

Appendix V

Analysis of meteorological data.

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This appendix provides an analysis of monthly total sunshine hours and average sea temperatures to allow the meteorological conditions experienced during the survey period to be placed into the context of prevailing meteorological conditions in Jersey. Data for the years 1961 to 1996 and for January to October 1997 has been provided by the States of Jersey Meteorological Department.

To compare the 30 year averages with conditions experienced during the survey period t-tests were carried out between the 1961-1990 (30 year) monthly averages and 1997 monthly data. The results from this analysis are presented in Tables V.1 (monthly sunshine hours) and V.2 (monthly average sea temperature), whilst graphical representations of the data are provided in Figures V.1 (monthly sunshine hours) and V.2 (monthly average sea temperature).

The 1997 monthly total sunshine hours show a significant difference from the 30 year average during all months within the study period, with the exception of March (Table V.1). The months of February, June and August all displayed significantly lower sunshine than the 30 year average, whilst April, May, July, September and October all experienced more sunshine than the 30 year average (Table V.1 and Figure V.1).

Table V.1: T-test results, comparison of sunshine hours data between the 30 year average and 1997 data.

Month	1997	1961-90 average		t-value	p
	Sunshine hours	Mean (hours)	Std. dev.		
February	58.10	91.32	20.49	8.88	0.00†
March	141.00	140.66	32.58	-0.06	0.95
April	287.10	192.42	35.84	-14.47	0.00†
May	277.80	240.98	41.87	-4.82	0.00†
June	158.40	249.11	50.16	9.90	0.00†
July	286.50	261.34	41.44	-3.33	0.002†
August	204.60	237.55	35.38	5.10	0.00†
September	251.00	176.72	26.48	-15.36	0.00†
October	155.80	126.08	29.23	-5.57	0.00†

† significant at $\alpha=0.05$

1997 sea temperatures measured at the end of the oil terminal outer breakwater displayed significant differences to the 30 year monthly averages during the whole study period, with the exception of February and July (Table V.2). Sea temperatures were warmer than the 30 year averages in all cases where there was a significant difference (Figure V.2).

Figure V.3 shows a comparison of Jersey Meteorological Department sea temperature data with the mean sea temperature in zones B and C during each survey. Generally, the sea temperatures recorded during the surveys were similar to either the 1997 monthly averages or the 30 year averages. Sea temperatures during survey 9 (29/10/97) were lower than the

monthly averages, whilst during surveys 1, 3 and 6 sea temperatures in zones B and C were warmer. Some differences between the average temperature and those measured during the surveys would be expected due to the surveys representing temperatures for a single day which are compared to monthly mean values. Also, the difference in locations of where the measurements are taken may be a factor in the differences.

Table V.2: T-test results, comparison of sea temperature data between the 30 year average and 1997 data.

Month	1997	1961-90 average		t-value	p
	Sea Temp (°C)	Mean (°C)	Std. dev.		
February	7.50	7.54	1.11	0.21	0.83
March	9.40	8.00	1.12	-6.85	0.00†
April	10.60	9.46	0.69	-9.06	0.00†
May	12.50	11.86	0.76	-4.61	0.00†
June	14.70	14.42	0.61	-2.53	0.02†
July	16.40	16.47	0.74	0.49	0.63
August	18.40	17.51	0.70	-6.98	0.00†
September	18.20	17.05	0.77	-8.2	0.00†
October	16.40	15.31	0.56	-10.74	0.00†

† significant at $\alpha=0.05$

It is unlikely that the intensity and duration of sunlight experienced during February was particularly favourable for phytoplankton growth, especially given the lower than average number of sunlight hours. This is reflected by the high nutrient concentrations during surveys 1 and 2 (late February and early April).

Conditions during April, when over 90 more sunshine hours than the 30 year average were experienced, are likely to favour phytoplankton growth. This is reinforced by the results of the predictive modelling, which indicate suitable conditions during neap tides in March (see Section 5.3). The relatively large difference in the mean zone B sea temperature recorded at the end of April, when compared to the 30 year average (a difference of 3.7°C), may also be related to the increased number of hours sunshine during this month. The warmer than normal sea temperature may also encourage phytoplankton growth. Hence, during April phytoplankton growth was encouraged by the greater than average sunshine hours and warmer sea temperatures. An increased level of phytoplankton growth during this month (i.e. between surveys 2 and 3) was possibly reflected in the decrease in nutrient concentrations in zones B and C. However, such a drop in nutrient concentrations is expected at this time of year. Therefore, it is difficult to determine whether the above average hours of sunshine, and increased sea temperatures, contributed to an enhanced algal bloom. However, growth of the bloom may have been limited to some extent by the assimilation of nutrients.

June experienced 90 hours less sunshine than the 30 year average, a factor which may have contributed to the cooler than average sea temperature measured during survey 5 (1/7/97). These factors may combine to inhibit algal growth, although there was no evidence to suggest this; chlorophyll *a* concentrations vary little between both the preceding and subsequent surveys. June experienced a total of 158 hours sunshine during 1997, 18 hours more than the average for the month of March. Predictions to determine whether suitable conditions for algal growth exist (see Section 5.3) suggest that suitable conditions occur during neap tides during March. This suggests the reduced hours of sunlight may affect growth to such an extent that it may be similar to that predicted for March. Without *in-situ*

measurements throughout the month, however, it is difficult to determine whether this is, in fact, the case.

It should be noted, however, that the 1997 average June sea temperature recorded by the Meteorological Department was warmer than the long-term average, although July showed no variation. Sea temperatures tend to lag air temperatures, and the trend of warmer than average sea temperatures during 1997 may have been interrupted during July by the reduced hours of direct irradiation during June.

The reduced number of sunshine hours during August may also have caused a reduction in phytoplankton growth, although, again, there is no evidence to indicate a reduced chlorophyll *a* concentration during the subsequent survey (survey 7 - 9/9/97). Chlorophyll *a* concentrations in zone B increased slightly between surveys 6 and 7, whilst in the immediate nearshore zone concentrations exceeded the CSTT (1994) threshold of 10 mg chl m⁻³. Again, it is difficult to ascertain whether an average period of direct sunlight during August 1997 would have further encouraged phytoplankton growth in the immediate nearshore zone.

Despite the significant differences in sunshine hours and average and observed sea temperatures, it is difficult to determine whether the particular conditions experienced affected the data collected for this study. It is, important, however, to note that in terms of sunshine hours and sea temperatures, 1997 appears to be a somewhat anomalous year.

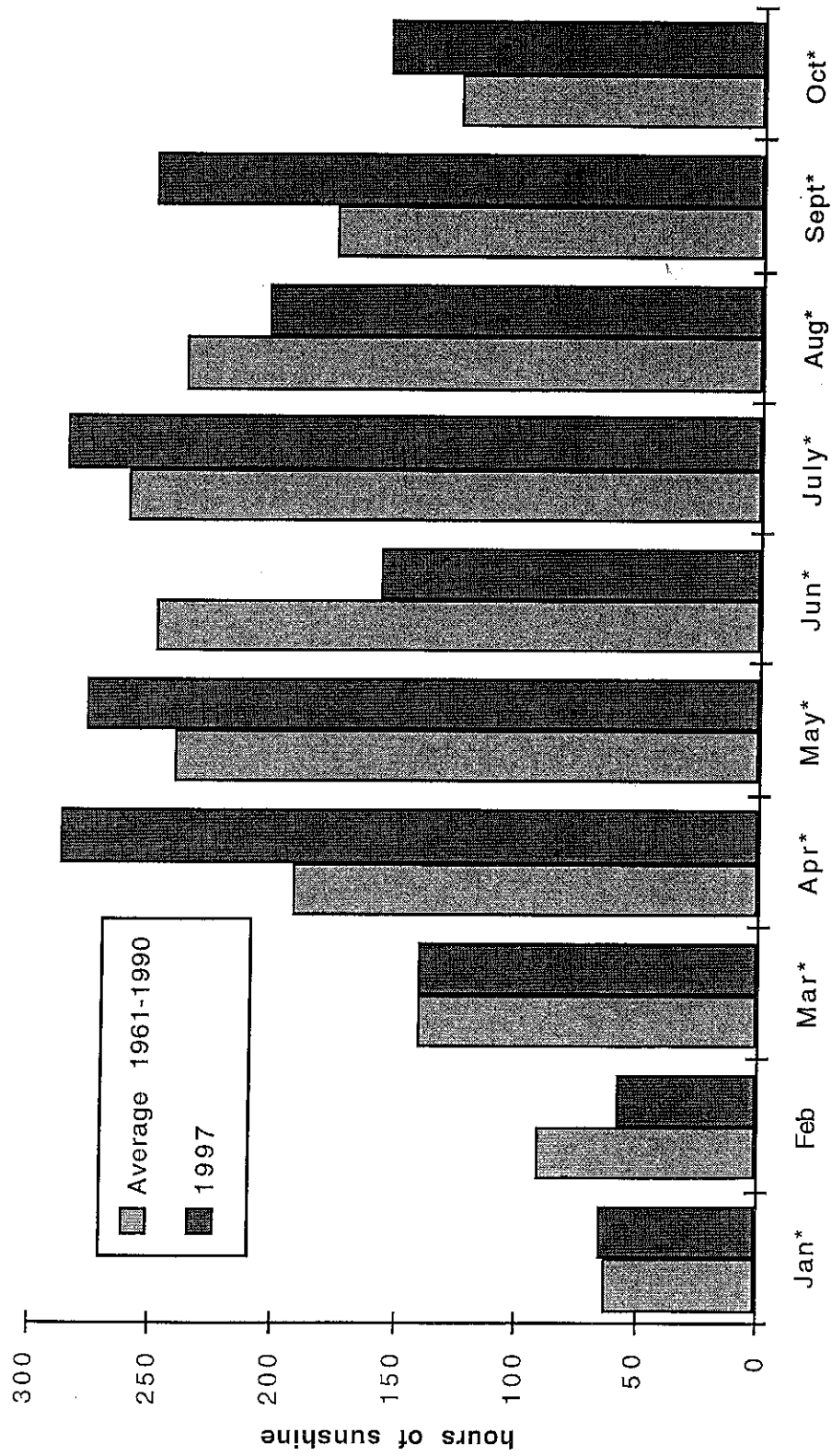


Figure V.1: Sunshine hours recorded at Fort Regent (Data: States of Jersey Meteorological Department).
 * denotes months which display a significant difference at $\alpha = 0.05$

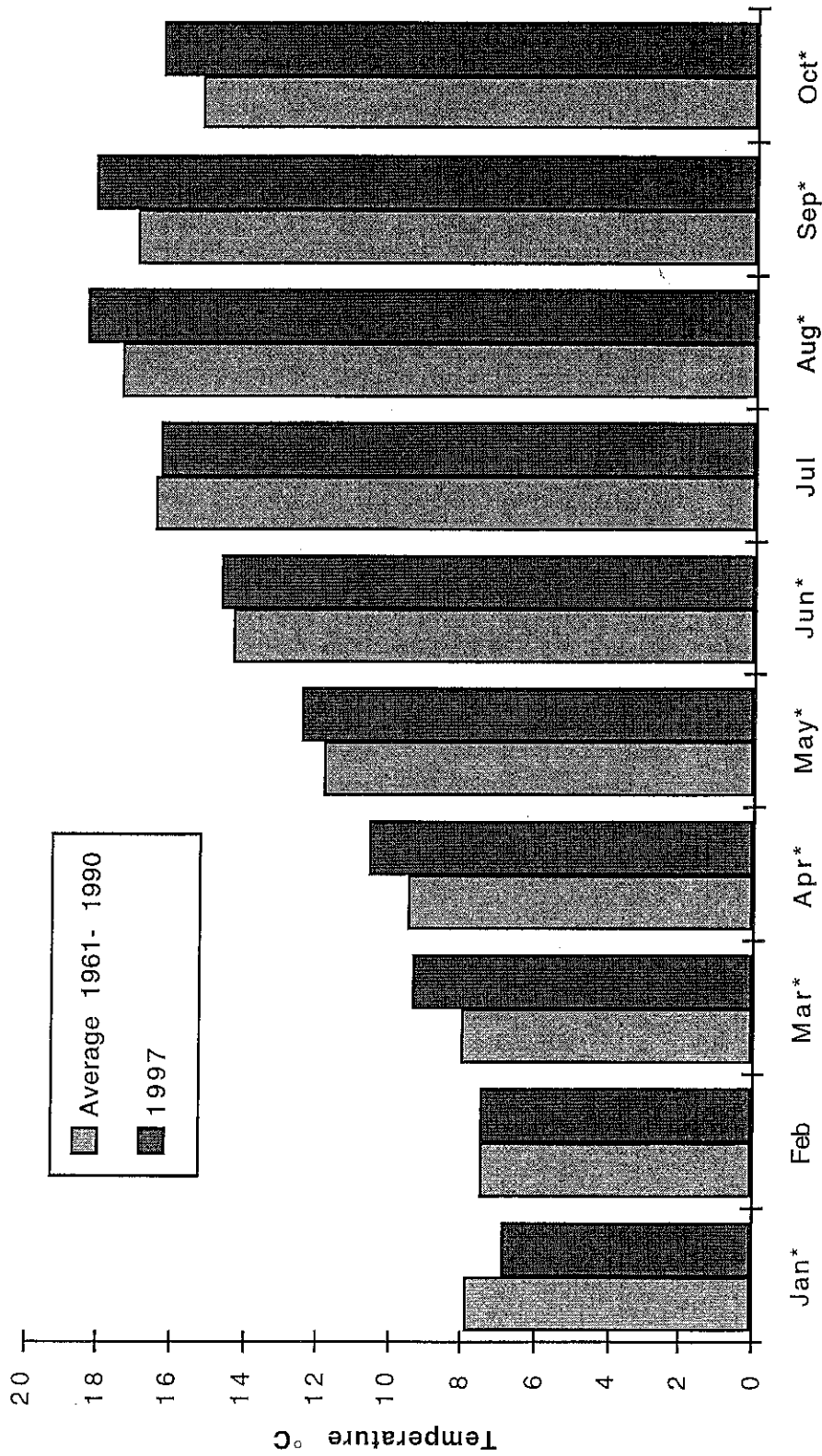


Figure V.2: Sea temperatures recorded at the oil terminal outer breakwater (Data: States of Jersey Meteorological Department).
 * denotes months which display a significant difference at $\alpha = 0.05$

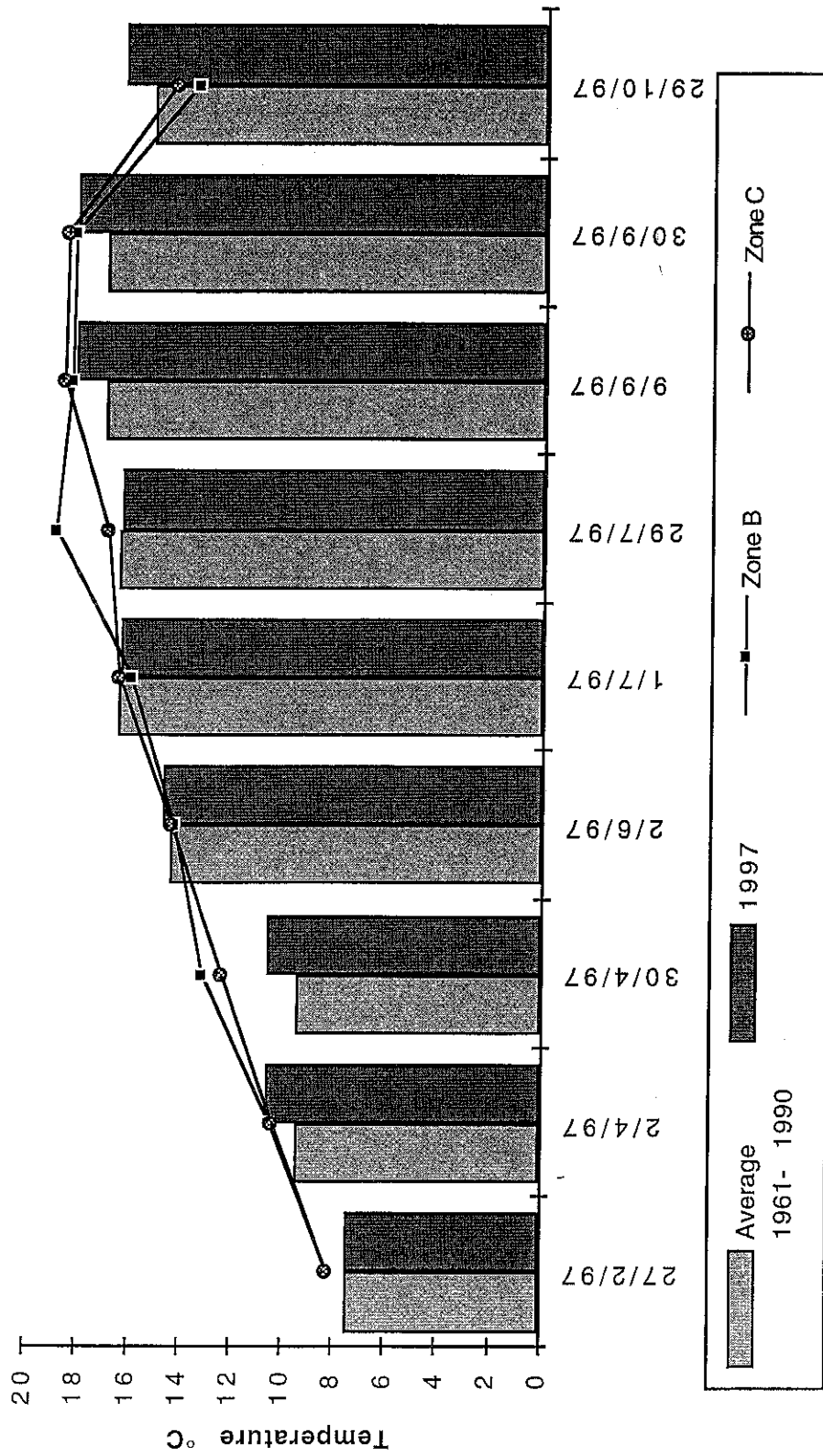


Figure V.3: Comparison of 1961-1990 average and 1997 sea temperatures with mean zone B and C sea temperatures recorded during the sea surveys.

Appendix VI

**Further analysis of the potential impacts of nitrogen
removal from Bellozanne STW effluent.**