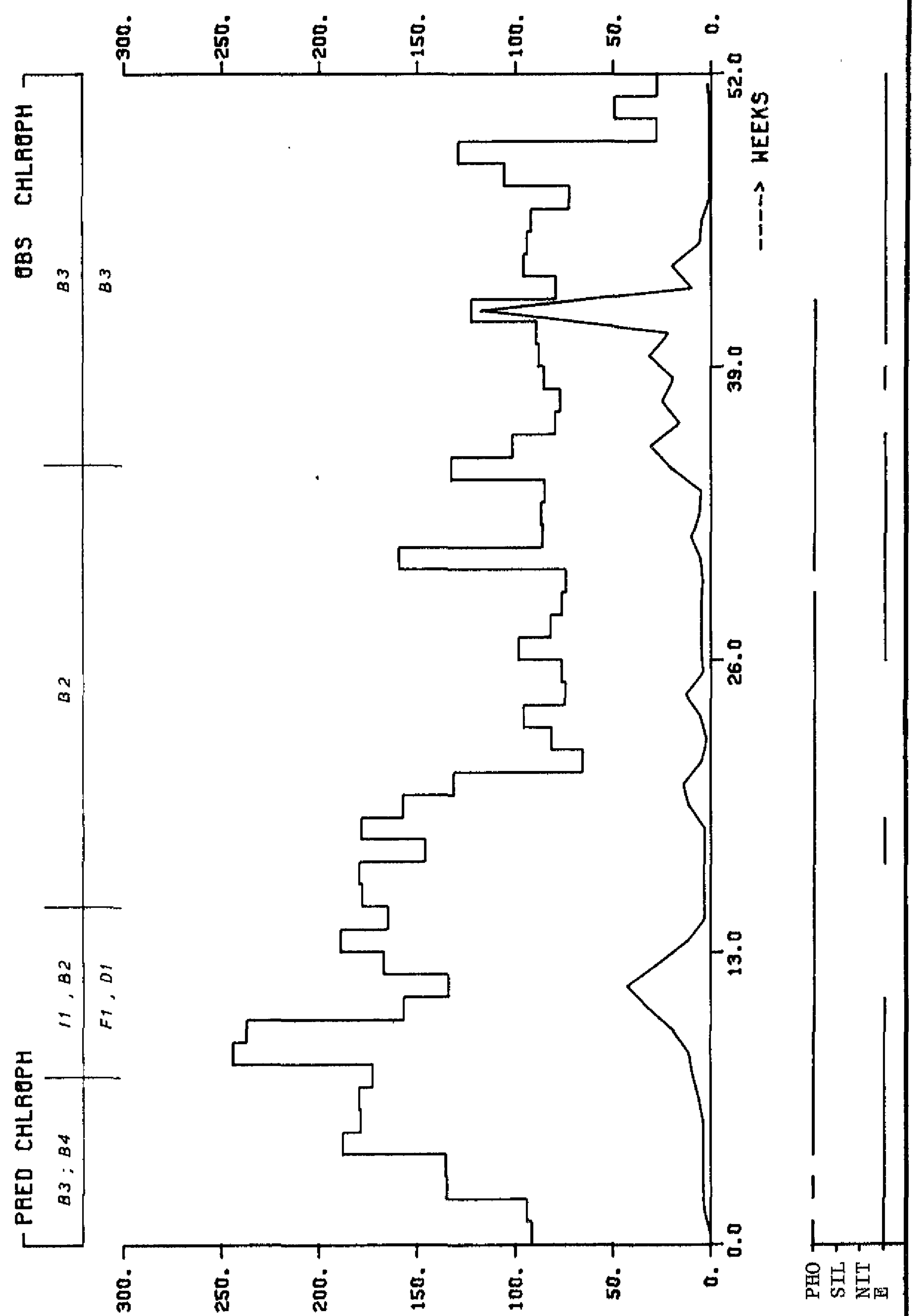


GROTE RUG, RING 1 1976. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-6.3

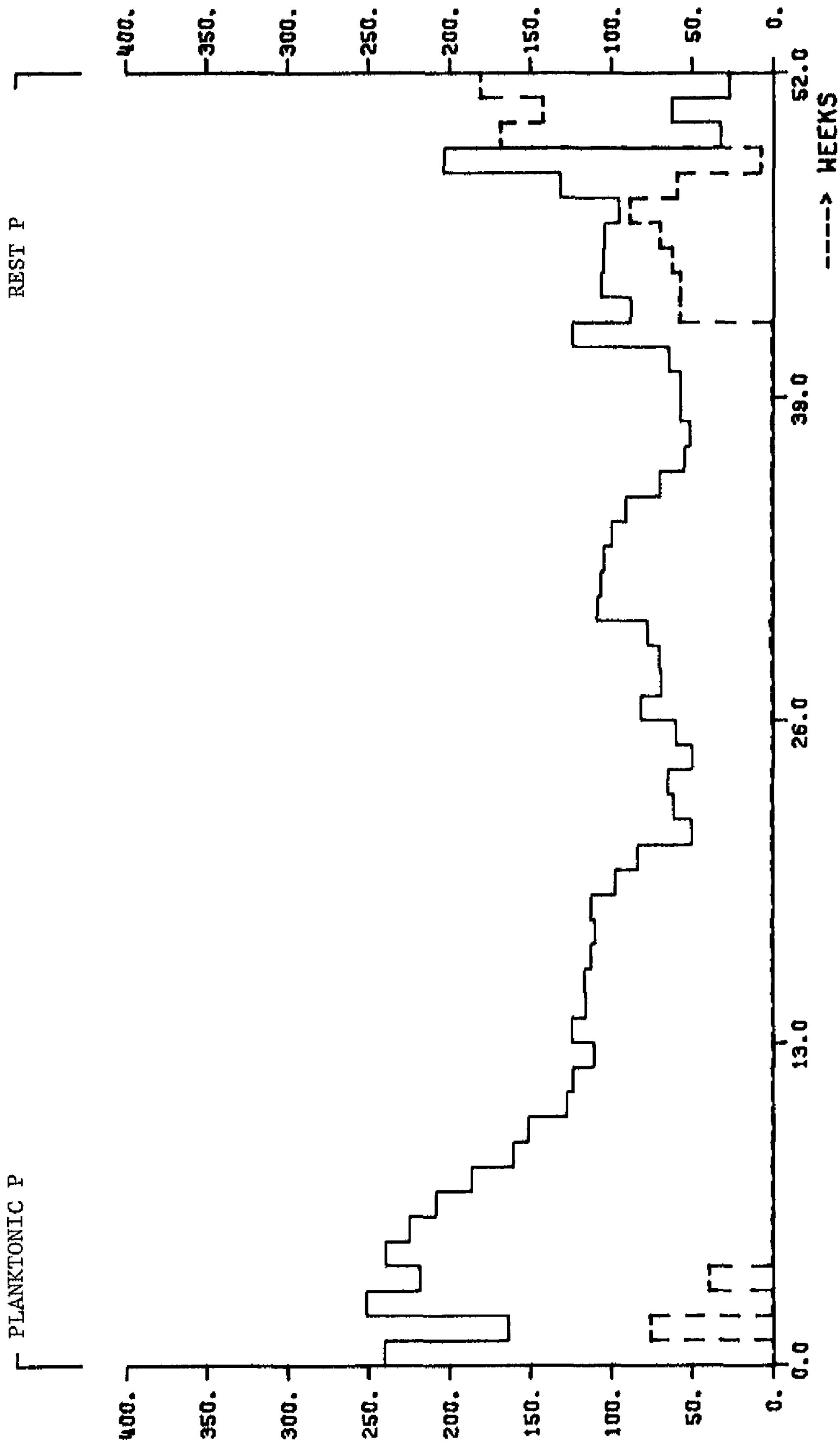


GROTE RUG, RING 3 1977. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-7.1

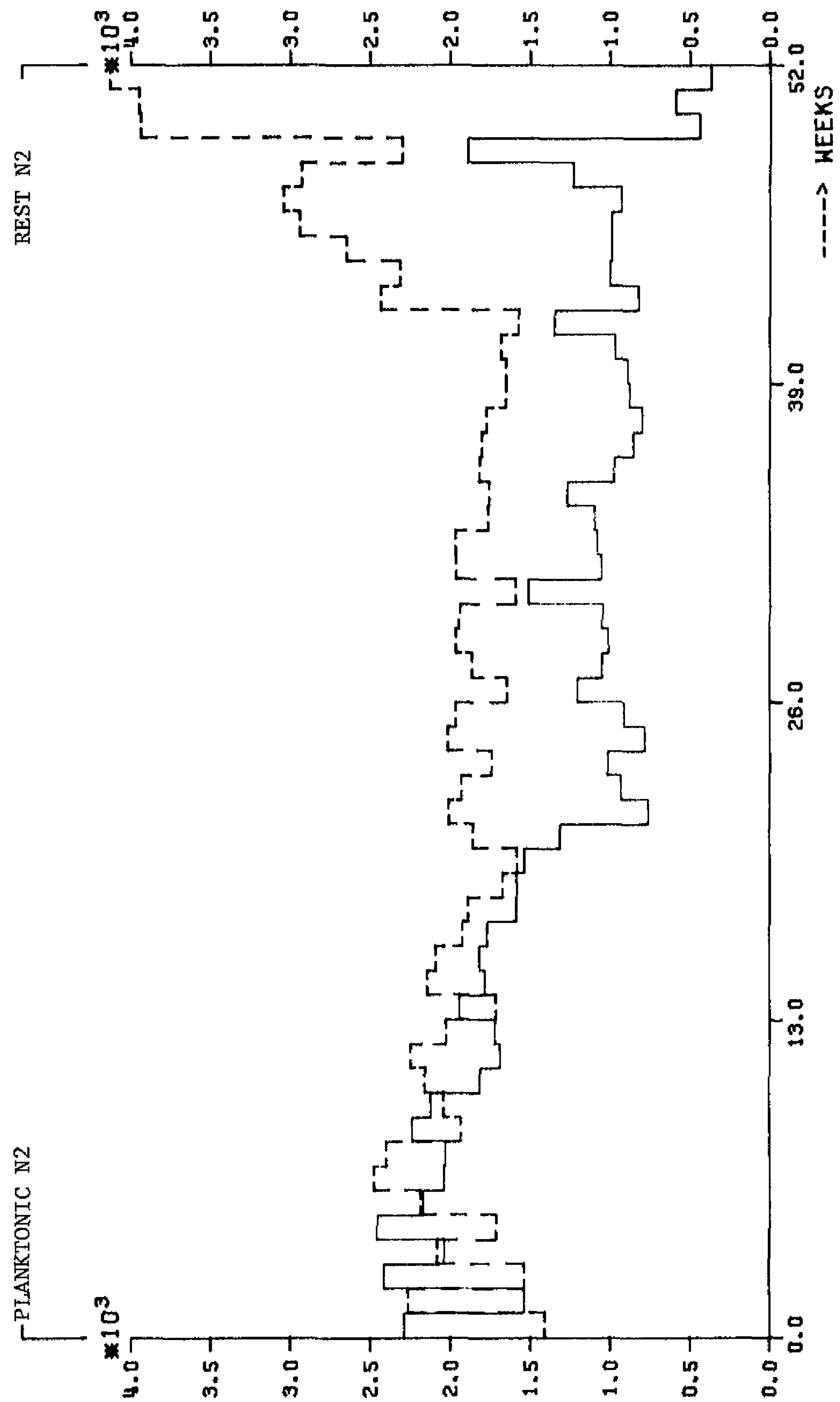


GROTE RUG, RING 3 1977. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. NOMINAL RUN.

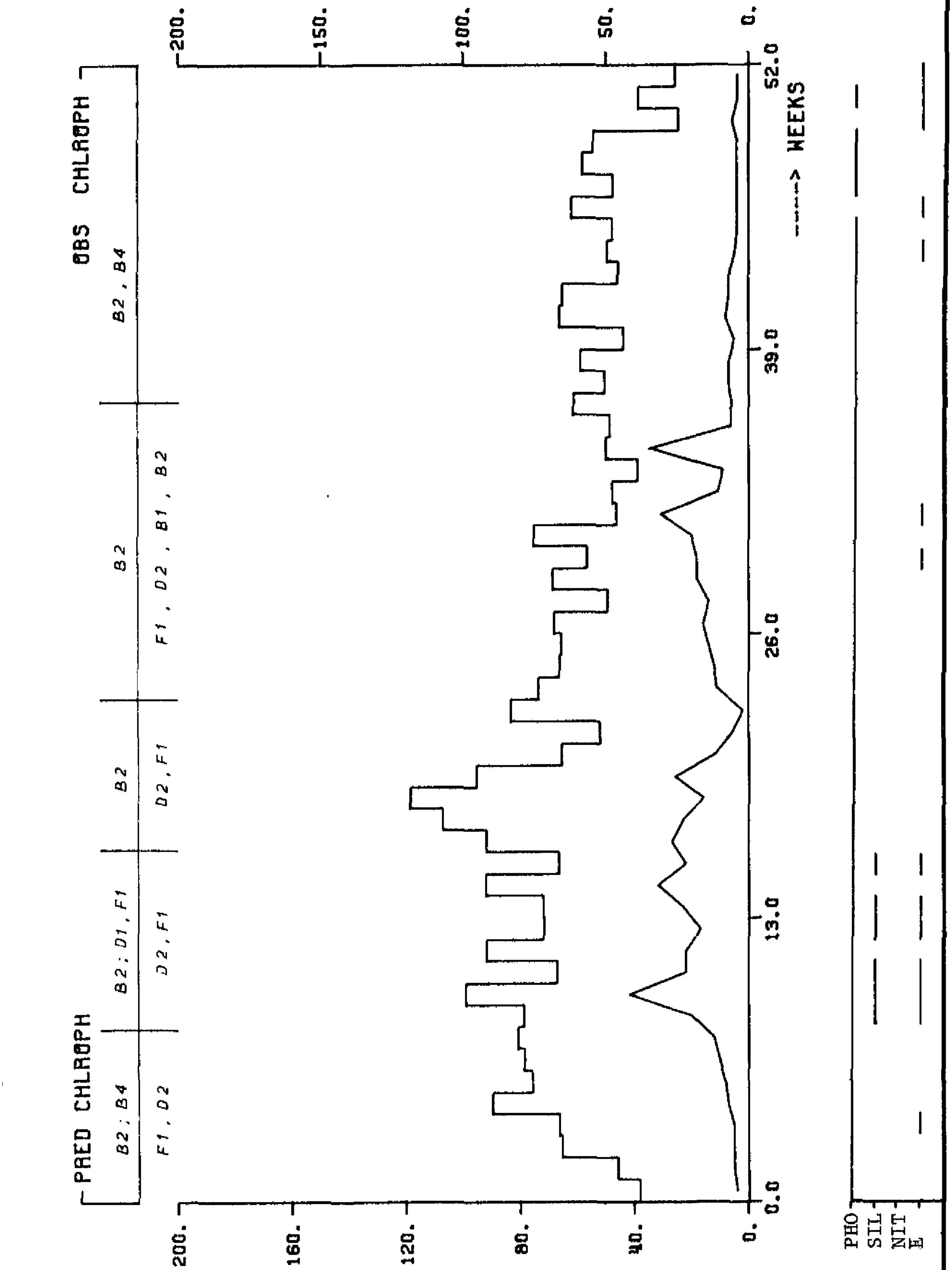
A4

DELFT HYDRAULICS LABORATORY

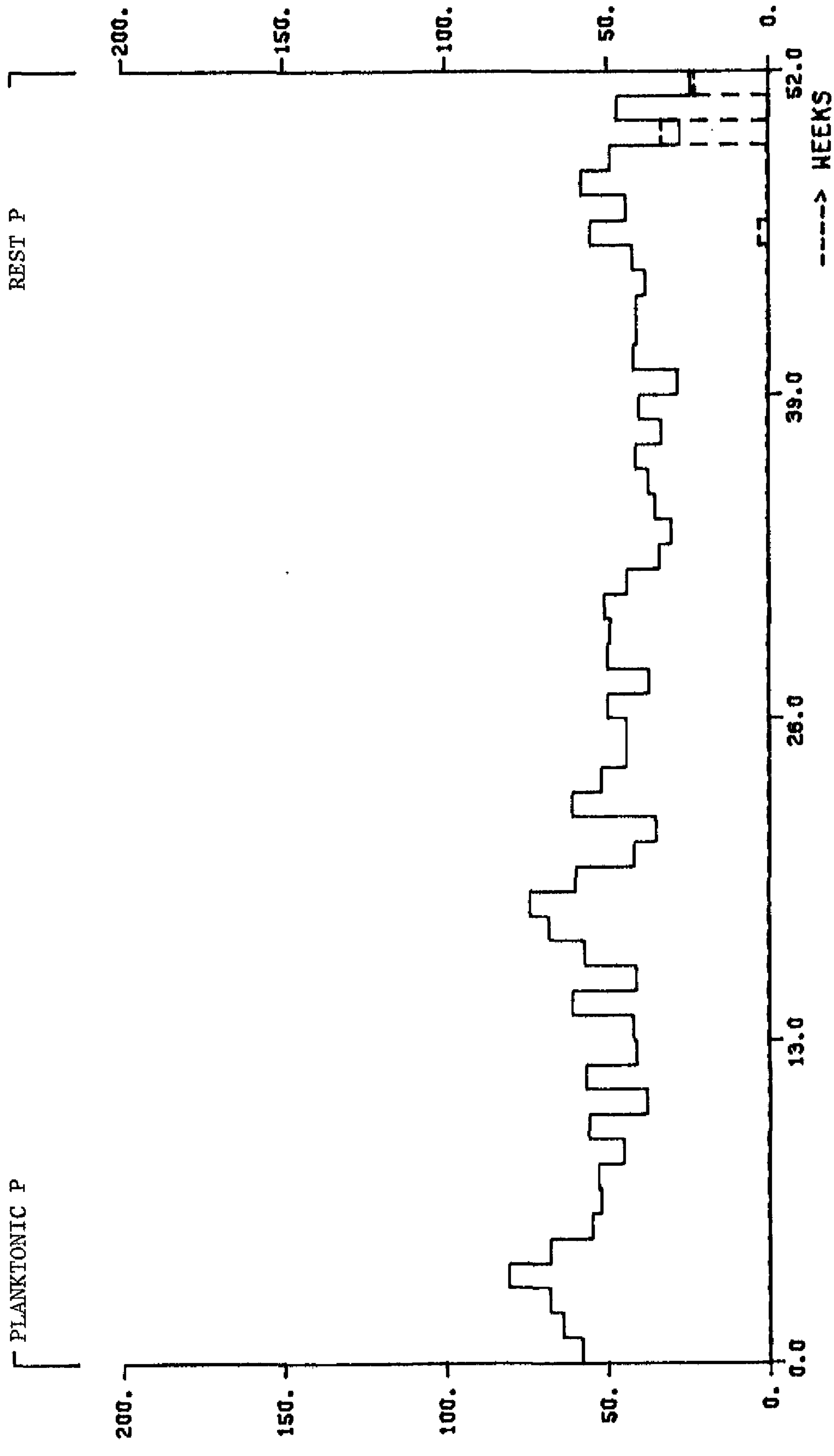
Fig. A-7.2



GROTE RUG, RING 3 1977. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. NOMINAL RUN.	A4
DELFT HYDRAULICS LABORATORY	Fig. A-7.3



GROTE RUG, RESERVOIR 1977. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. NOMINAL RUN.		
		A4
DELFT HYDRAULICS LABORATORY	Fig. A-8.1	

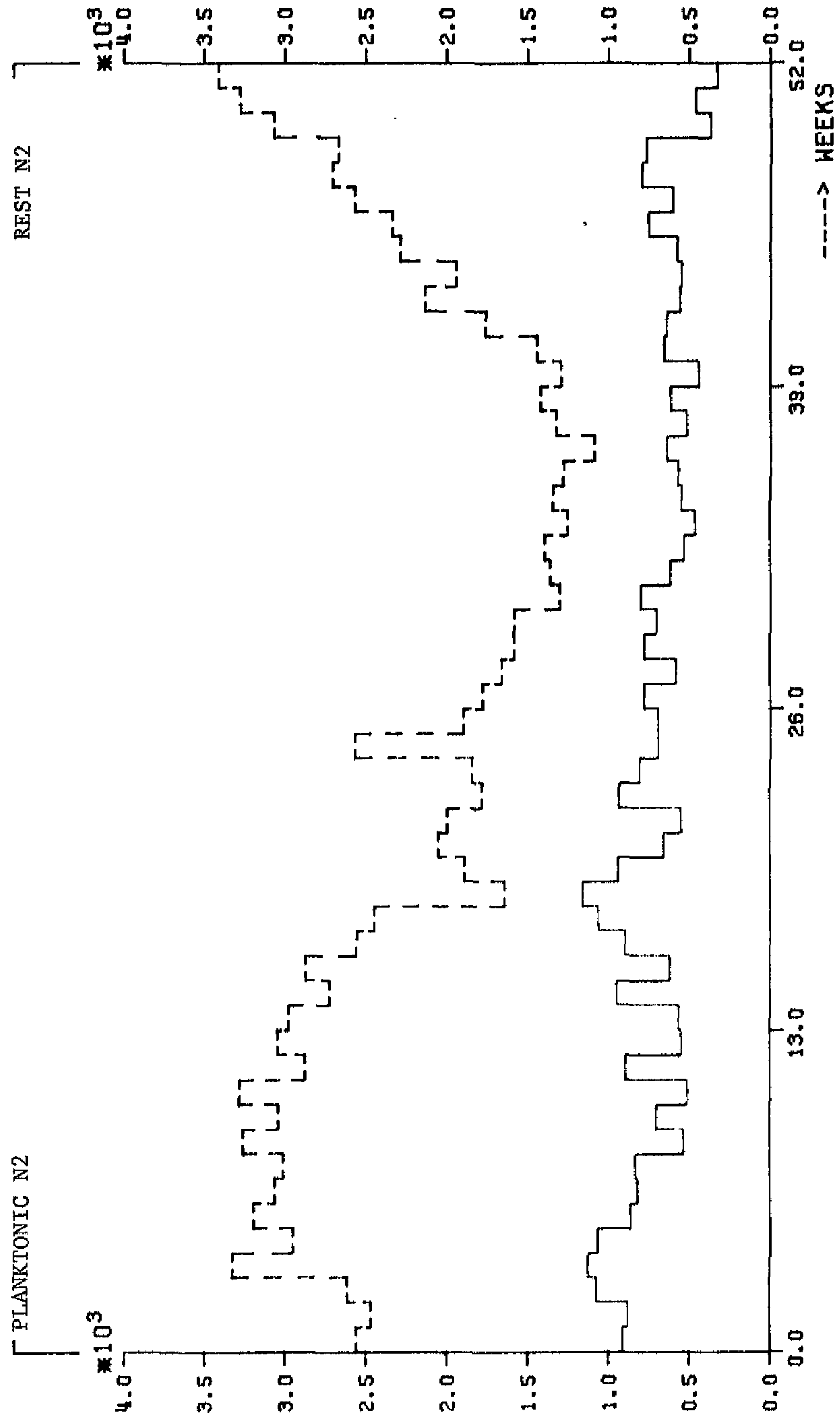


GROTE RUG, RESERVOIR 1977. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-8.2

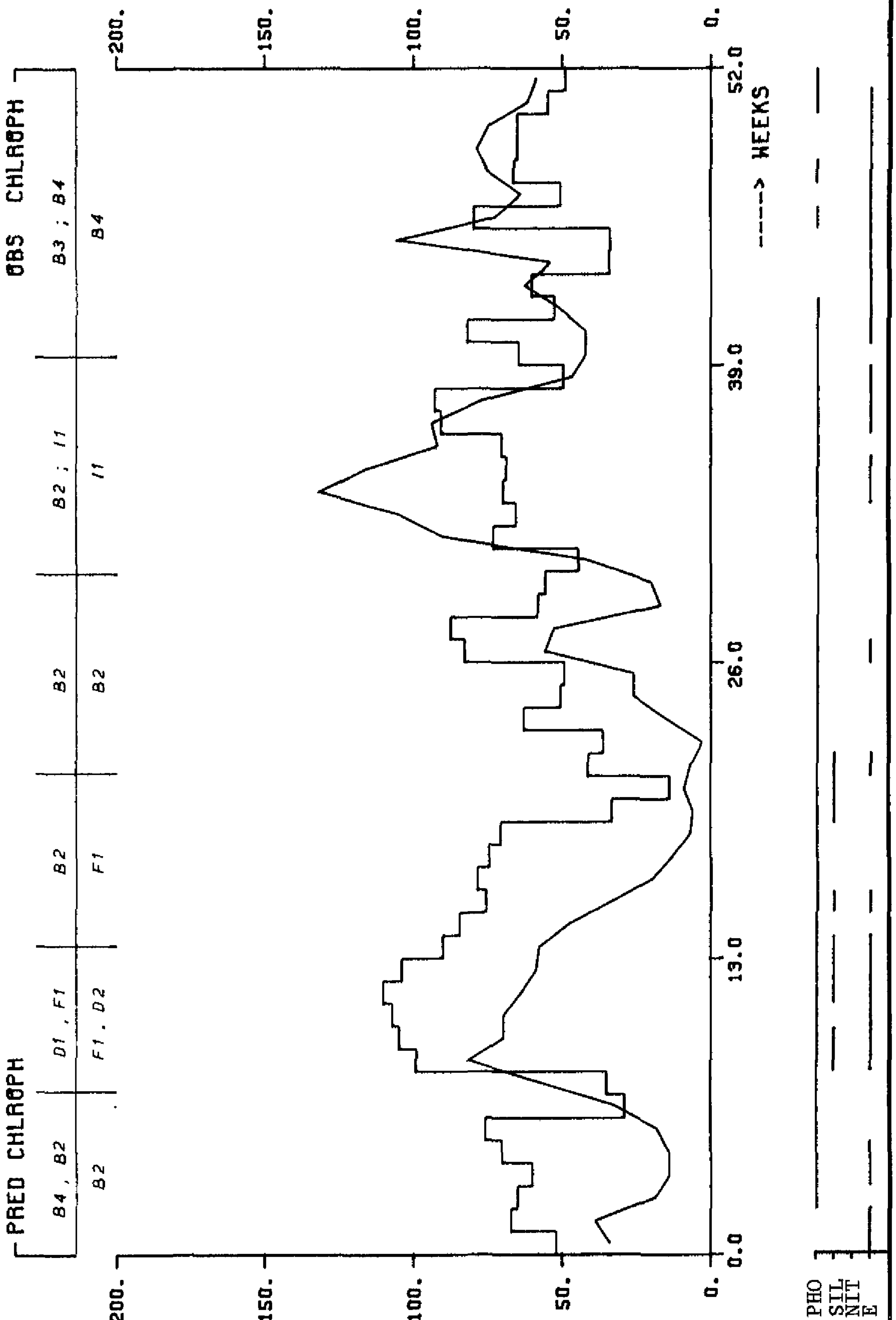


GROTE RUG, RESERVOIR 1977. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-8.3

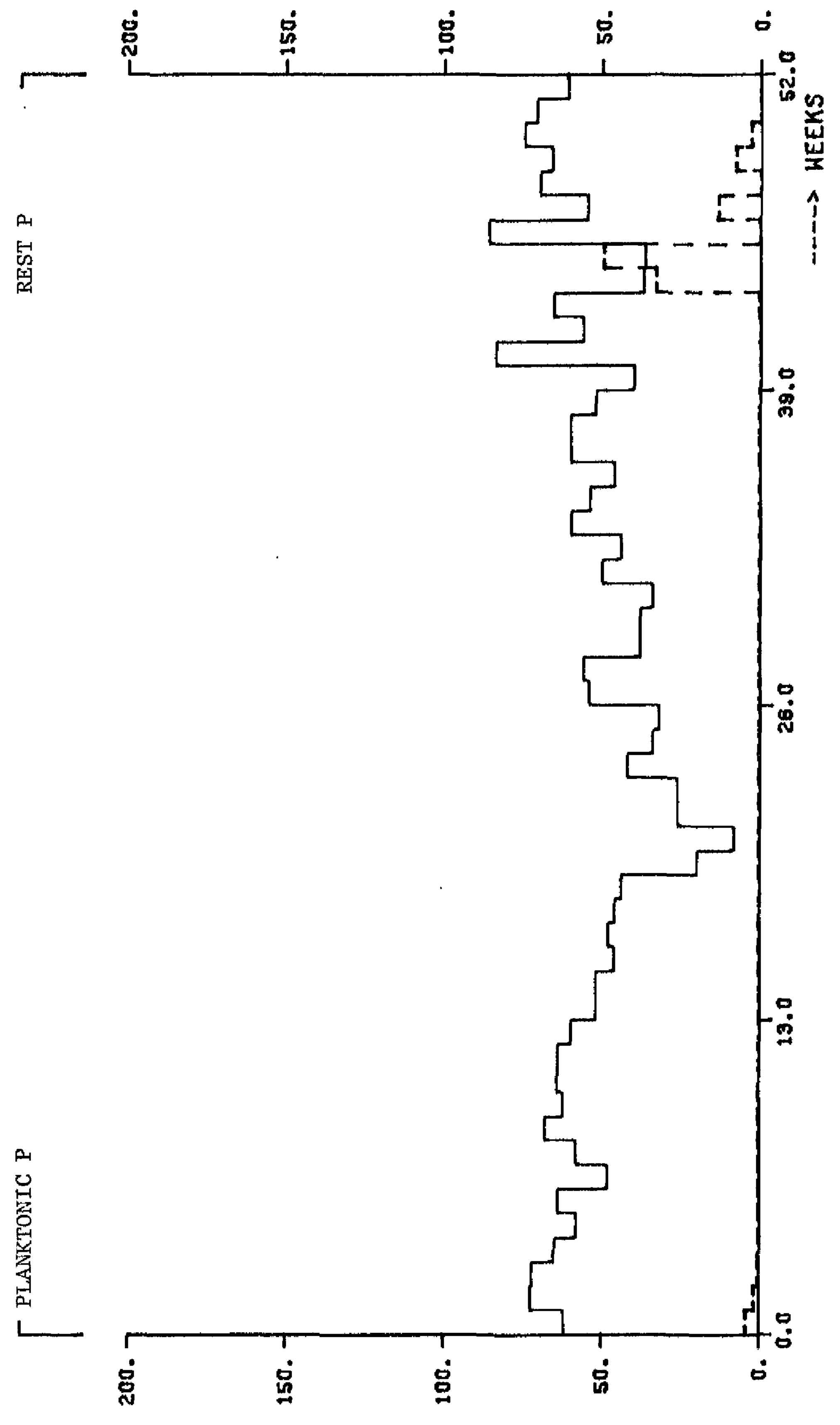


GROTE RUG, RING 2 1978. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. NOMINAL RUN.

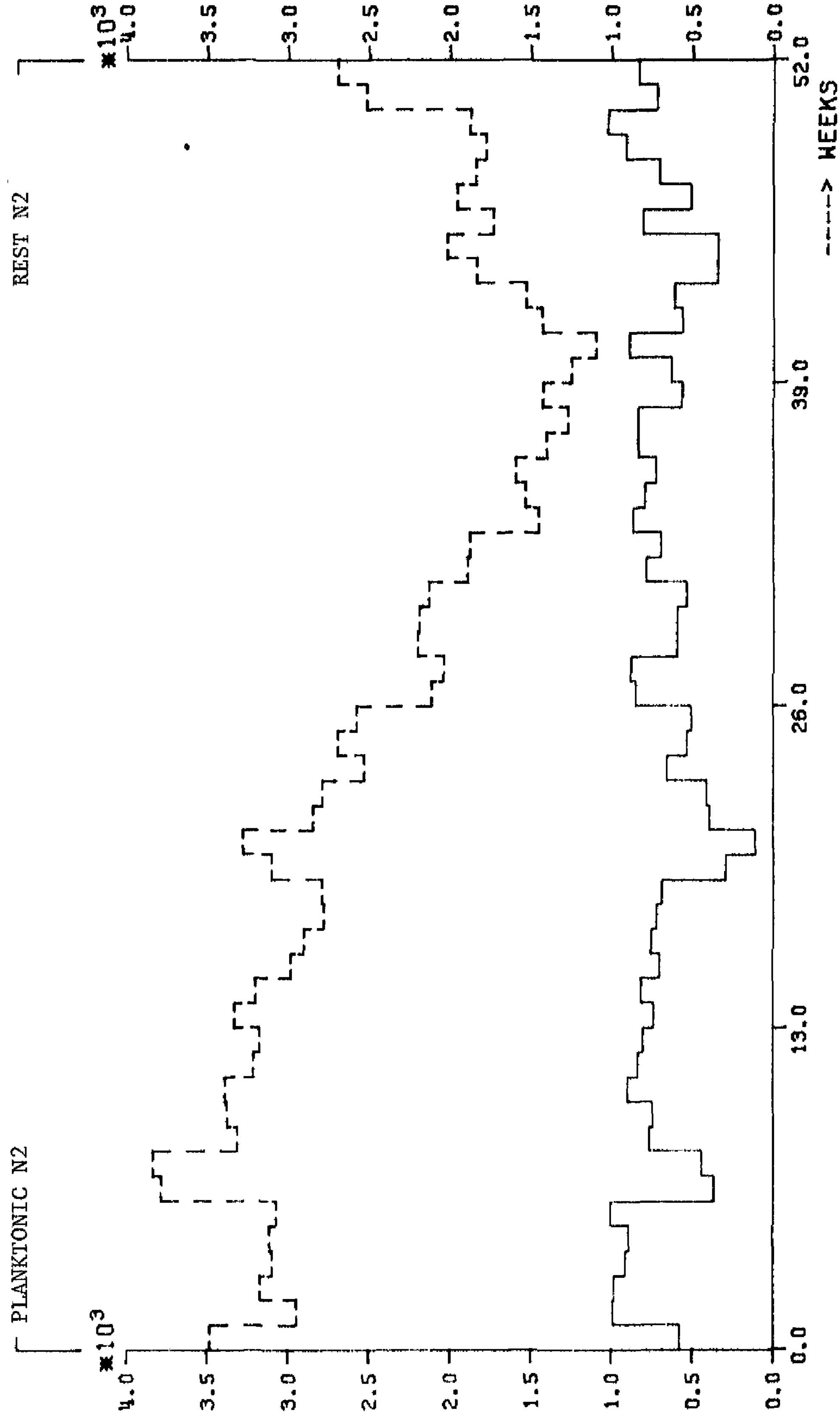
A4

DELFT HYDRAULICS LABORATORY

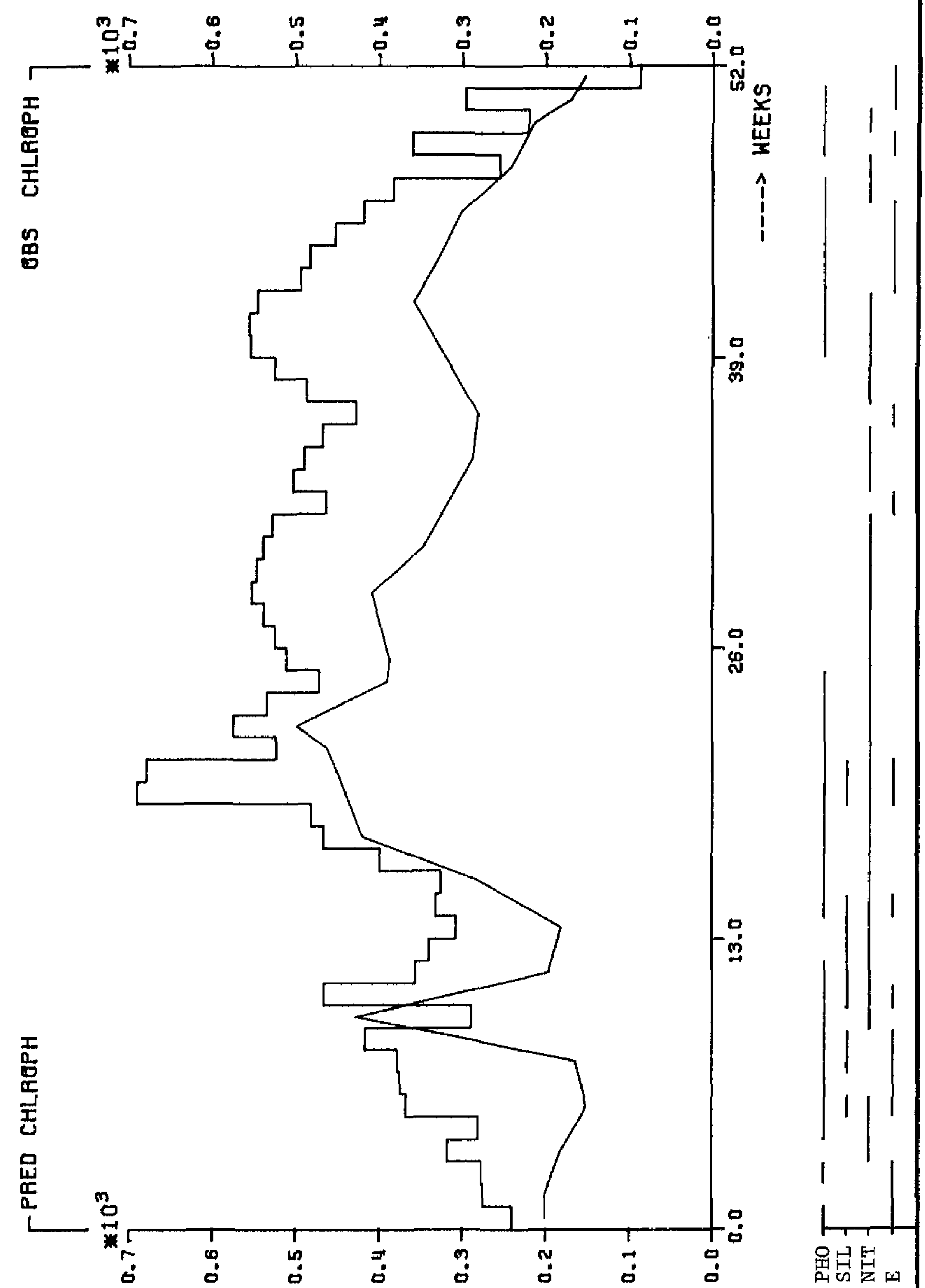
Fig. A-9.1



GROTE RUG, RING 2 1978. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. NOMINAL RUN.		A4
DELFT HYDRAULICS LABORATORY	Fig. A-9.2	



GROTE RUG, RING 2 1978. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. NOMINAL RUN.		A4
DELFT HYDRAULICS LABORATORY	Fig. A-9.3	

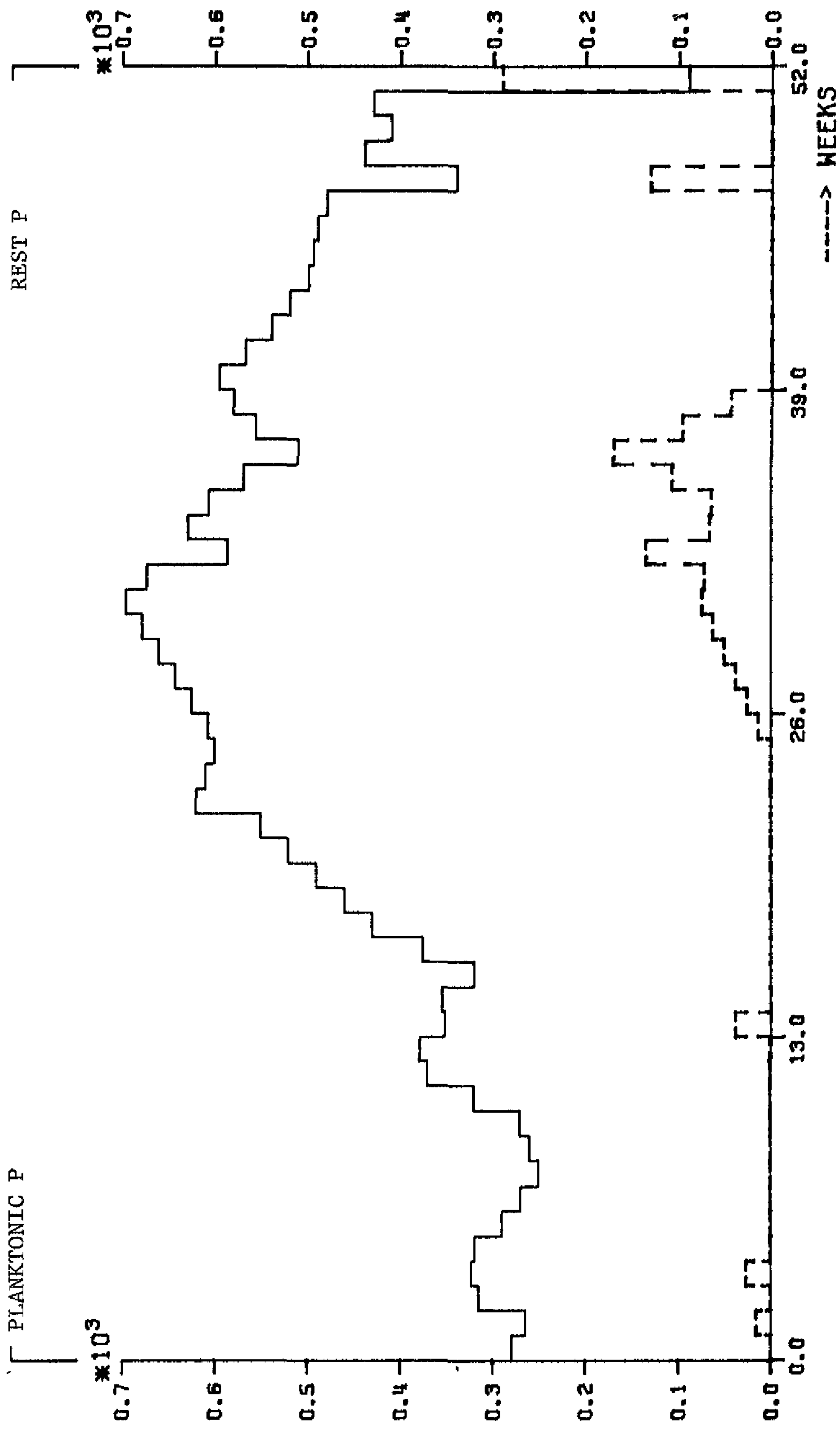


LAKE VELUWE, 1975. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-10.1

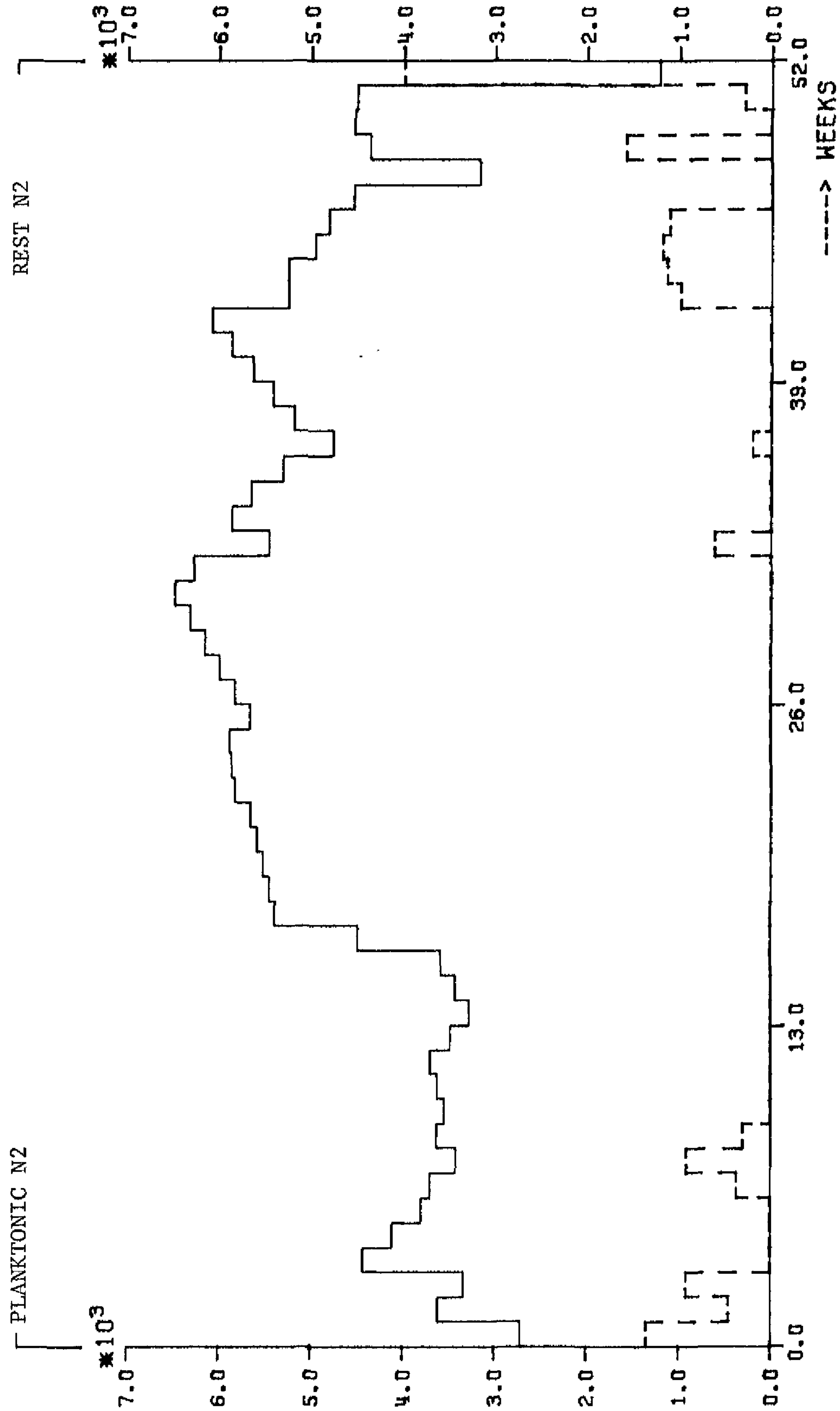


LAKE VELUWE, 1975. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-10.2

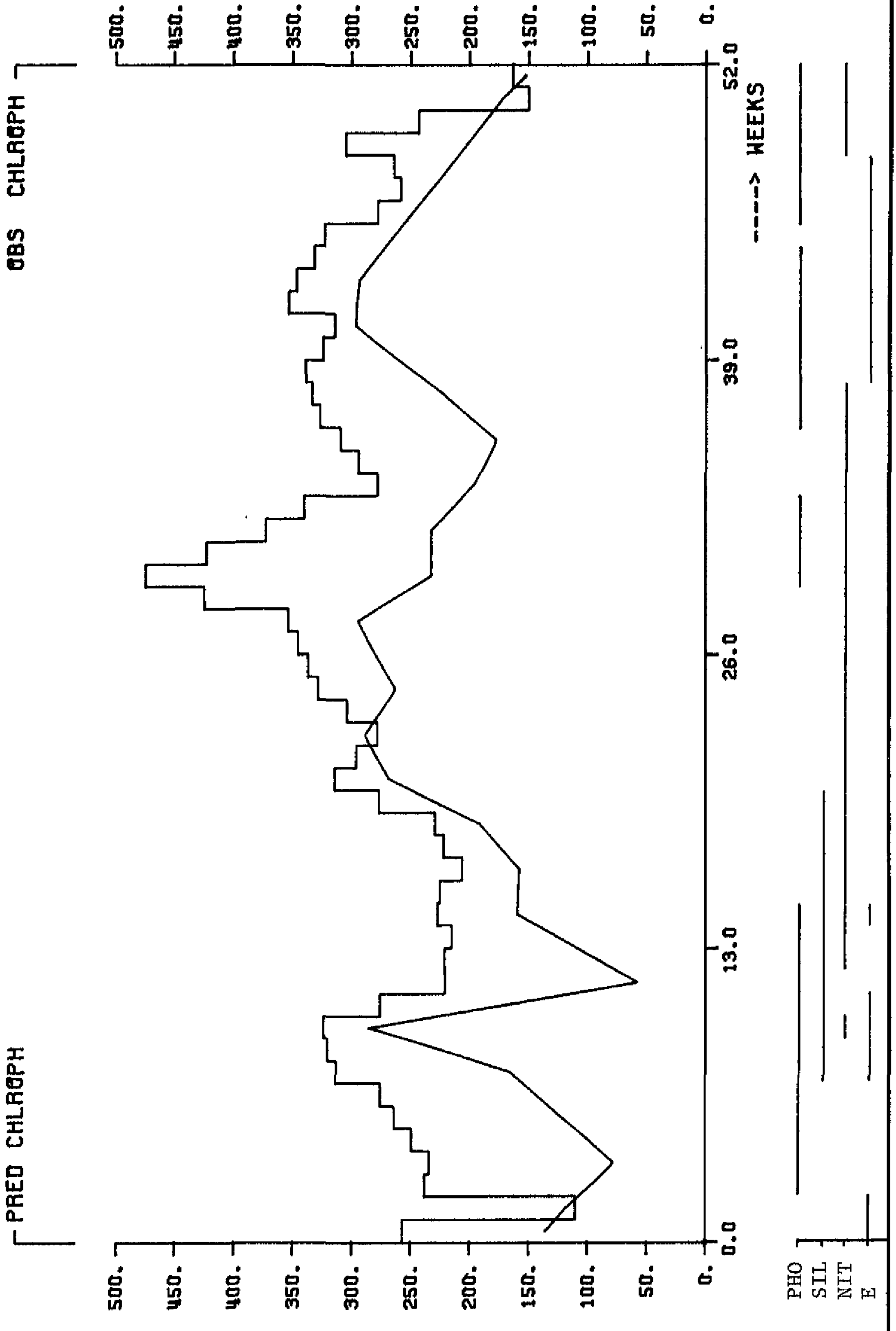


LAKE VELUWE, 1975. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-10.3

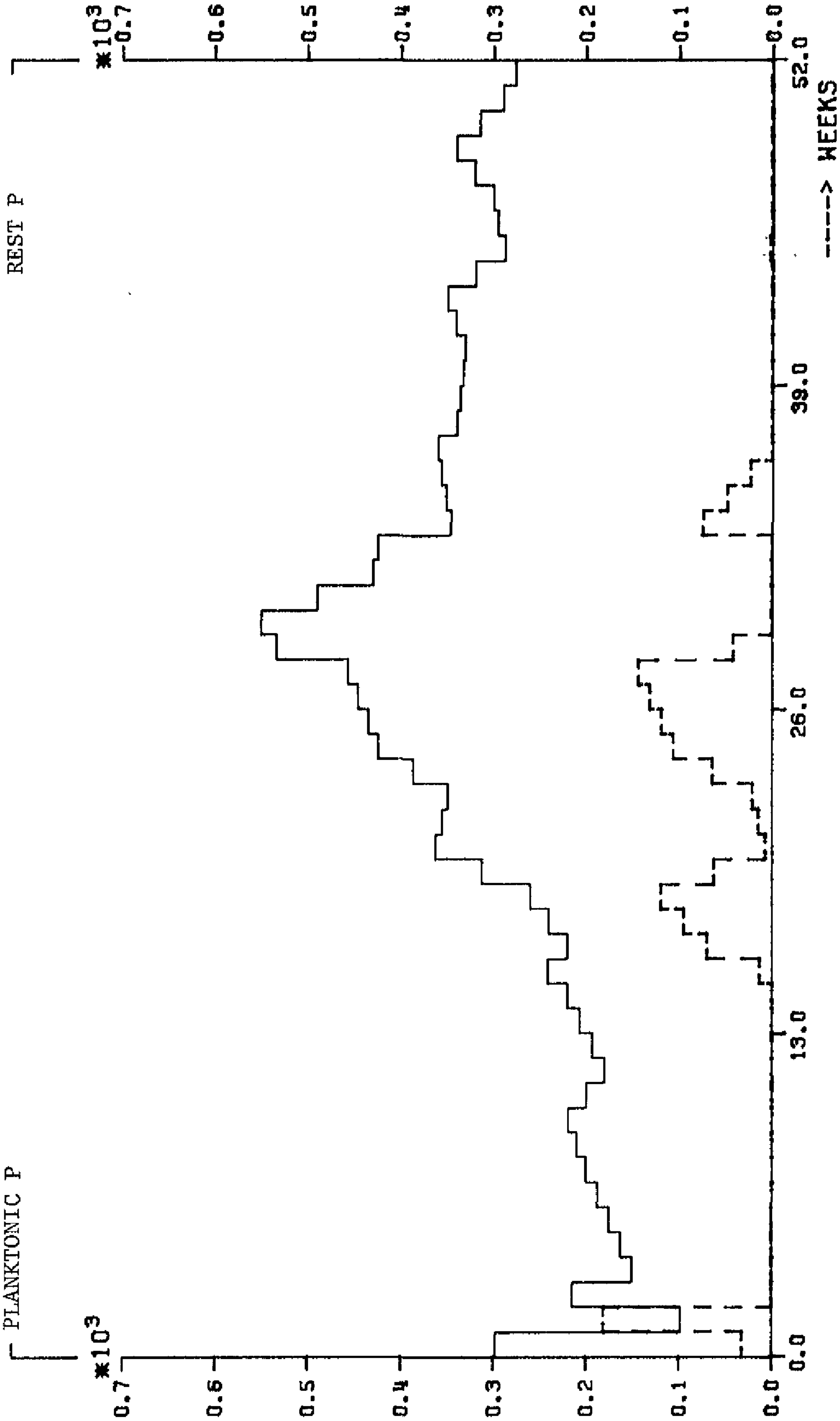


LAKE VELUWE, 1976. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. NOMINAL RUN.

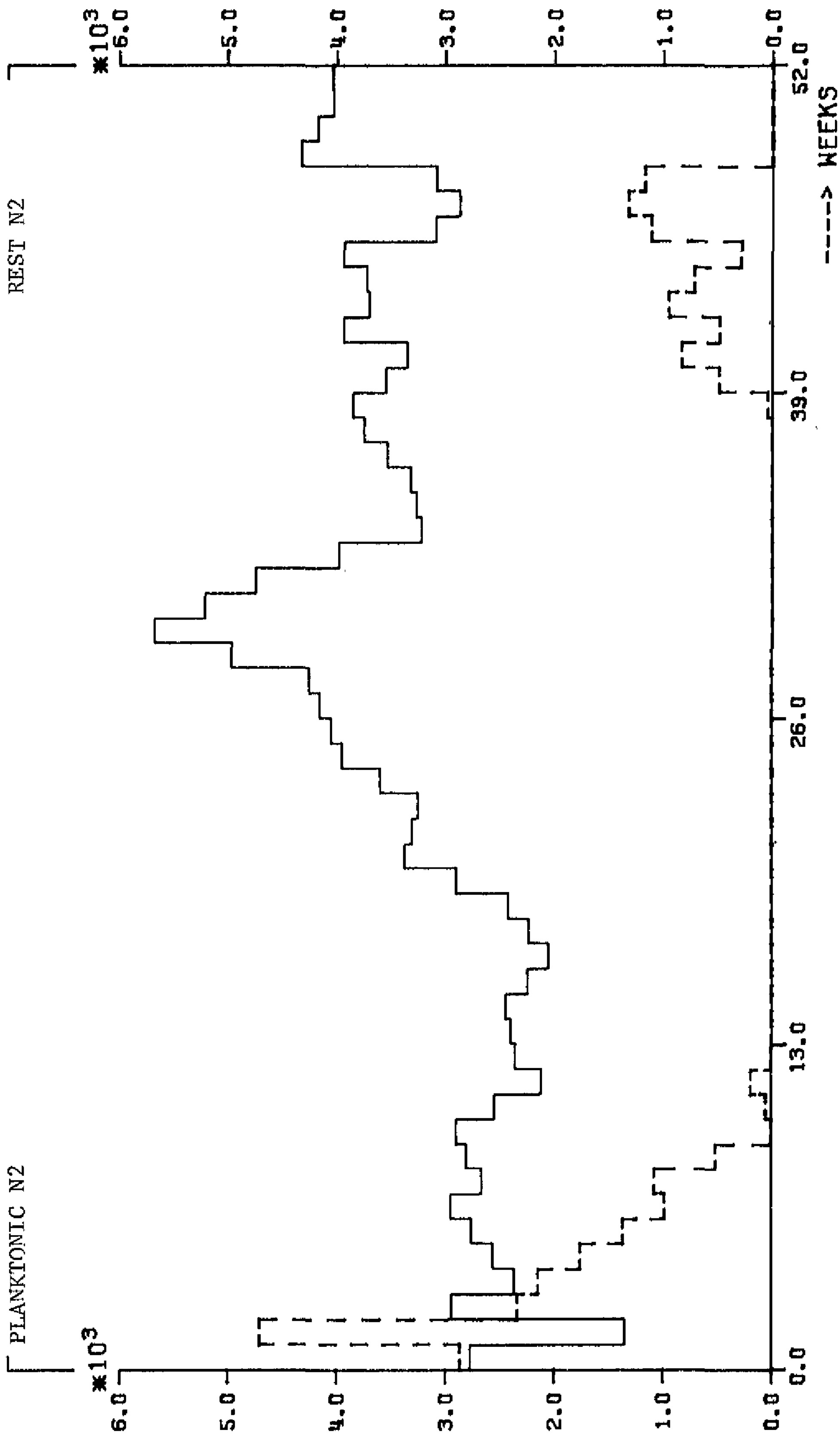
A4

DELFT HYDRAULICS LABORATORY

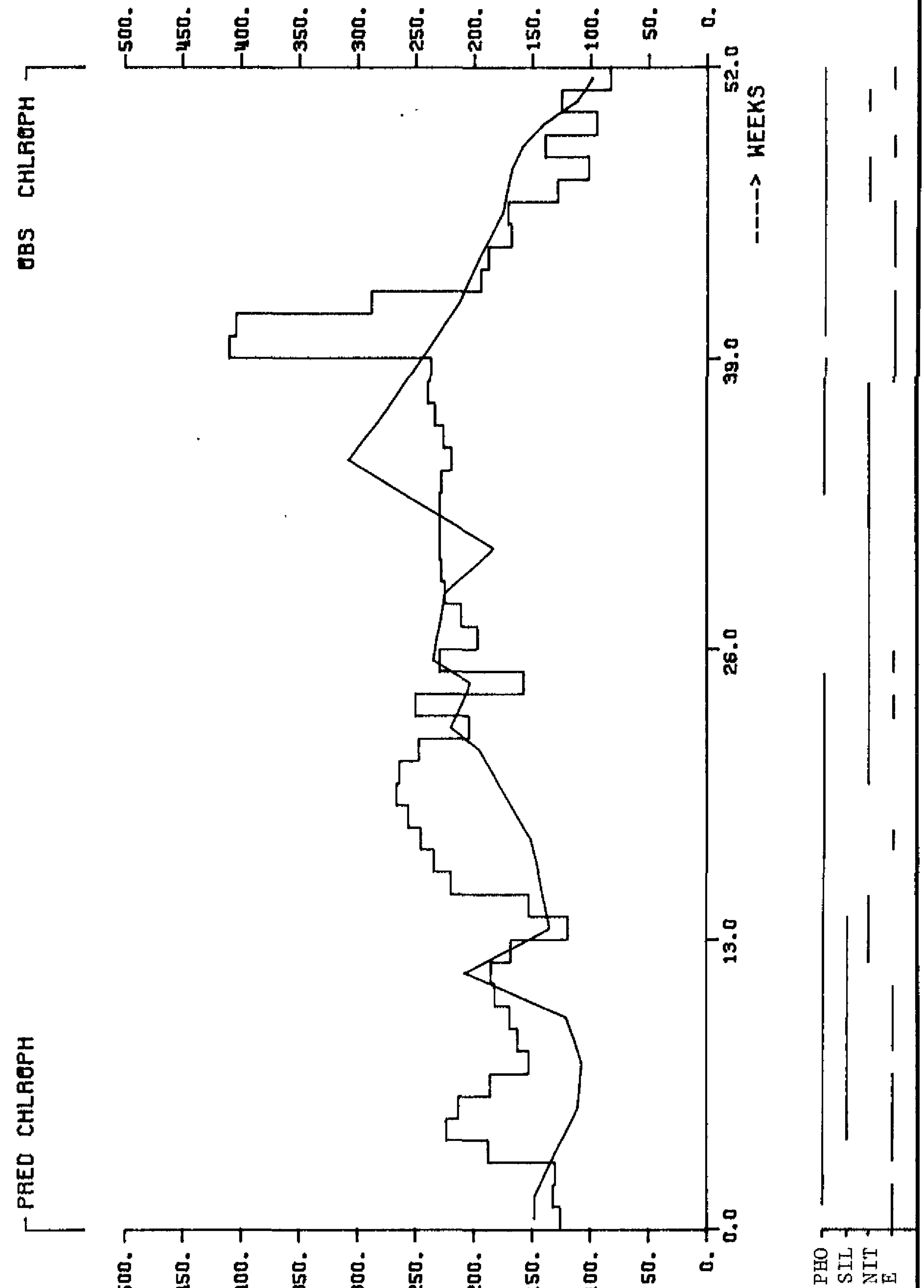
Fig. A-11.1



LAKE VELUWE, 1976. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. NOMINAL RUN.		A4
DELFT HYDRAULICS LABORATORY	Fig. A-11.2	



LAKE VELUWE, 1976. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. NOMINAL RUN.		A4
DELFT HYDRAULICS LABORATORY	Fig. A-11.3	

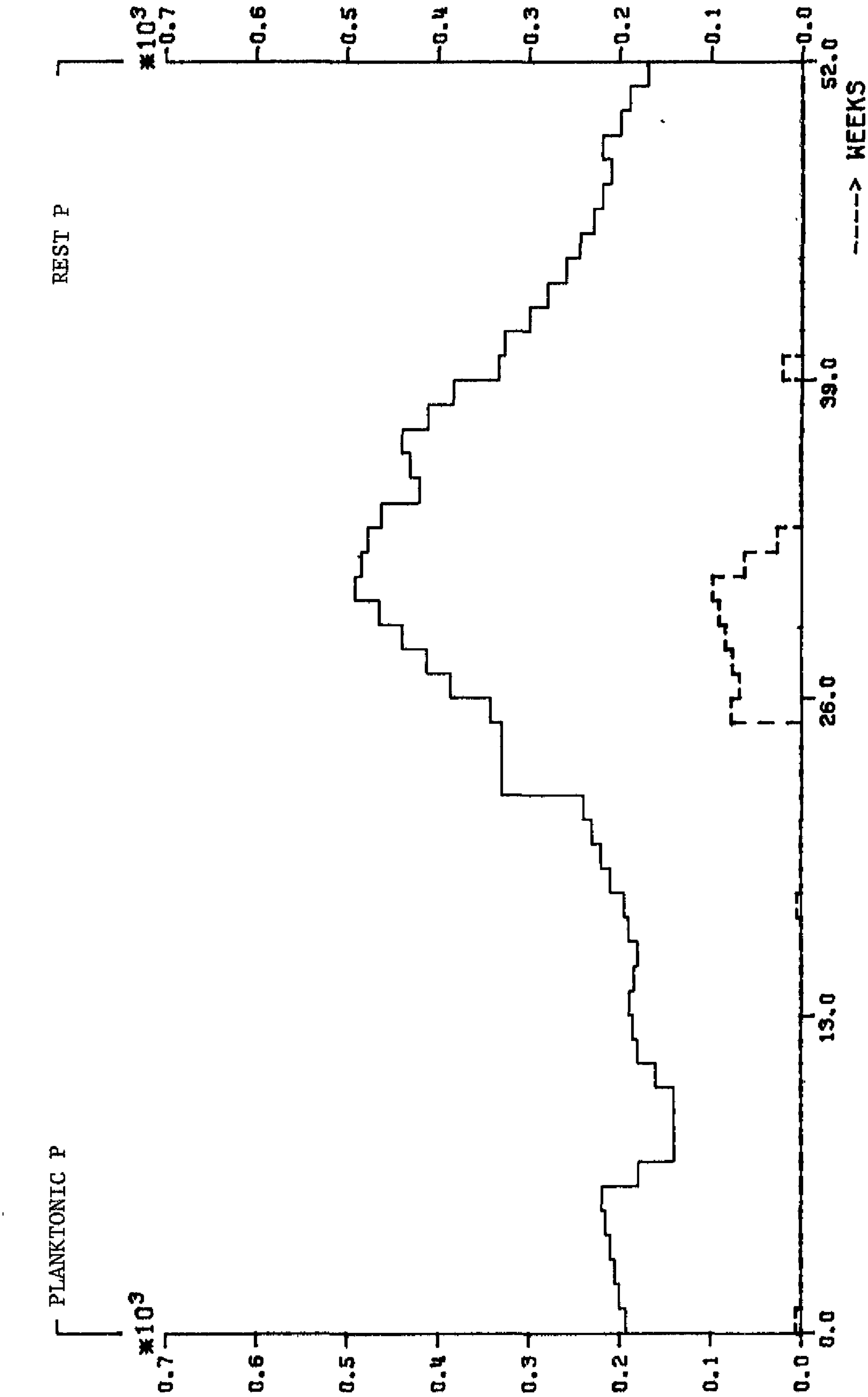


LAKE WOLDERWIJD, 1975. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. NOMINAL RUN.

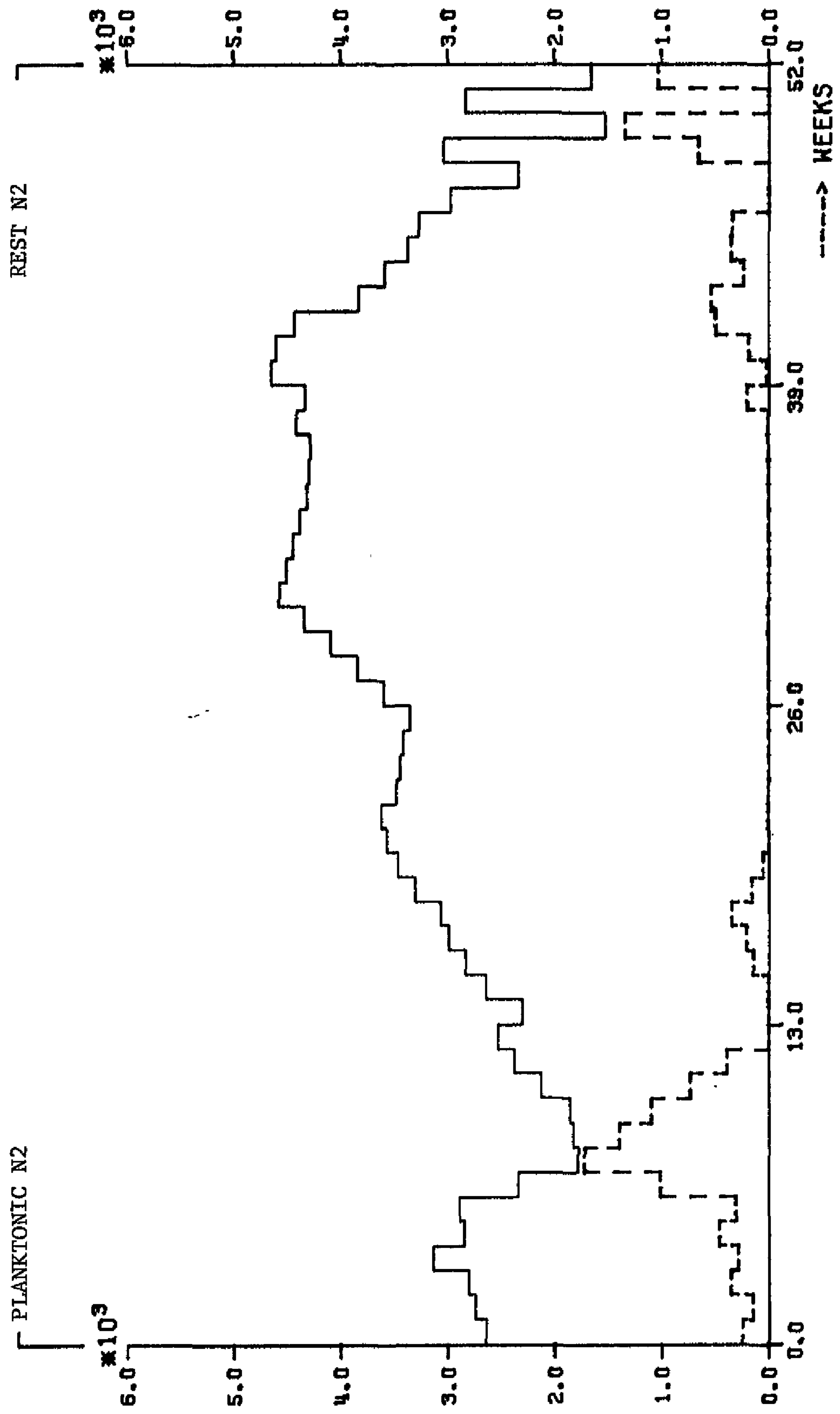
A4

DELFT HYDRAULICS LABORATORY

Fig. A-12.1



LAKE WOLDERWIJD, 1975. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. NOMINAL RUN.		A4
DELFT HYDRAULICS LABORATORY	Fig. A-12.2	

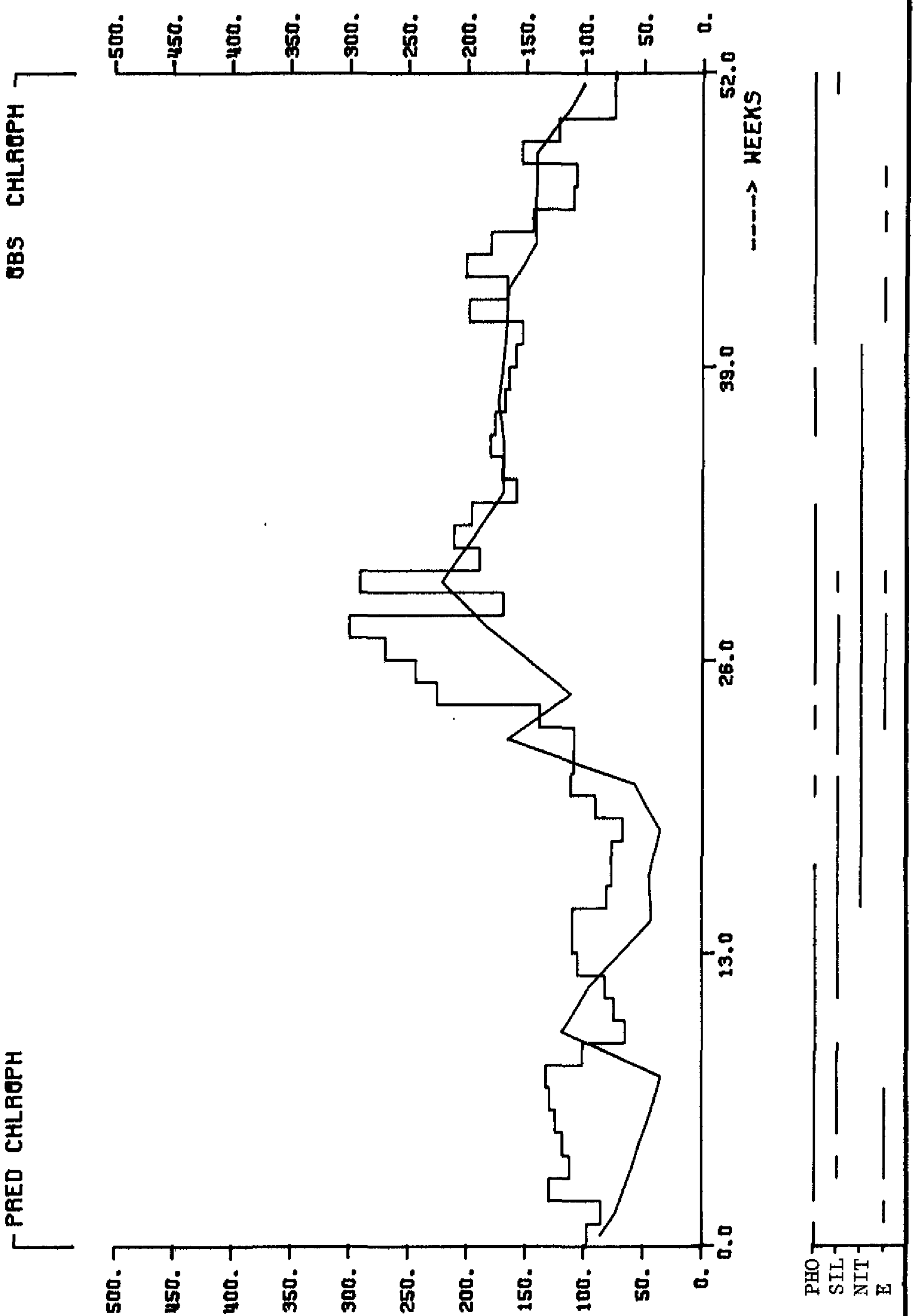


LAKE WOLDERWIJD, 1975. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. NOMINAL RUN.

A4

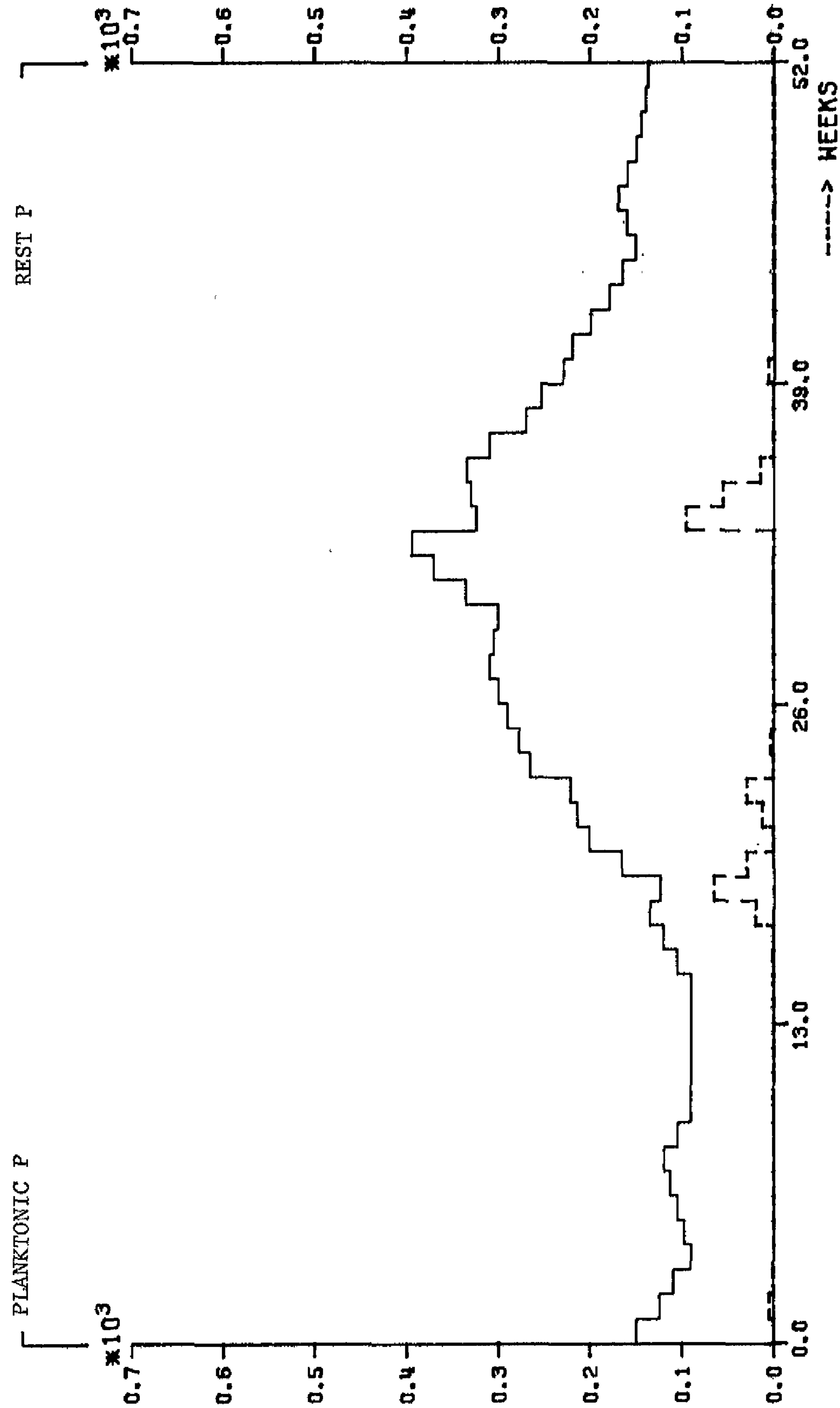
DELFT HYDRAULICS LABORATORY

Fig. A-12.3



LAKE WOLDERWIJD, 1976. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. NOMINAL RUN.

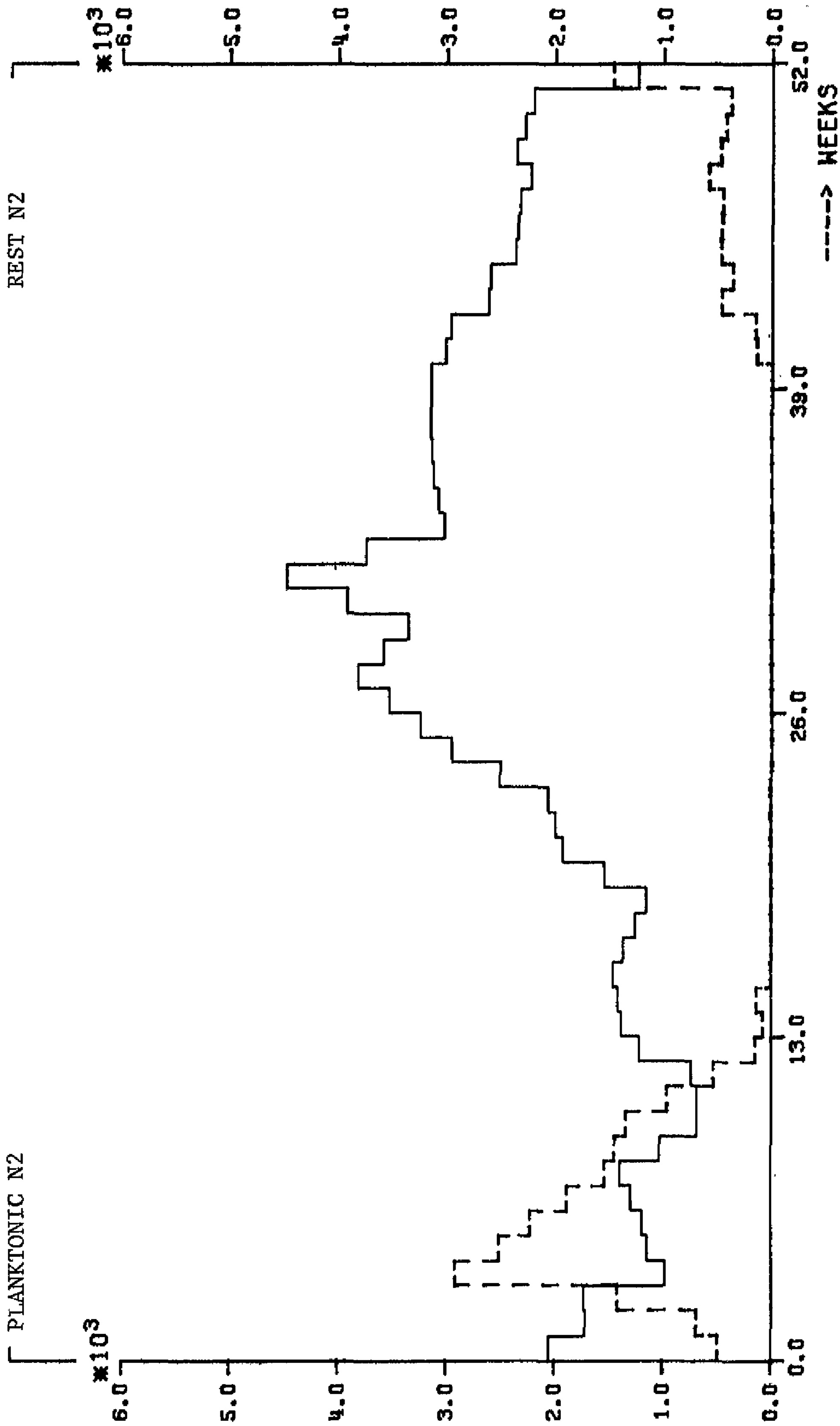
	A4
DELFT HYDRAULICS LABORATORY	Fig. A-13.1



LAKE WOLDERWIJD, 1976. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. NOMINAL RUN.

DELFT HYDRAULICS LABORATORY	Fig. A-13.2

A4

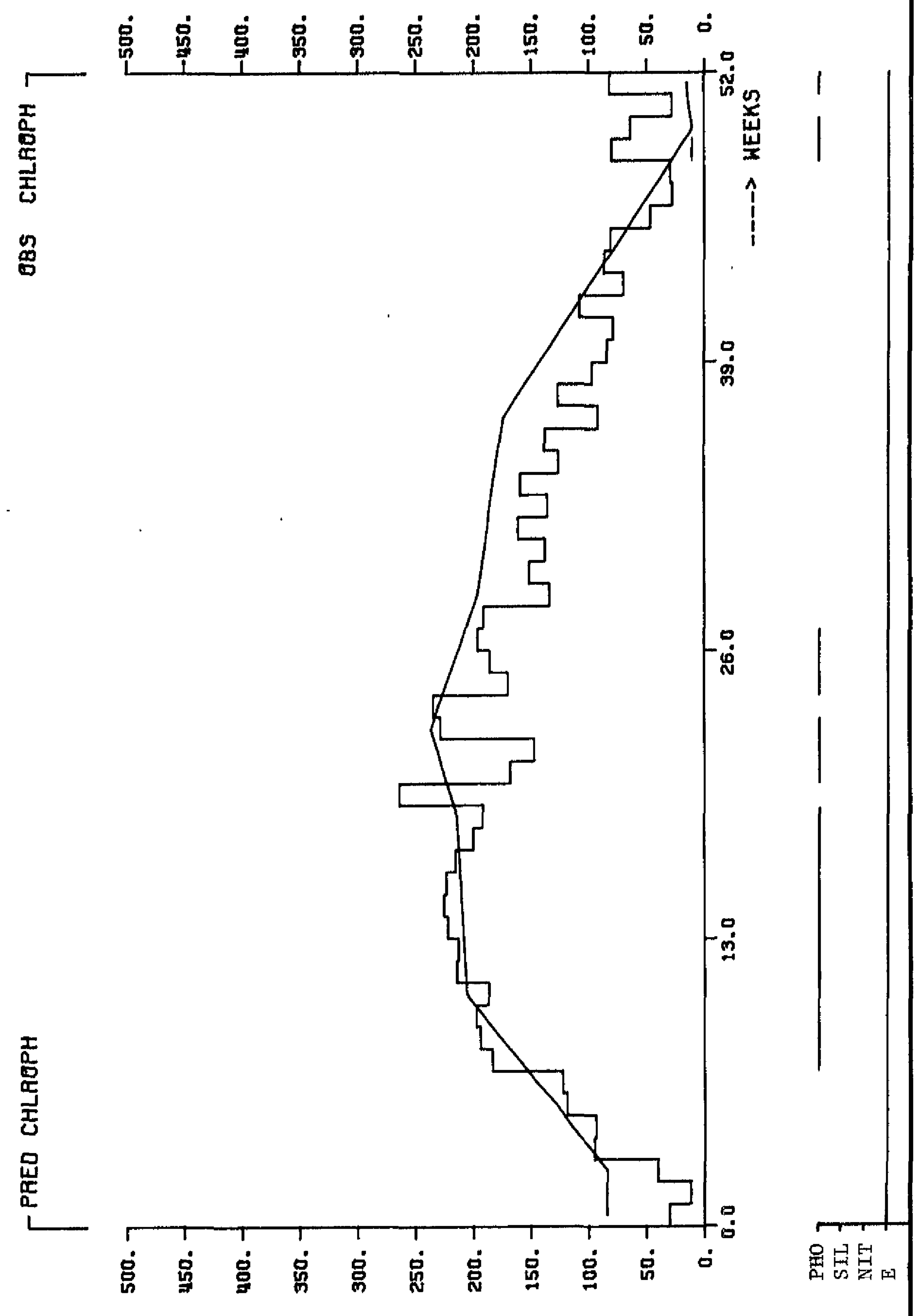


LAKE HOLDERNIJD, 1976. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-13.3

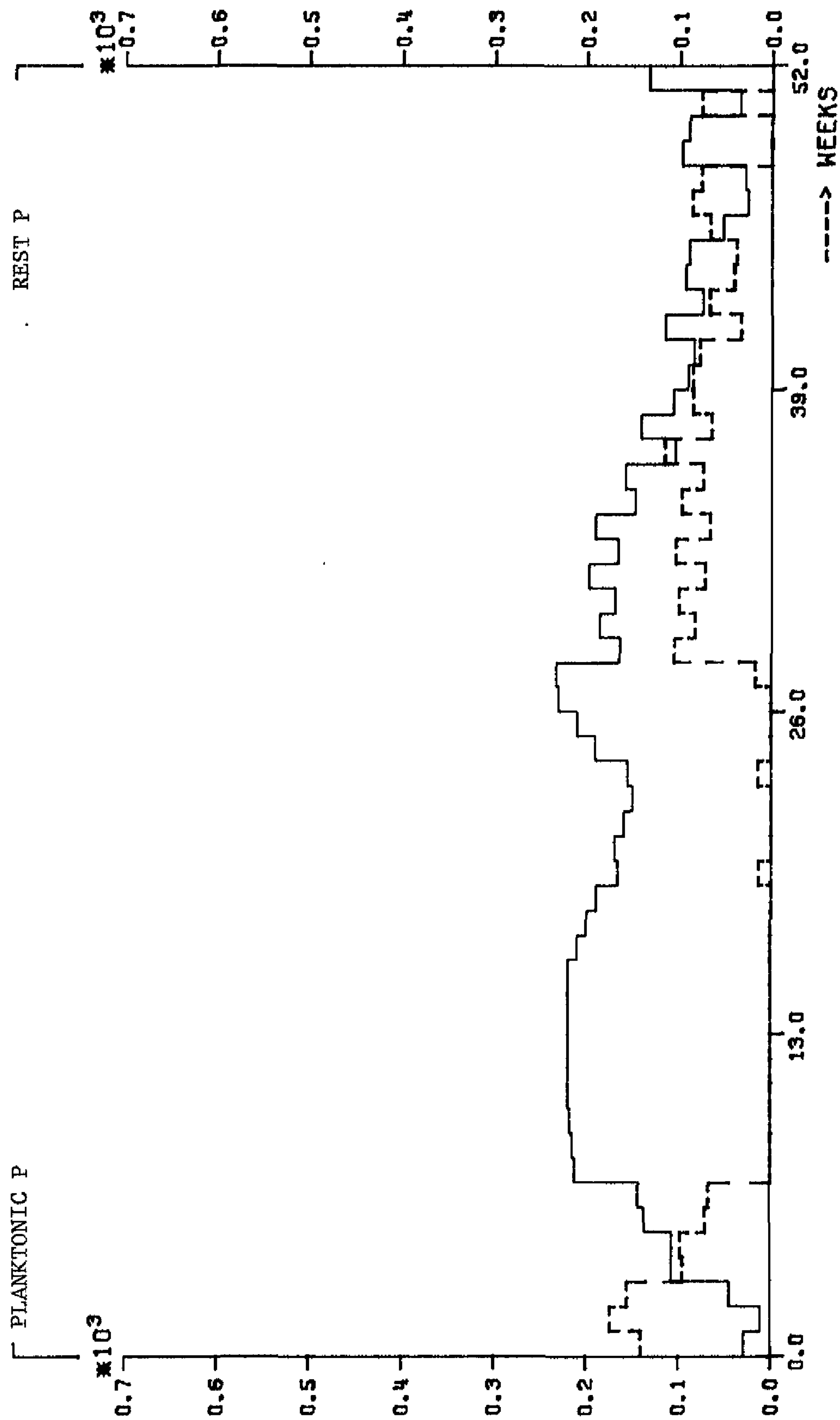


LAKE IJSSEL, 1976. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. NOMINAL RUN.

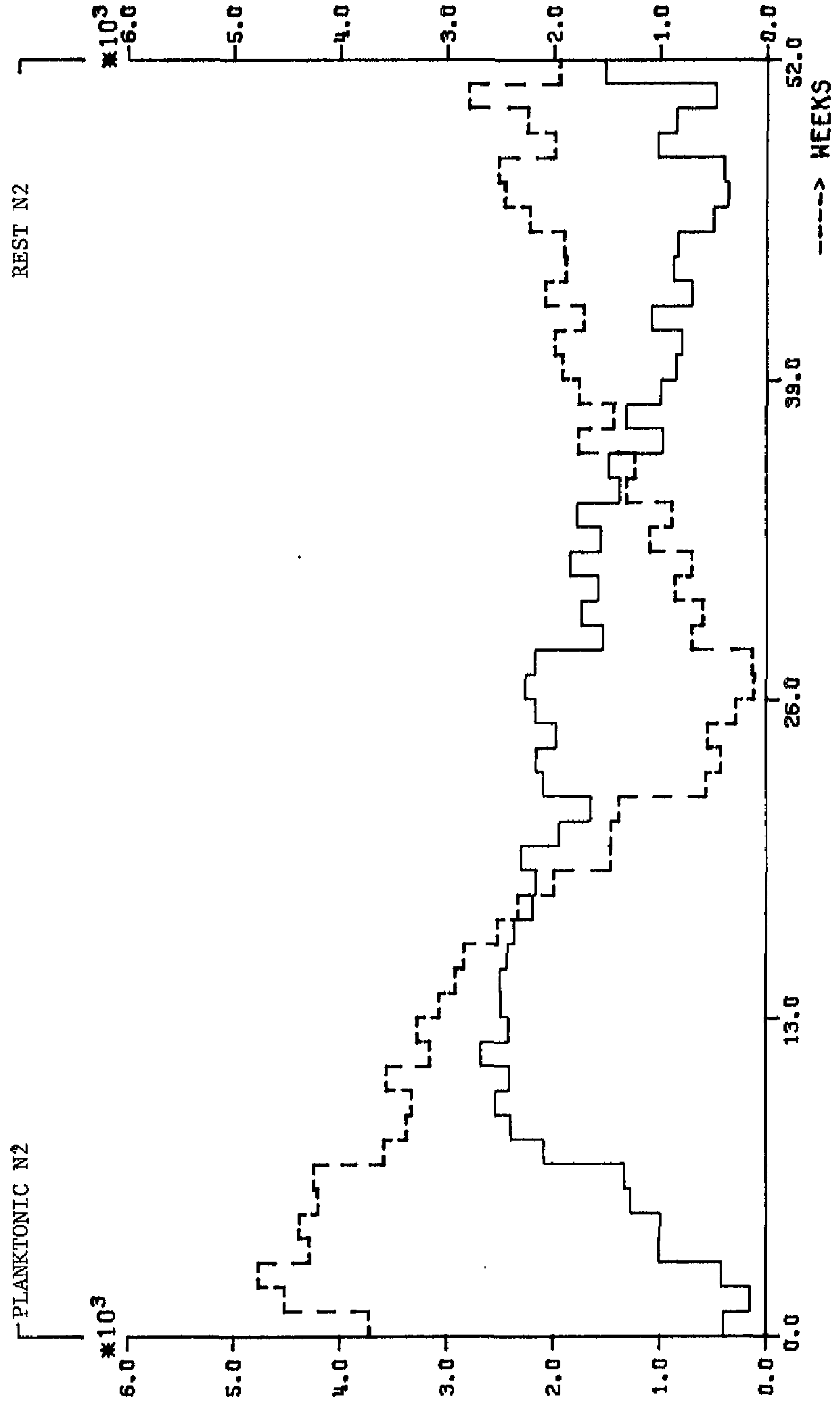
A4

DELFT HYDRAULICS LABORATORY

Fig. A-14.1



LAKE IJSSEL, 1976. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. NOMINAL RUN.		A4
DELFT HYDRAULICS LABORATORY	Fig. A-14.2	

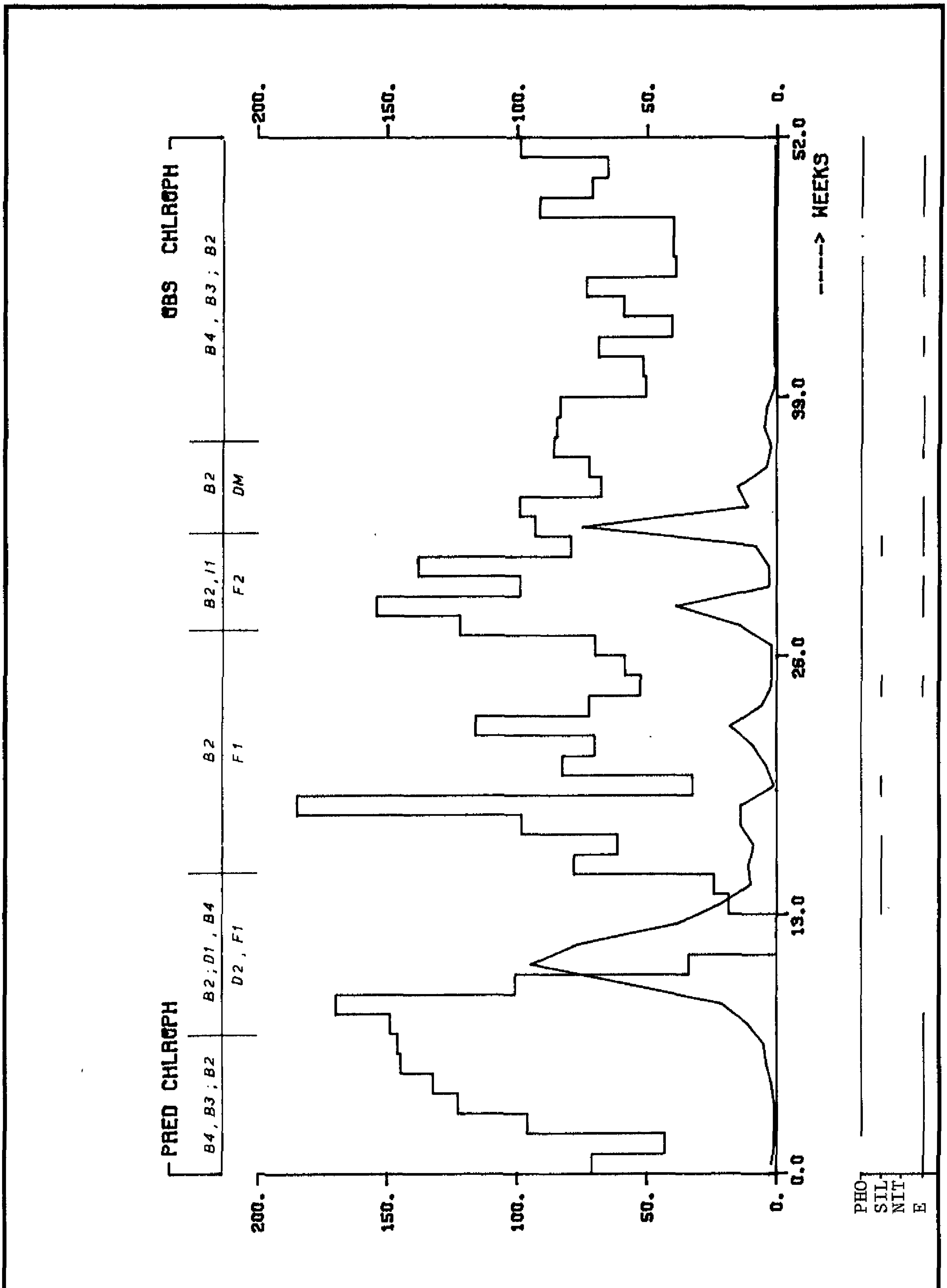


LAKE IJSSEL, 1976. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. NOMINAL RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-14.3

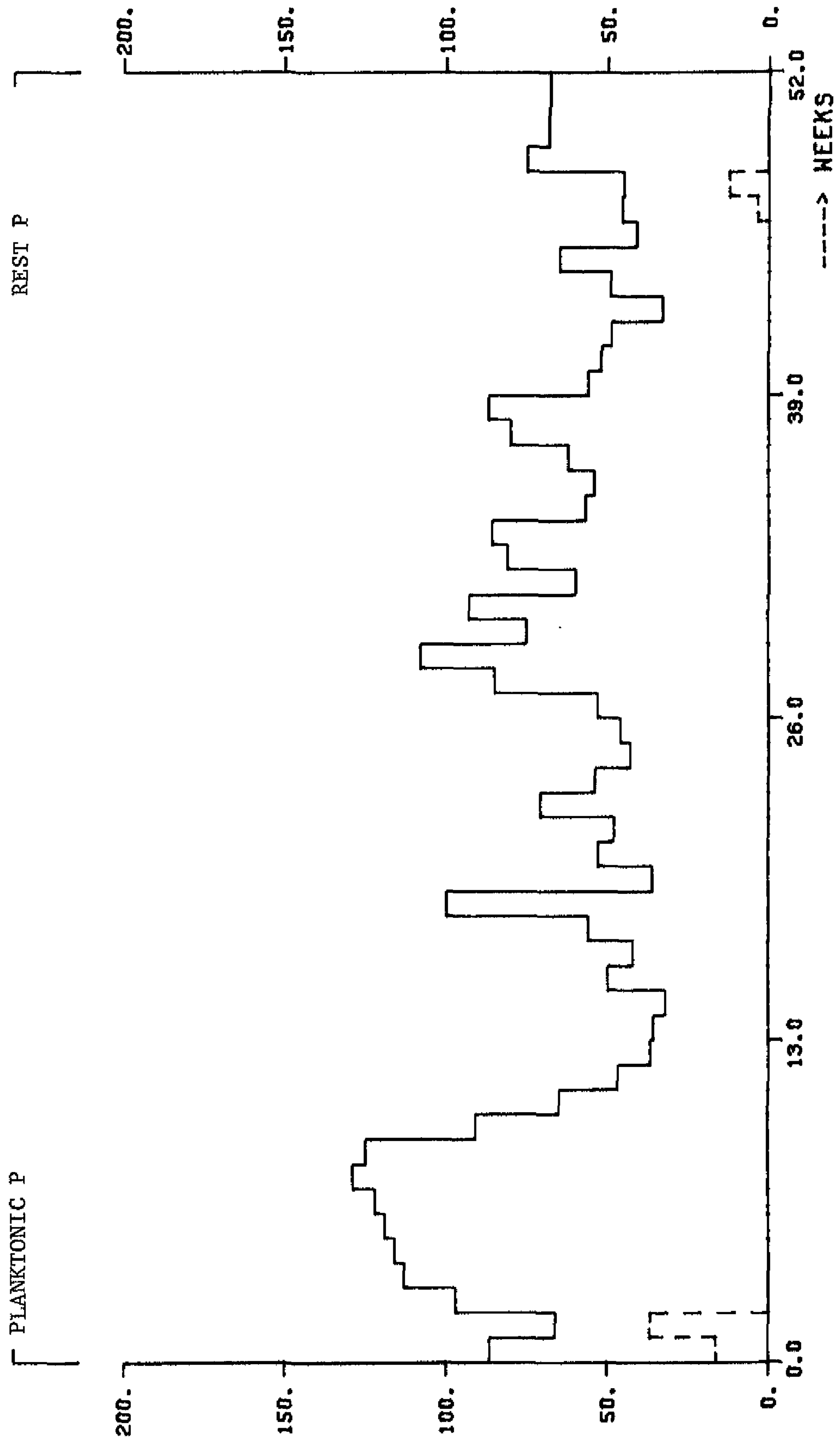


GROTE RUG, RING 1 1976. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. DYNAMIC DETRITUS RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-15.1

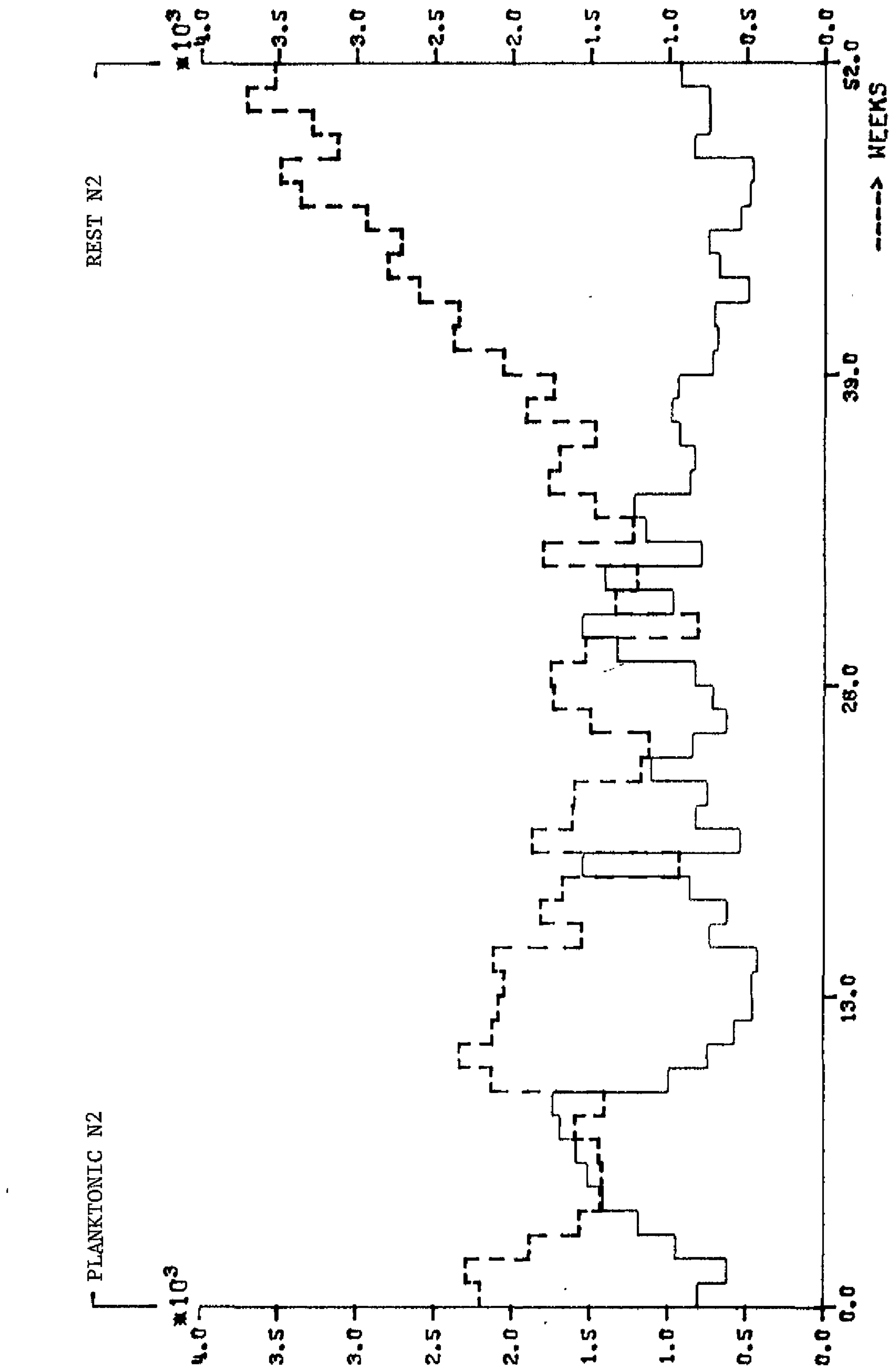


GROTE RUG, RING 1 1976. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. DYNAMIC DETRITUS RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-15.2

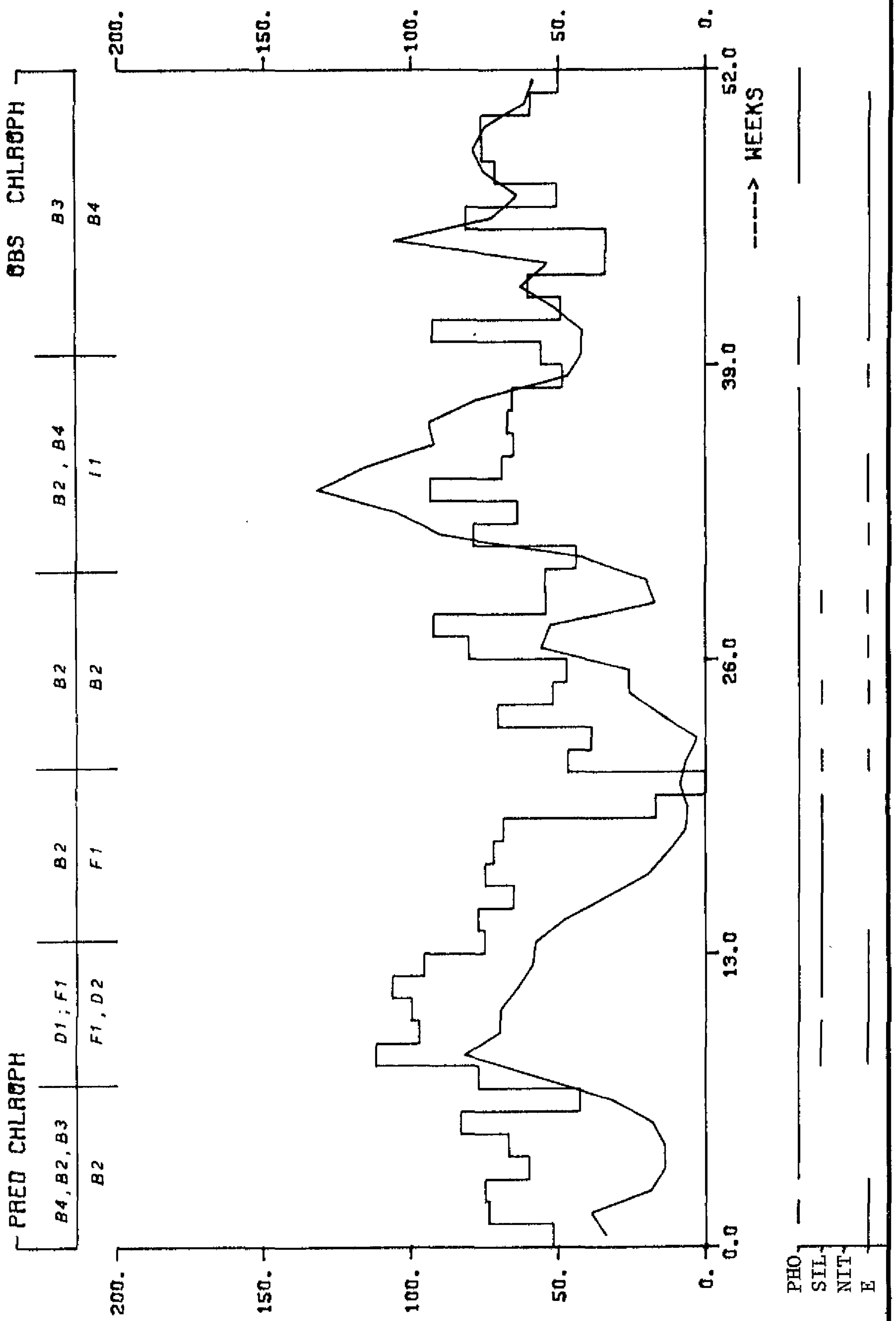


GROTE RUG, RING 1 1976. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. DYNAMIC DETRITUS RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-15.3

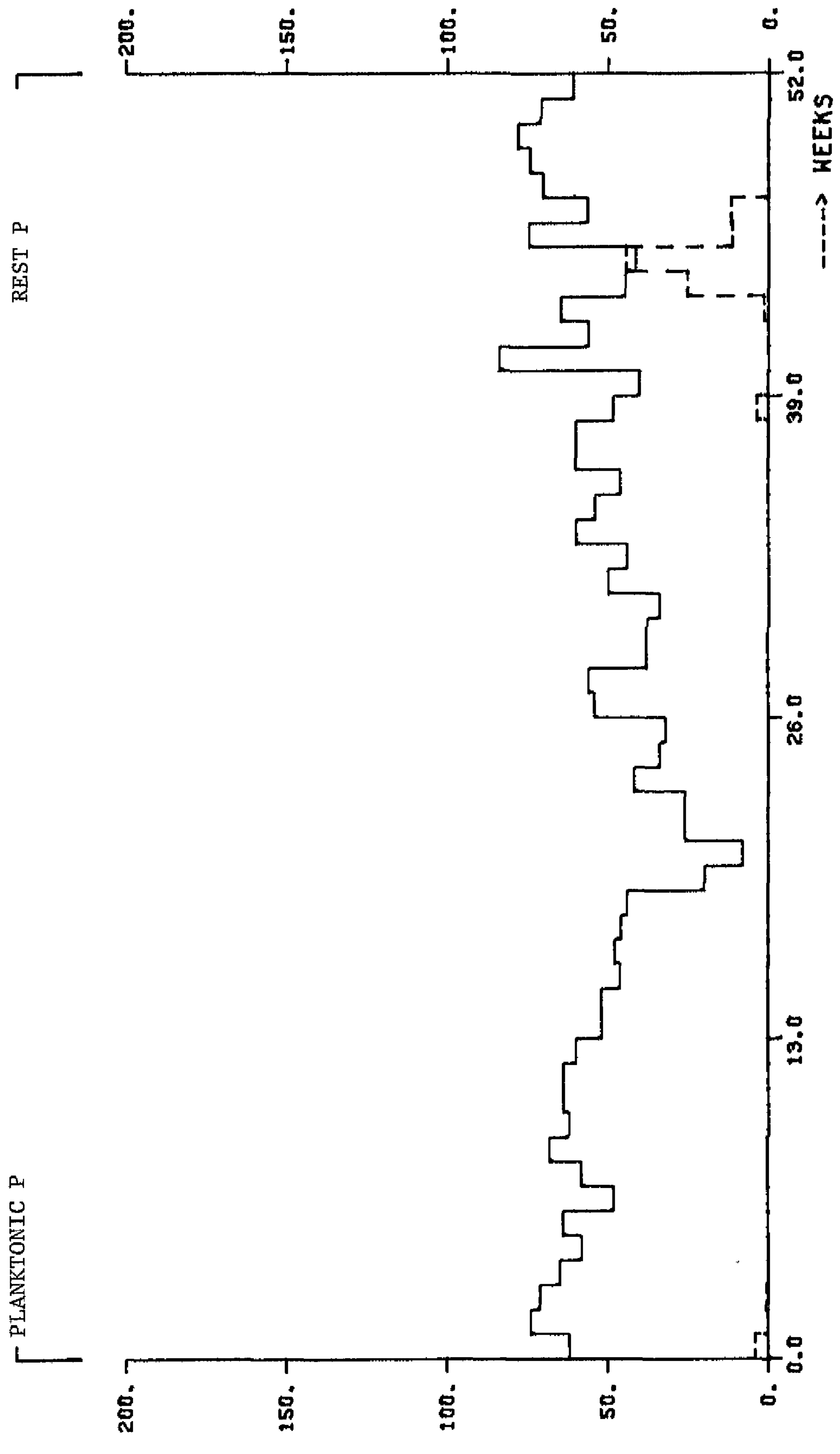


GROTE RUG, RING 2 1978. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. DYNAMIC DETRITUS RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-16.1

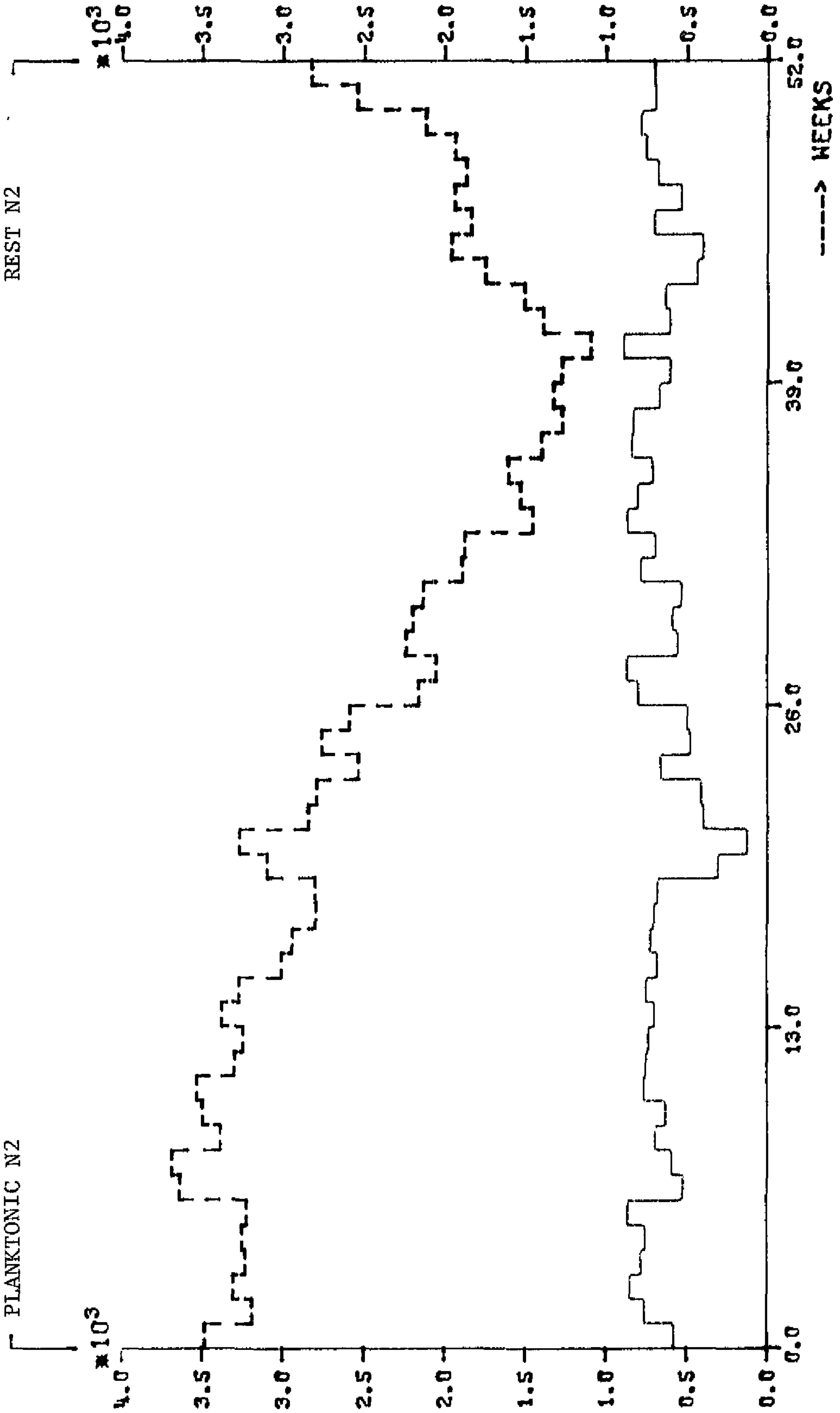


GROTE RUG, RING 2 1978. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. DYNAMIC DETRITUS RUN.

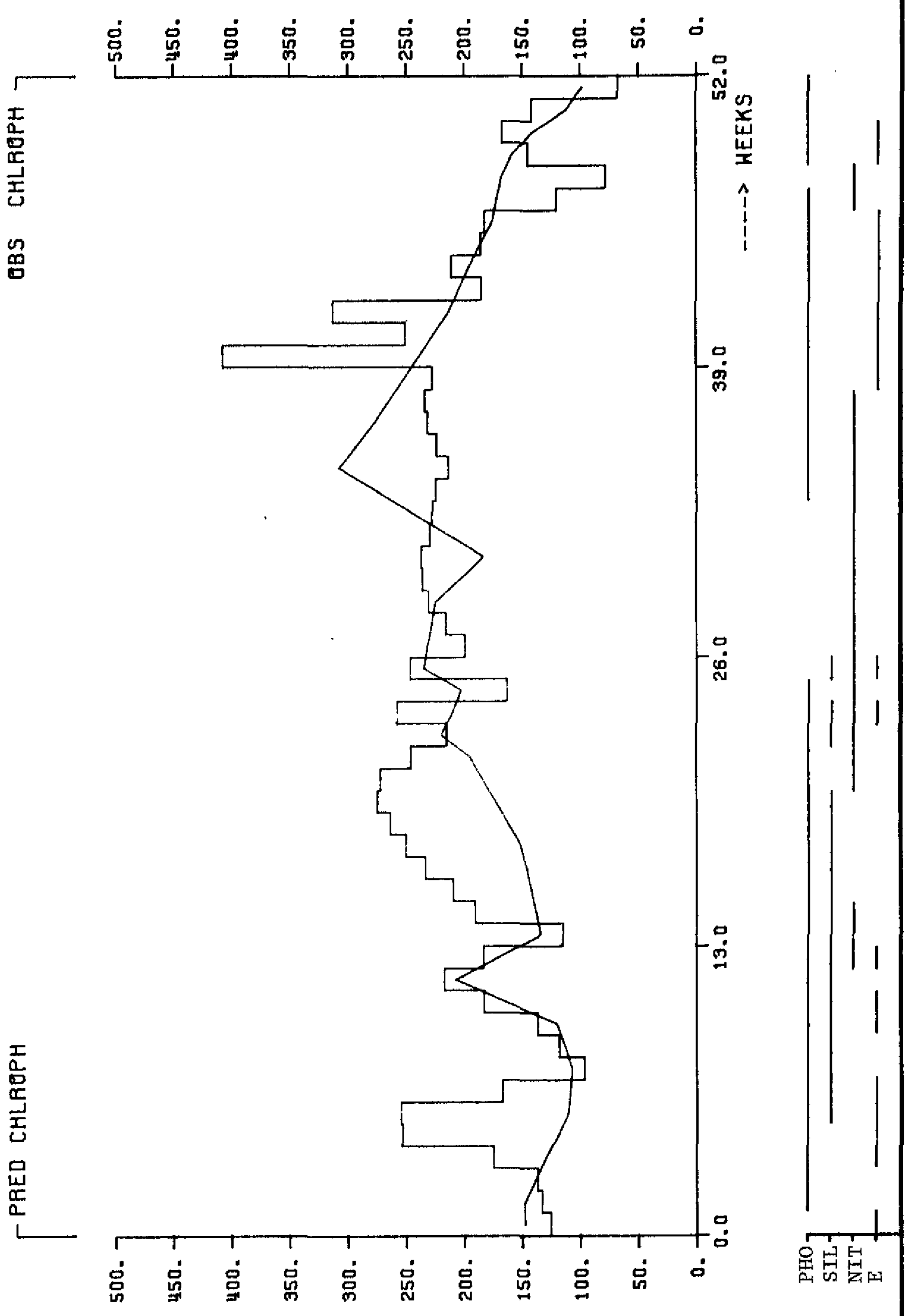
A4

DELFT HYDRAULICS LABORATORY

Fig. A-16.2



GROTE RUG, RING 2 1978. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. DYNAMIC DETRITUS RUN.		A4
DELFT HYDRAULICS LABORATORY	Fig. A-16.3	

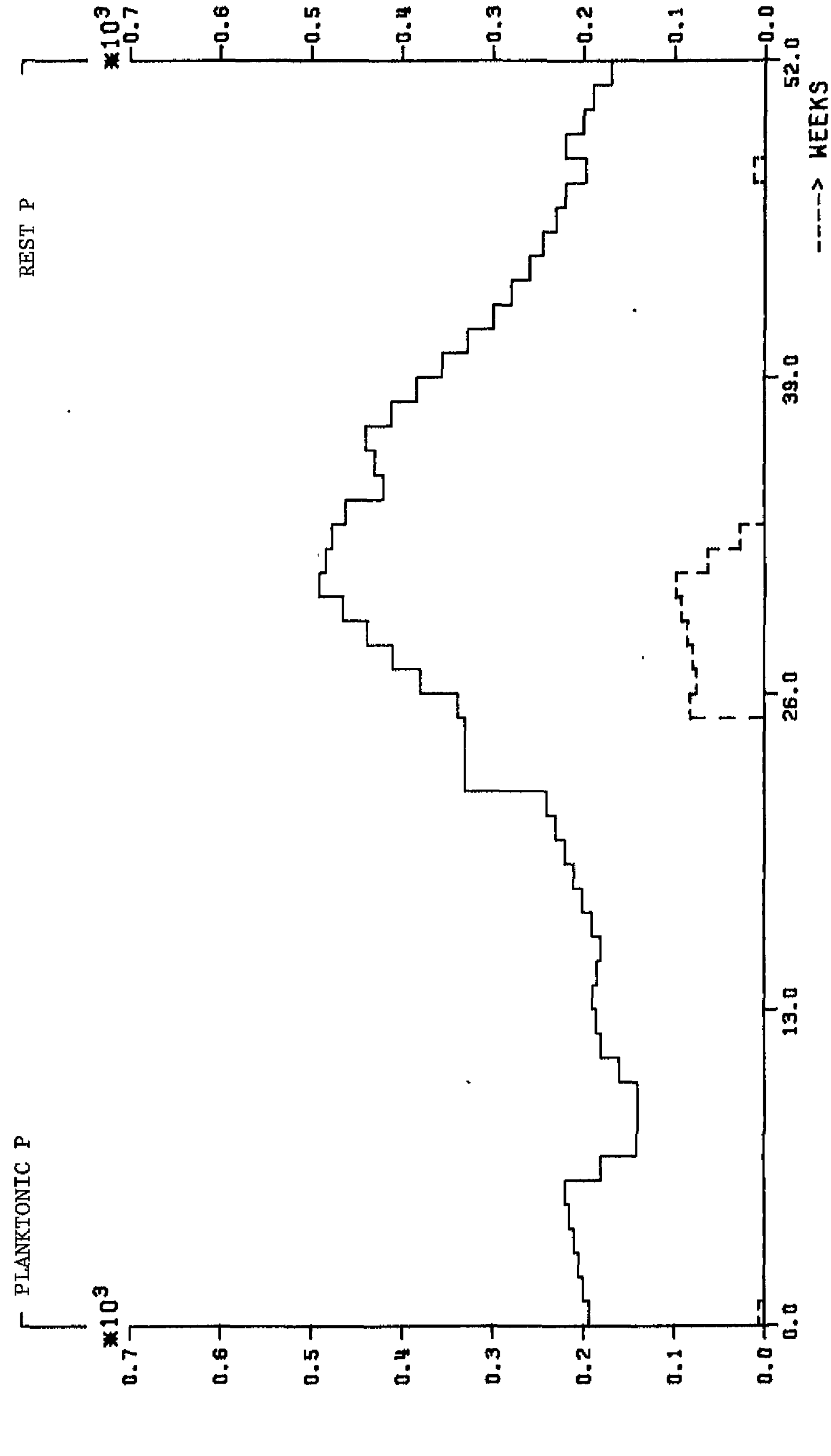


LAKE WOLDERWIJD, 1975. PREDICTED AND OBSERVED CHLOROPHYLL IN UG/L. DYNAMIC DETRITUS RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-17.1

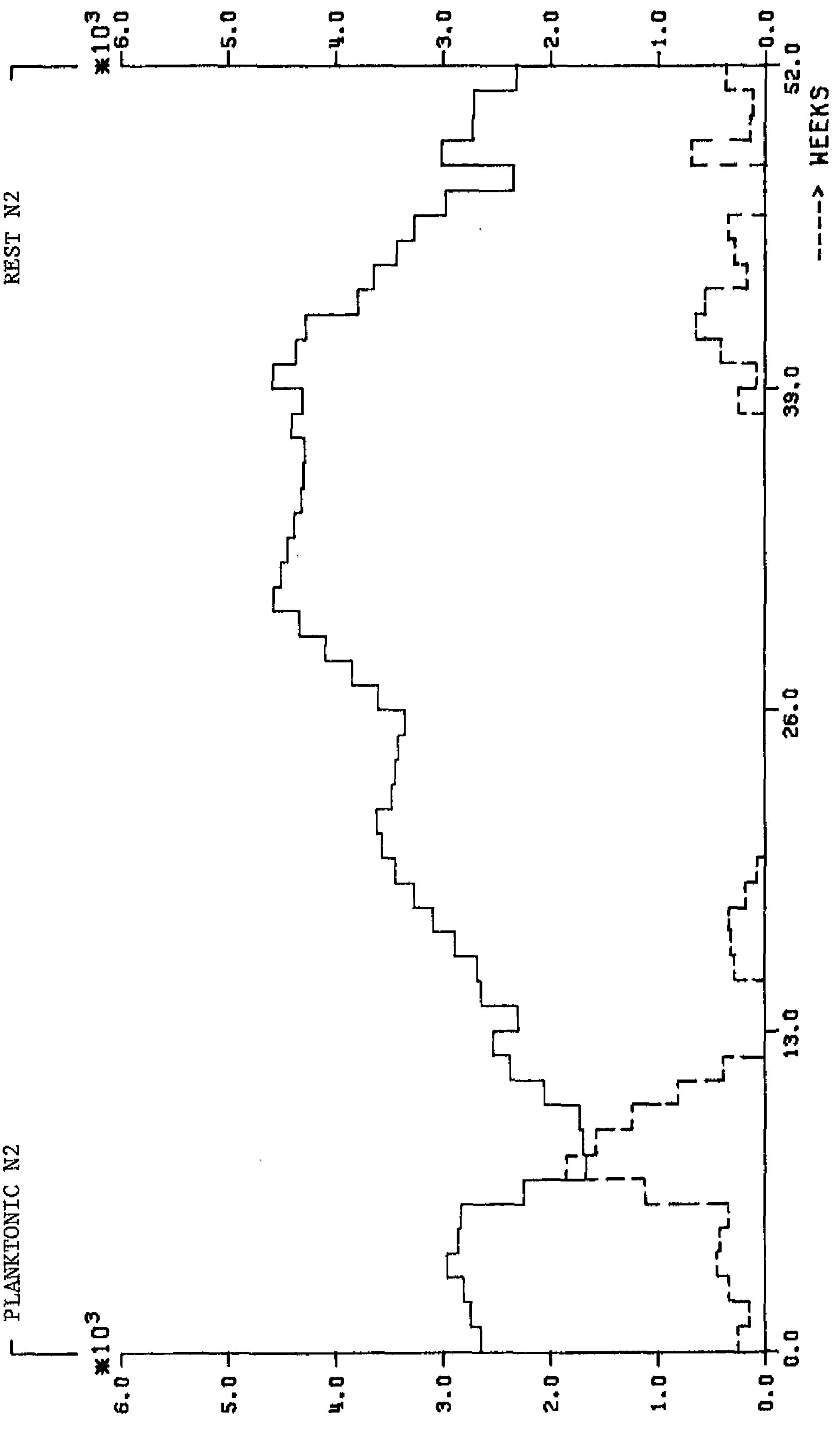


LAKE WOLDERWIJD, 1975. P IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC P) AND THE SUM OF ALL OTHER FRACTIONS (REST P) IN UG/L. DYNAMIC DETRITUS RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-17.2

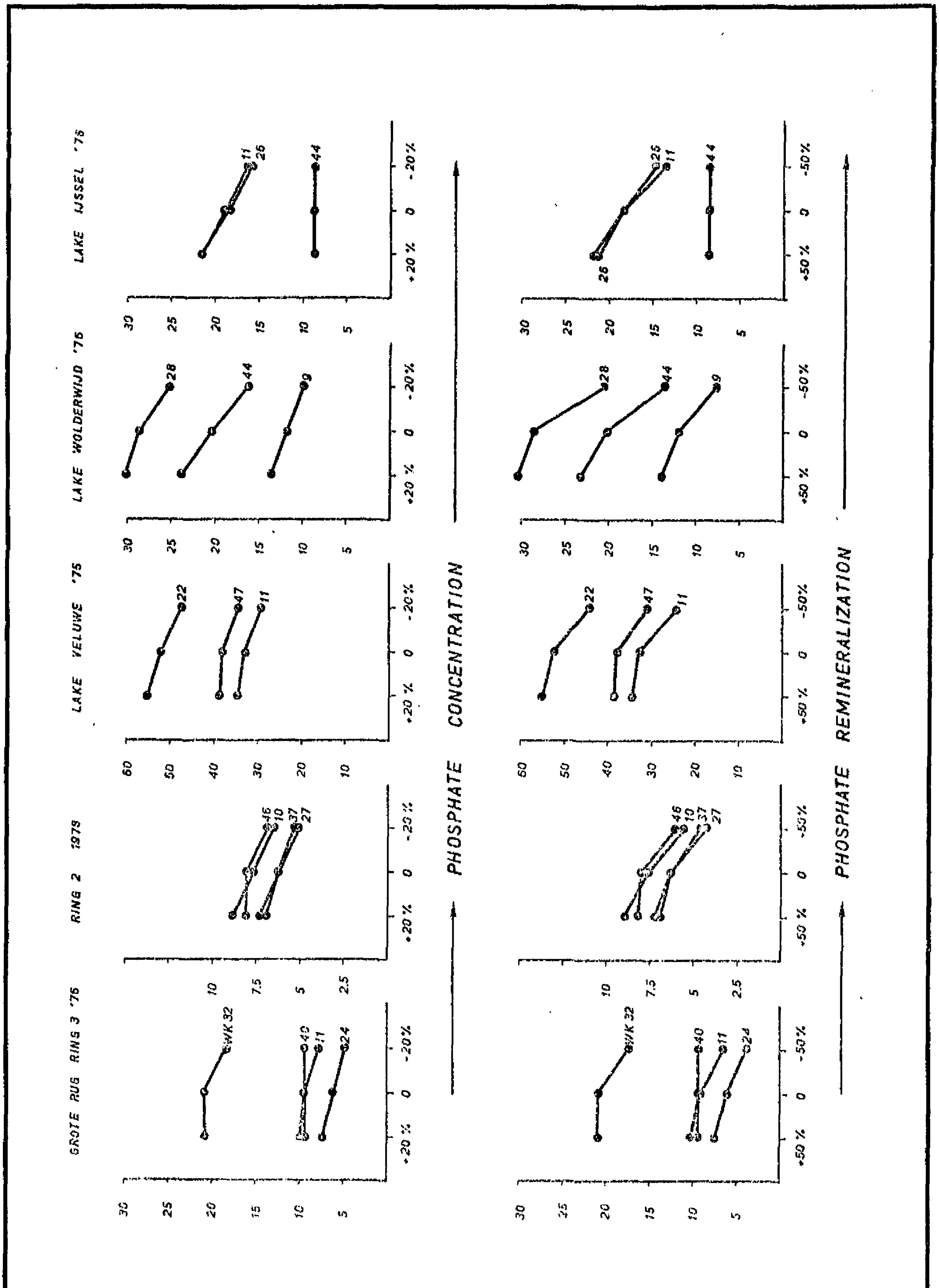


LAKE WOLDERWIJD, 1975. N2 IN PHYTOPLANKTON, ZOOPLANKTON AND DETRITUS (PLANKTONIC N2) AND THE SUM OF ALL OTHER FRACTIONS (REST N2) IN UG/L. DYNAMIC DETRITUS RUN.

A4

DELFT HYDRAULICS LABORATORY

Fig. A-17.3

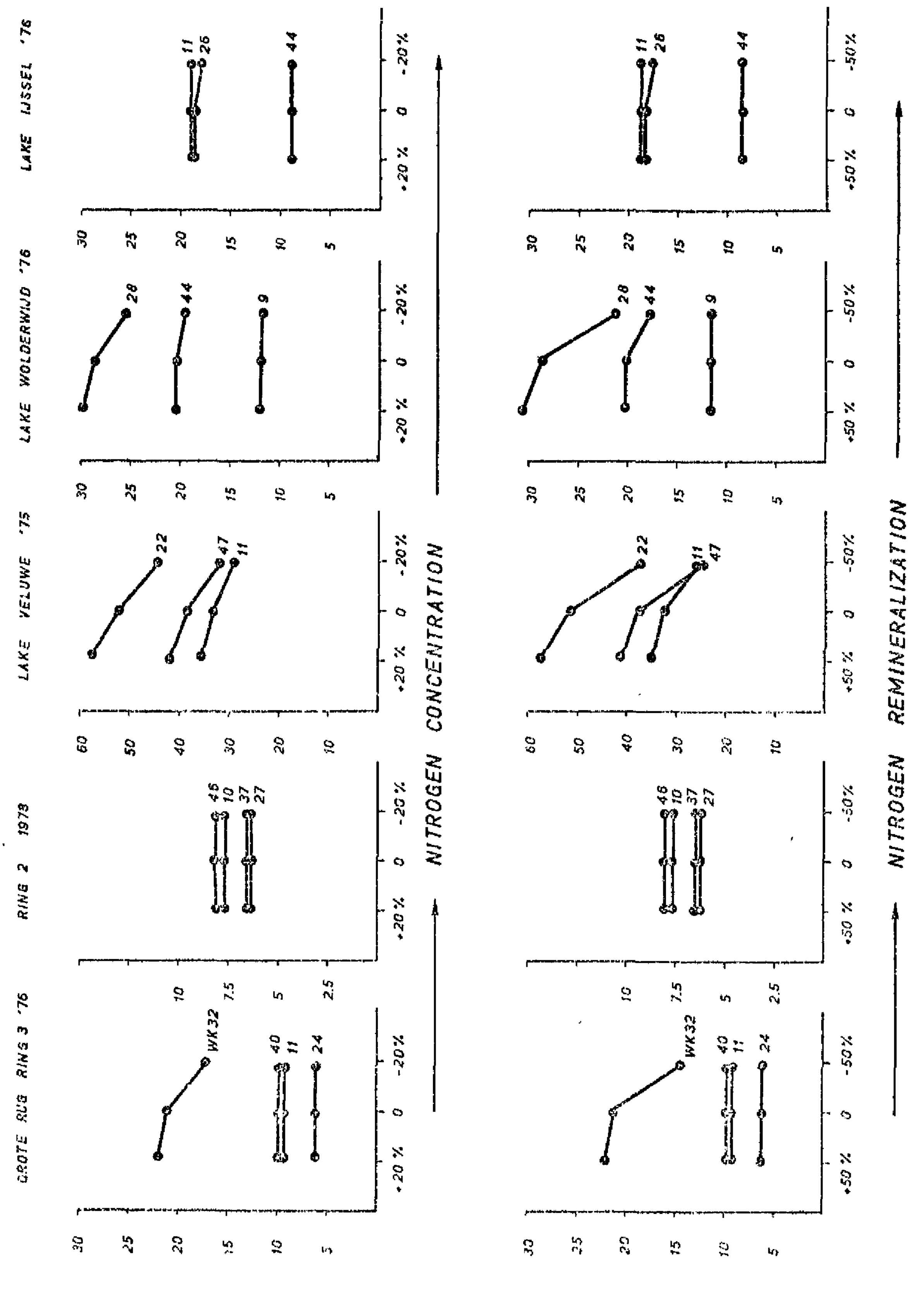


PHYTOPLANKTON CONCENTRATION (•) IN GRAM DRYWEIGHT PER M^3 AT NOMINAL (O) AND PERTURBED CONDITIONS FOR SEVERAL WEEKS IN FIVE CASES

A4

DELFT HYDRAULICS LABORATORY

Fig. A-18

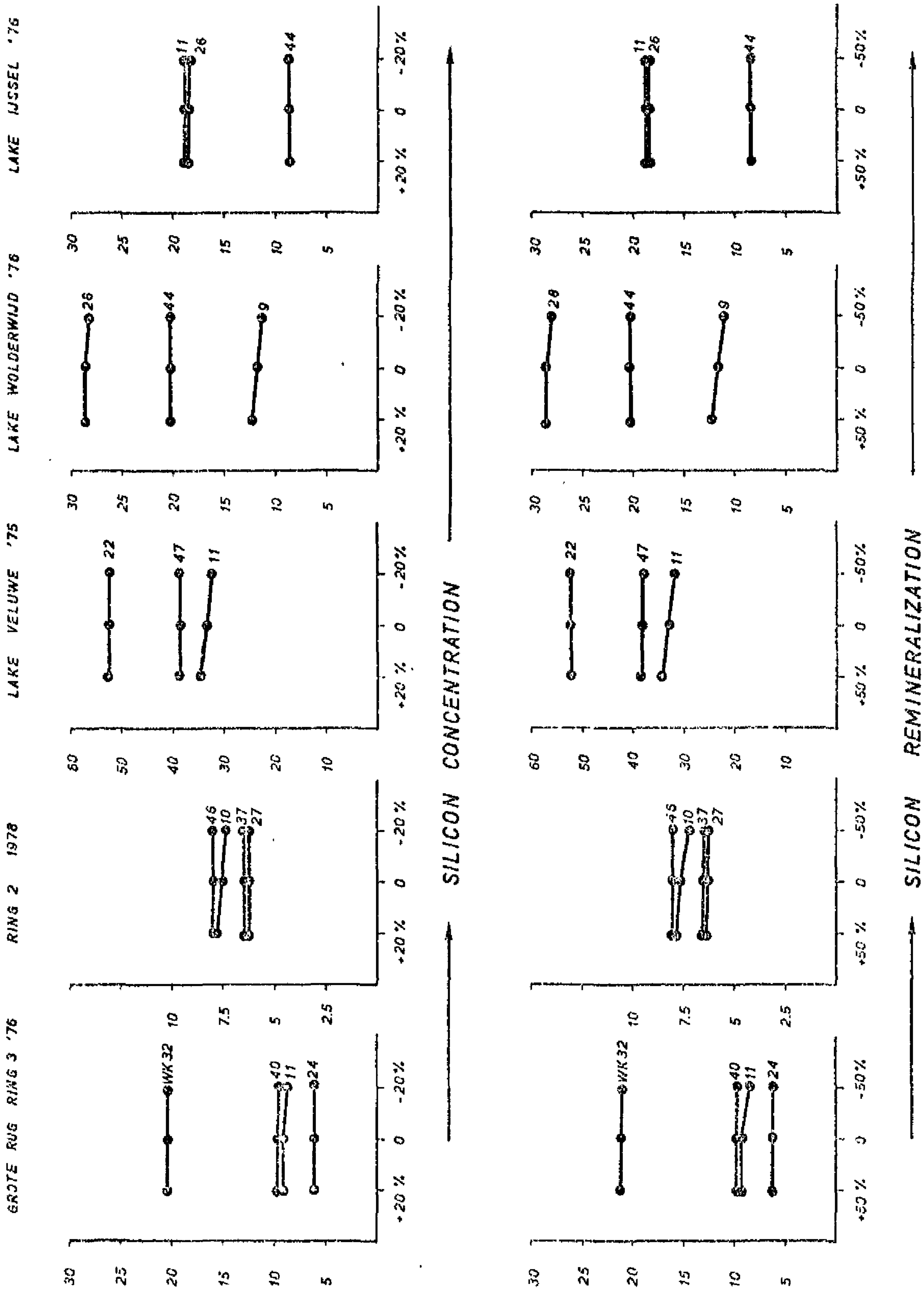


PHYTOPLANKTON CONCENTRATION (•) IN GRAM DRYWEIGHT PER M^3 AT NOMINAL (O) AND PERTURBED CONDITIONS FOR SEVERAL WEEKS IN FIVE CASES

A4

DELFT HYDRAULICS LABORATORY

Fig. A-19

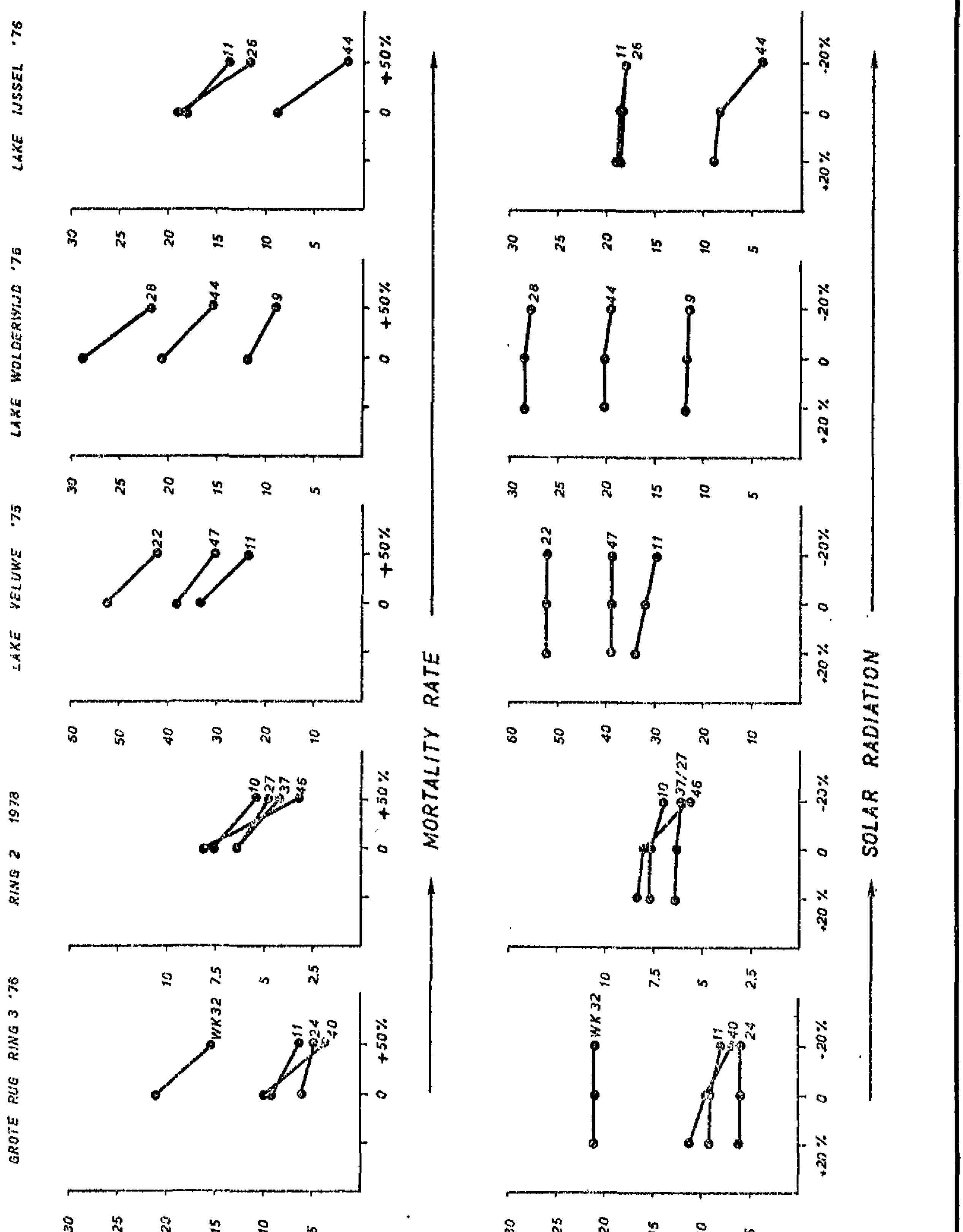


PHYTOPLANKTON CONCENTRATION (●) IN GRAM DRYWEIGHT PER M^3 AT NOMINAL (O) AND PERTURBED CONDITIONS FOR SEVERAL WEEKS IN FIVE CASES

A4

DELFT HYDRAULICS LABORATORY

Fig. A-20

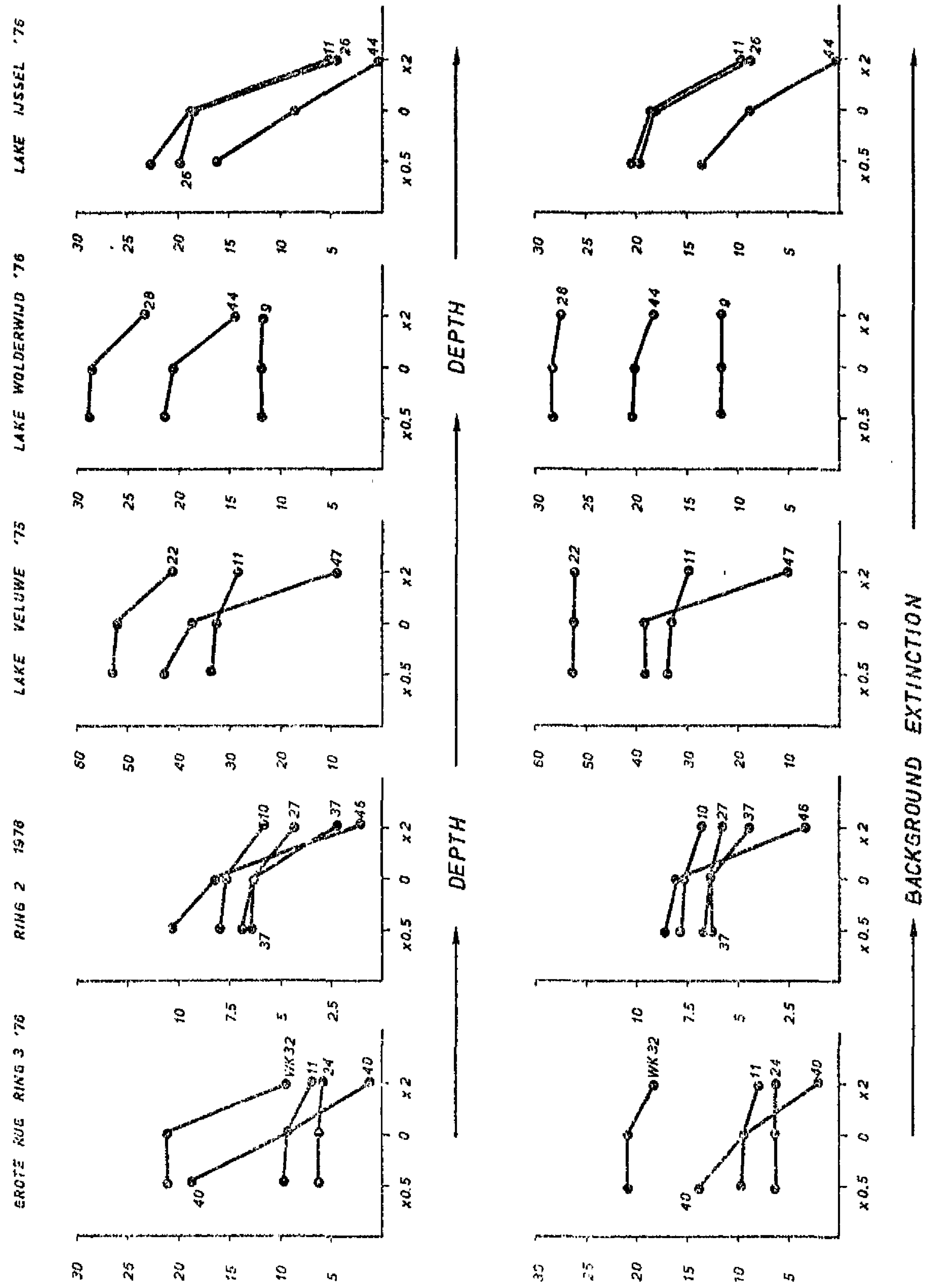


PHYTOPLANKTON CONCENTRATION (•) IN GRAM DRYWEIGHT PER M^3 AT NOMINAL (O) AND PERTURBED CONDITIONS FOR SEVERAL WEEKS IN FIVE CASES

A4

DELFT HYDRAULICS LABORATORY

Fig. A-21



PHYTOPLANKTON CONCENTRATION (●) IN GRAM DRYWEIGHT PER M^3 AT NOMINAL (O) AND PERTURBED CONDITIONS FOR SEVERAL WEEKS IN FIVE CASES

	A4
DELFT HYDRAULICS LABORATORY	Fig. A-22

p.o. box 177 2600 mh delft the netherlands