

Table 11a – Comparison of Median PO₄ Values – Liffey Estuary (Surface Samples) 2000/1, 2001/2, 2002/3 & 2003/4.

	Range of Median Phosphate values (µgP/l)			
	Surface Samples			
	2000/2001	2001/2002	2002/2003	2003/2004
July - June PO ₄ µgP/l	34 - 215	29 - 133	35 - 150	42 - 162
Salinity psu	7.6 – 32.4	11.4 – 32.5	11.4 – 32.7	7.6 – 32.8
Summer PO ₄ µgP/l	29 - 215	21 - 145	29 - 162	39 - 236
Salinity psu	12.2 – 33.1	13.2 – 33.2	15.7 – 33.1	9.1 – 33.1
Winter PO ₄ µgP/l	38 - 249	30 - 117	49 - 252	46 - 148
Salinity psu	0.4 – 31.9	10.3 – 32.7	1.1 – 31.9	4.2 – 31.7

Table 11b – Comparison of Median PO₄ Values – Liffey Estuary (Depth Samples) 2000/1, 2001/2, 2002/3 & 2003/4

	Range of Median Phosphate values (µgP/l)			
	Depth Samples			
	2000/2001	2001/2002	2002/2003	2003/2004
July - June PO ₄ µgP/l	22 - 47	20 - 35	23 - 67	33 - 56
Salinity psu	31.3 – 33.8	32.4 – 34.1	31.1 – 33.8	31.8 – 33.7
Summer PO ₄ µgP/l	16 - 47	14 - 62	14 - 68	20 - 65
Salinity psu	30.8 – 34.0	32.7 – 34.1	31.5 – 34.0	32.4 – 33.7
Winter PO ₄ µgP/l	21 - 46	21 - 32	34 - 78	27 - 55
Salinity psu	31.0 – 33.6	31.7 – 34.1	29 – 32.9	30.1 – 33.8

7.1.6.5 Total Phosphorus

Maximum total phosphorus concentrations were recorded for samples taken in the vicinity of the Ringsend Treatment Works. The median total phosphorus values for surface samples ranged from 64 µgP/l (D/GCB) to greater 200 µgP/l (site off Rathmines and Pembroke outfall). These values were similar to values recorded during the second and third years of the monitoring programme. Median total phosphorus values for (depth) near bottom samples ranged from 68 µgP/l (Ocean Pier) to 117 µgP/l (Matt Talbot Bridge). These values were similar to the values recorded in during the first three years of the programme. The median total phosphorus values for all fifteen sites (surface and depth) are displayed alongside the corresponding values recorded during the first two years of the programme in Figures 17 and 18 below. It should be noted that the value for the site 'off Rathmines and Pembroke outfall' may be underestimated

The yearly, winter and summer range of median TP values for surface and depth samples are tabulated alongside the corresponding values recorded for 2000/1, 2001/2

and 2002/3 in Table 12 a and b below. Total phosphorus was not determined for the Dublin Bay WQMP.

Table 12a – Comparison of Median TP Values – Liffey Estuary (Surface Samples) 2000/1, 2001/2, 2002/3 & 2003/4.

		Range of Median TP values (µgP/l)			
		Surface Samples			
	2000/2001	2001/2002	2002/2003	2003/2004	
July - June TP µgP/l	86 - 379	63 - 198	66 - 219	64 - >200	
Salinity psu	7.6 – 32.4	11.4 – 32.5	11.4 – 32.7	7.6 – 32.8	
Summer TP µgP/l	72 - >400	63 - 314	80 - 172	61 - >200	
Salinity psu	12.2 – 33.1	13.2 – 33.2	15.7 – 33.1	9.1 – 33.1	
Winter TP µgP/l	97 - 385	40 - 193	61 - >200	61 - >200	
Salinity psu	0.4 – 31.9	10.3 – 32.7	1.1 – 31.9	4.2 – 31.7	

Table 12b – Comparison of Median TP Values – Liffey Estuary (Depth Samples) 2000/1, 2001/2, 2002/3 & 2003/4

		Range of Median TP values (µgP/l)			
		Depth Samples			
	2000/2001	2001/2002	2002/2003	2003/2004	
July - June TP µgP/l	66 - 115	46 - 93	70 - 116	68 - 117	
Salinity psu	31.3 – 33.8	32.7 – 34.1	31.1 – 33.8	31.8 – 33.7	
Summer TP µgP/l	66 - 126	46 - 148	54 - 122	58 - 94	
Salinity psu	30.8 – 34.0	32.7 – 34.1	31.5 – 34.0	32.4 – 33.7	
Winter TP µgP/l	66 - >200	45 - 66	76 - 157	65 - 117	
Salinity psu	31.0 – 33.6	31.7 – 34.1	29 – 32.9	30.1 – 33.8	

Figure 17: Median TP Liffey Estuary (Surface Samples) - 2000/1 to 2003/4

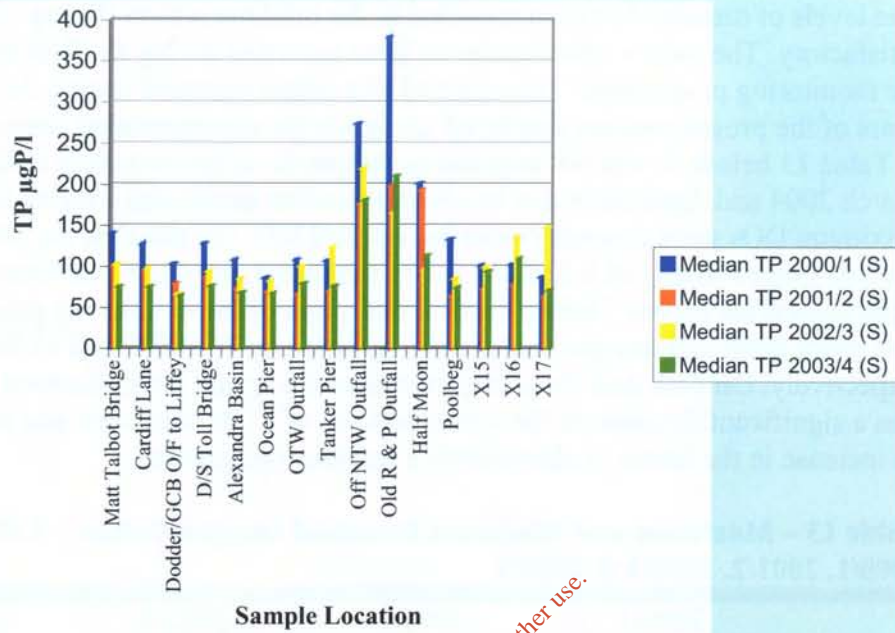
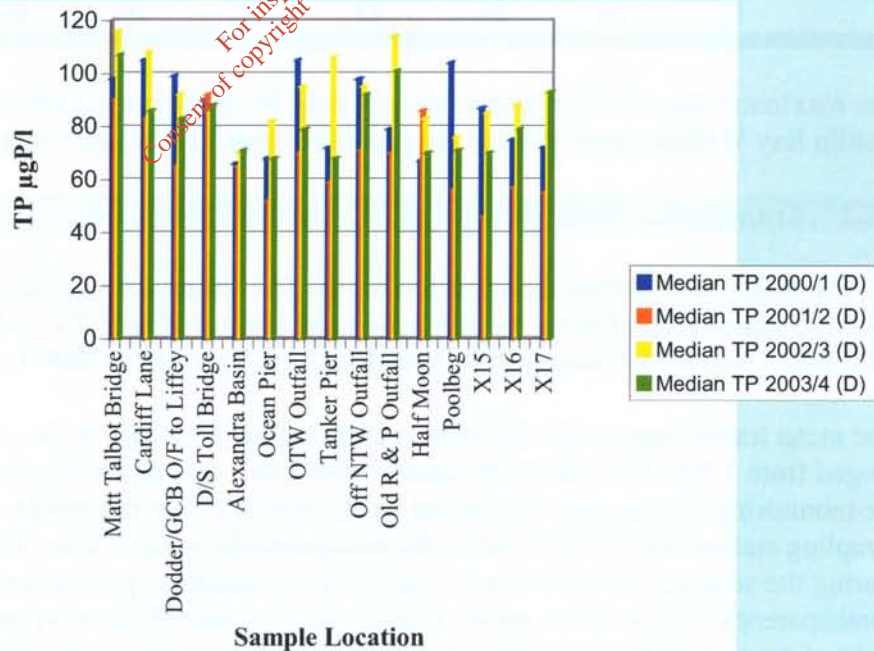


Figure 18: Median TP Liffey Estuary (Depth Samples) - 2000/1 to 2003/4



7.2 Offshore Waters

7.2.1 Dissolved Oxygen (DO)

The levels of dissolved oxygen recorded in the offshore waters during 2003/4 were satisfactory. The values were similar to those recorded during the first three years of the monitoring programme. The range of DO values recorded during the first four years of the programme are displayed alongside the corresponding sampling stations in Table 13 below. It was not possible to sample the offshore waters in Oct 2003, March 2004 and April 2004 due to adverse weather conditions. During 2003/4 the maximum DOs were generally recorded on 03/07/03. On this date the DOs at all stations ranged from 106.6.1 to 113.2.7 % saturation and there was some evidence of a phytoplankton bloom. During the first two years of the monitoring programme maximum dissolved oxygen values were recorded on 26/04/01 and 15/05/02 respectively. On both date there was evidence of a spring phytoplankton bloom. There was a significant decrease in the concentrations of TON, ammonia and phosphate and an increase in the levels of chlorophyll a and phaeopigments.

Table 13 – Maximum and Minimum Dissolved Oxygen Values - Liffey Estuary 2000/1, 2001/2, 2002/3 & 2003/4

	2000/1		2001/2		2002/3		2003/4	
	min	max	min	max	min	max	min	max
DO %								
Saturation	84.9	122.8	91.4	117.0	88.3	112.7	89.6	115.2
Location	Pt. 6	Pt. 3	Pt. 2	Pt. 4	Pt. 2	Pt. 12	Pt 27	Pt 5
Date	21/02/ 01	26/04/ 01	11/10/ 01	15/05/ 02	18/07/ 02	09/04/ 03	07/08/ 03	12/05/ 04

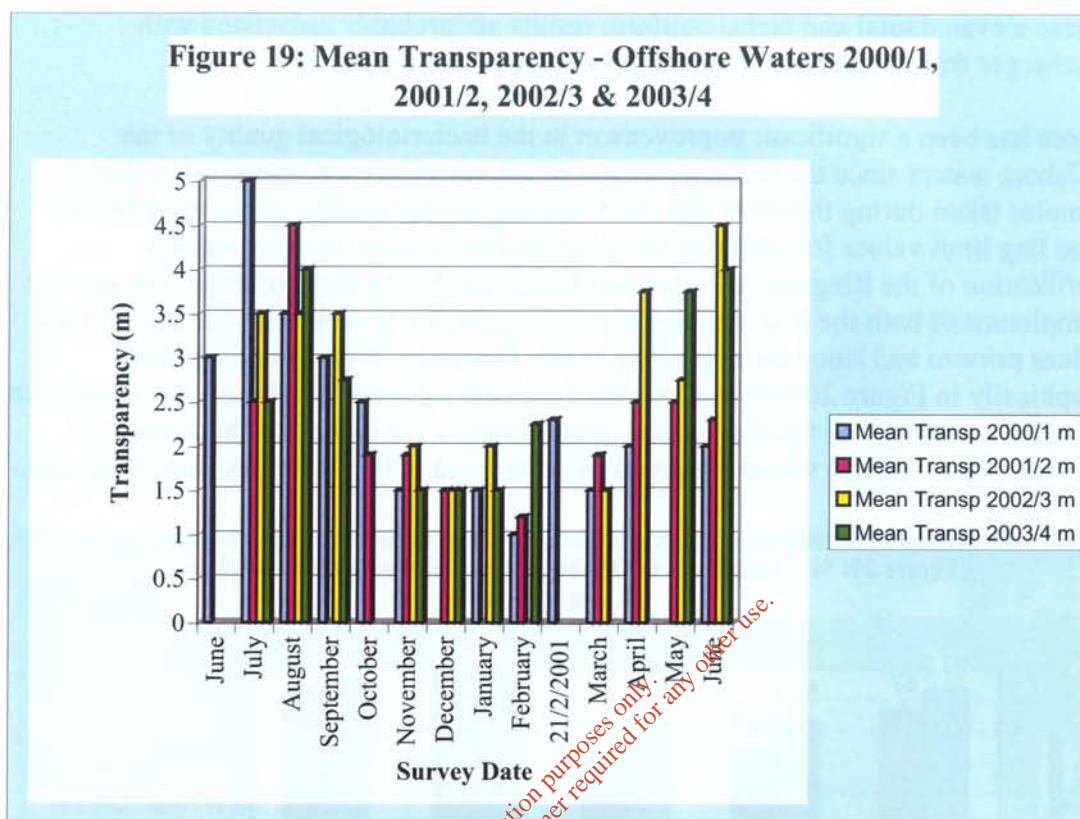
The maximum dissolved oxygen value recorded for the surveys carried out for the Dublin Bay WQMP (June 1986 to August 1988) was 117 % saturation.

7.2.2 Transparency/pH

All pH values were within the expected limits. The values for samples taken from the offshore waters ranged from 7.9 to 8.2 pH units compared with 7.9 to 8.2 pH units (2002/3), 7.8 to 8.3 pH units (2001/2) and 7.8 to 8.5 pH units (2000/1).

The mean transparencies for the individual sampling locations in the offshore waters ranged from 2.5 to 3.25 metres compared with 2 to 3 metres for the first three years of the monitoring programme. Maximum transparencies were recorded in the majority of sampling stations on 07/08/03 when the transparencies ranged from 3 to 5.25 metres. During the second, third and fourth years of the monitoring programme no station had a transparency of less than 1 metre. During the first year of the monitoring programme eight of the twenty-four sampling stations had transparencies of less than 1 metre on 08/02/01. There are indications that there has been an improvement in the offshore water clarity subsequent to the commencement of the secondary treatment at Ringsend. It should be noted that transparency is a very crude measure of water clarity as factors such as wind, wave action and sunlight could affect the measurement. The survey mean values recorded for the DBWQMP varied from 2.1 to 4.2 m (inner bay)

and from 1.9 to 5.9 m (outer bay). The mean transparencies recorded for the individual surveys during 2003/4 are displayed alongside the corresponding values for the first two years of the monitoring programme in Figure 19 below.



7.2.3 Biochemical Oxygen Demand (BOD)

As in previous years the BOD results were generally satisfactory. The majority of results for all sampling stations were less than or equal to 2mgO₂/l. A number of samples had BOD results of 3 or 4 mgO₂/l. Two samples had BOD values of 6 and the sample taken from Point 17 on 03/07/03 had a BOD value greater than 6. This sample was taken at low water however the nutrient and bacteriological results were not indicative of sewage pollution.

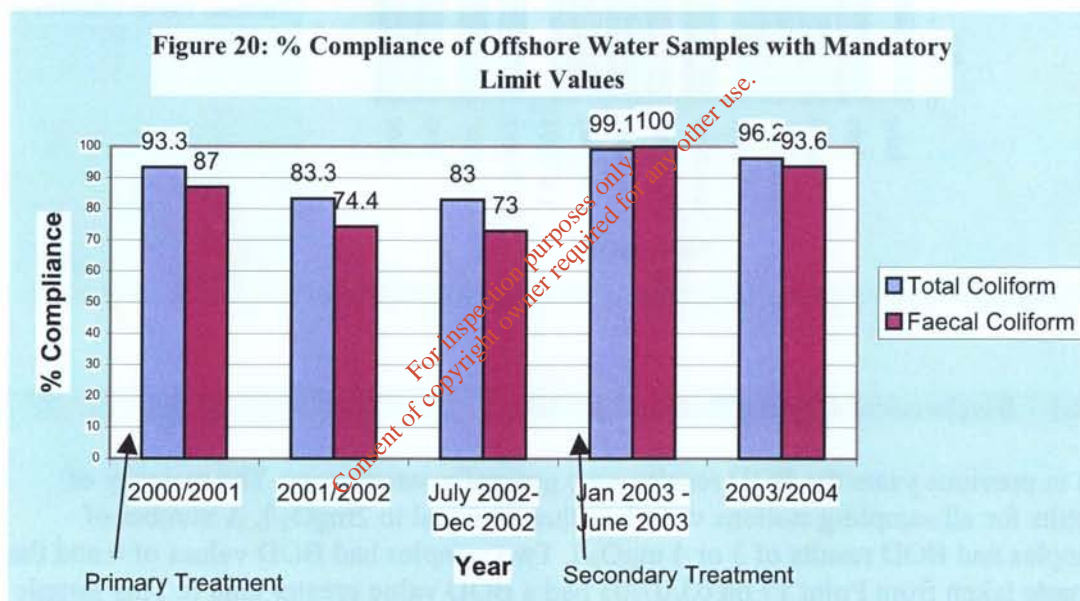
7.2.4 Total and Faecal Coliforms

During the fourth year of the monitoring programme a total of nine surveys of the offshore waters were carried out. It was not possible to sample the offshore waters in October 2003, March 2004 and April 2004 and only a number of stations were sampled on 28/01/04 due to adverse weather conditions

The total and faecal coliform results for all samples taken on 03/07/03, 07/08/03 and 30/06/04 (i.e. during the bathing season) complied with the blue flag limit values. The treatment process at Ringsend involves uv sterilisation of the effluent during the bathing season. Outside of the bathing season the total coliform results for 7 out of 118 samples (5.9%) exceeded the mandatory limit value of 10,000 cfu/100ml. All seven results were greater than 20,000cfu/100ml and five of the samples were taken

on 12/05/04 and the remaining two samples were taken on 12/11/04. Twelve samples out of 119 (10%) exceeded the mandatory limit value for faecal coliforms when sampling was carried out outside of the bathing season. Two of these twelve samples were taken on 12/11/03 and had faecal coliform counts in excess of 20,000cfu/100ml. These elevated total and faecal coliform results are probably associated with discharges from Ringsend. The discharges ceased in May 2004.

There has been a significant improvement in the bacteriological quality of the Offshore waters since the commencement of the secondary treatment. All of the samples taken during the 2003 and 2004 bathing season months complied with the blue flag limit values for total and faecal coliforms. It must be noted that uv sterilisation of the Ringsend effluent was occurring during these months. The percent compliance of both the total and faecal coliform results with the EU mandatory limit values prior to and since the upgrading of the Treatment Works are displayed graphically in Figure 20 below. Outside of the bathing season, although there has been an improvement in the bacteriological quality there are a number of high total and faecal coliform results which are probably associated with discharges from Ringsend.



7.2.5 Chlorophyll a and Phaeopigments

The maximum values for chlorophyll a and phaeopigments were recorded for samples taken on 03/07/03 when the mean chlorophyll a and phaeopigment concentrations for all locations were 3.9 and 4.8 mg/m³ respectively compared with 2.9 and 1.2 mg/m³ chlorophyll a and phaeopigment respectively on 17/07/02. The highest chlorophyll a values recorded during the fourth year of the programme were 6.4 and 6.1 (Pts 7 & 3). These values were not as high as those recorded on 15/05/02 when chlorophyll a values as high as 7.5 and 7.4 mg/m³ were recorded for samples taken from Points 18 and 23 respectively. It was not possible to sample in March or April 2004 and it is possible that the spring bloom was missed.

7.2.6 Nutrients

7.2.6.1 Total Oxidised Nitrogen TON (Nitrate and Nitrite)

During the fourth year of the monitoring programme the maximum TON value of 391 $\mu\text{gN/l}$ was recorded for a sample taken from Point 1 near the Liffey Estuary on 12/02/04 when the salinity and temperature of the sample were 31.1 psu and 7.4°C respectively. This TON value was higher than the 2002/3 maximum value of 333 $\mu\text{gN/l}$ (Pt 1 on 13/11/02, salinity 30.2psu & temperature 10.4°C). With the exception of the survey on 18/01/01 which was carried out on an ebb tide and in very cold weather (water temperature was 5.8°C), the highest levels of TON were recorded during January and February 2004.

It was not possible to survey the offshore waters in October 2003, March and April 2004 and only eight stations were sampled in January due to adverse weather conditions. As in 2000/2001, 2001/2 and 2002/3 there was a marked seasonal variation in the values observed during winter and summer months. During 2002/3 mean TON values for the individual surveys ranged from 14 $\mu\text{gN/l}$ (03/07/03) to 249 $\mu\text{gN/l}$ (12/02/04). During the summer months of first two years of the monitoring programme the majority of TON results were less than 10 $\mu\text{gN/l}$. Since the secondary treatment commenced at Ringsend there has been a slight increase in the TON values during the summer months. The range of mean TON values recorded during the first four years of the programme are displayed in Table 14 and Figure 22 below. Further surveys are required in order to assess the impact of upgrading the Ringsend Sewage Treatment Works on the levels of nutrients in the Offshore waters.

The seasonal cycle observed during the four years of the programme to date is typical of northern temperate shelf seas. In late autumn and winter when light is limiting and biological uptake of nutrients is low the concentration of nutrients in water increase, primarily due to the *in situ* breakdown of organic matter. In spring and summer the nutrient concentrations in the euphotic zone become depleted as phytoplankton growth resumes. For purposes of calculating the survey mean TON result, values less than 10 $\mu\text{gN/l}$ were taken to be 9 $\mu\text{gN/l}$.

The nutrient versus salinity plots for data recorded during the winter months of 2001/2, 2002/3 and 2003/4 are displayed in Figure 21. The correlation coefficient for the TON versus salinity winter 2002/3 plot was only 0.46 compared with the R^2 valued of 0.883 recorded for the winter 2001/2 data. The correlation coefficients for the November/December data and the January/February data were 0.6097 and 0.882 respectively. It is not clear as to why the linearity changed during the winter of 2002/3. Nitrification of the Ringsend effluent was starting to occur and this may be the main factor, however, further winter data subsequent to the secondary treatment process is required. A linear correlation indicates that the dominant process is dilution. The OSPAR Commission QSR 2000, Region III, 2000 report showed a close relationship between salinity and winter nitrate concentration.

Figure 21 – Nutrient versus Salinity Plots for data recorded during the winter months in the Offshore Waters

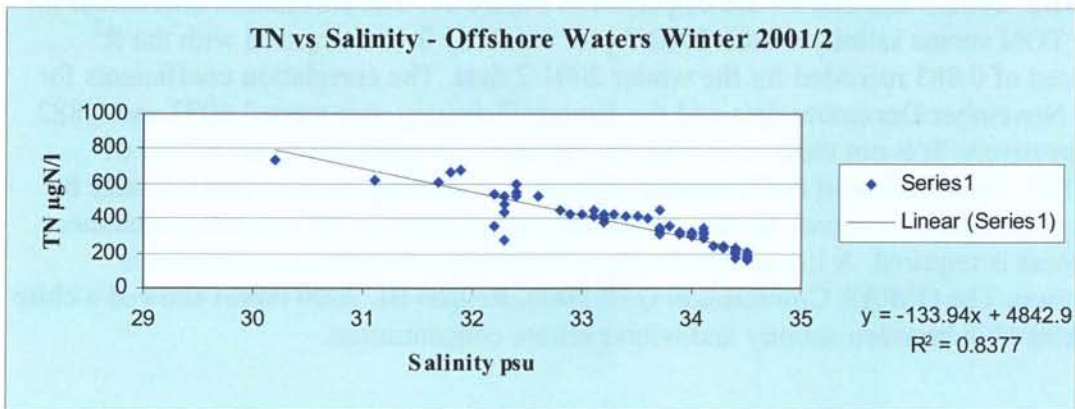
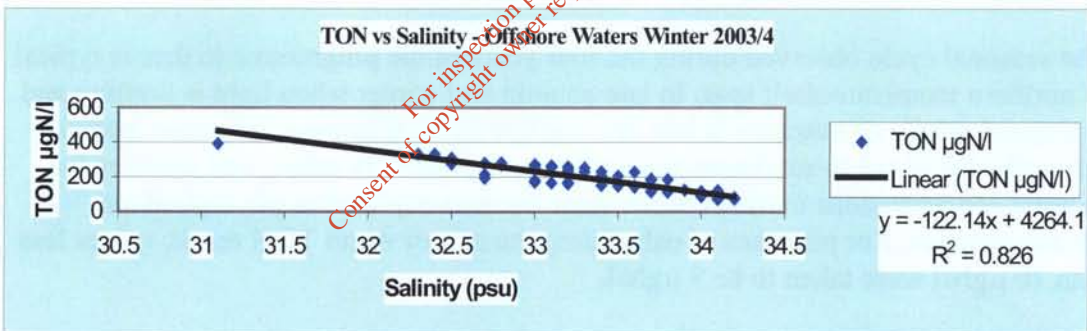
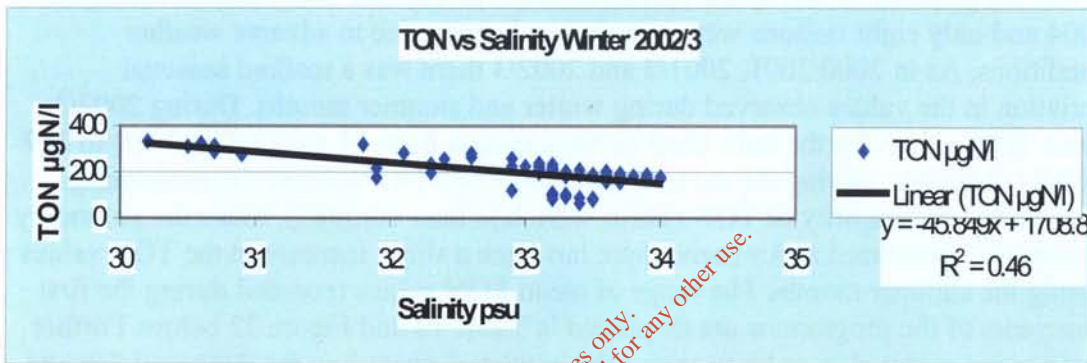
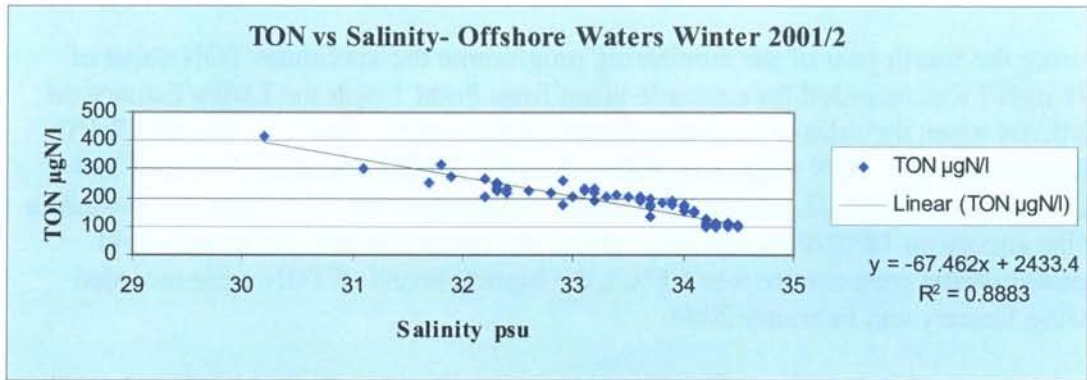


Figure 21 cont'd– Nutrient versus Salinity Plots for data recorded during the winter months in the Offshore Waters

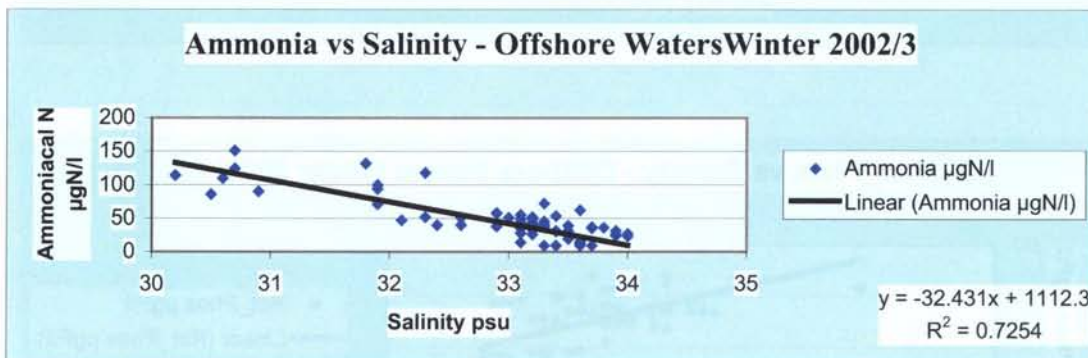
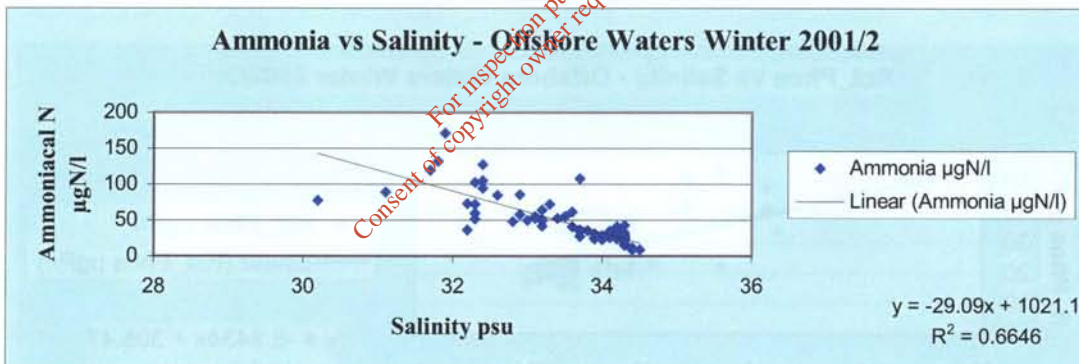
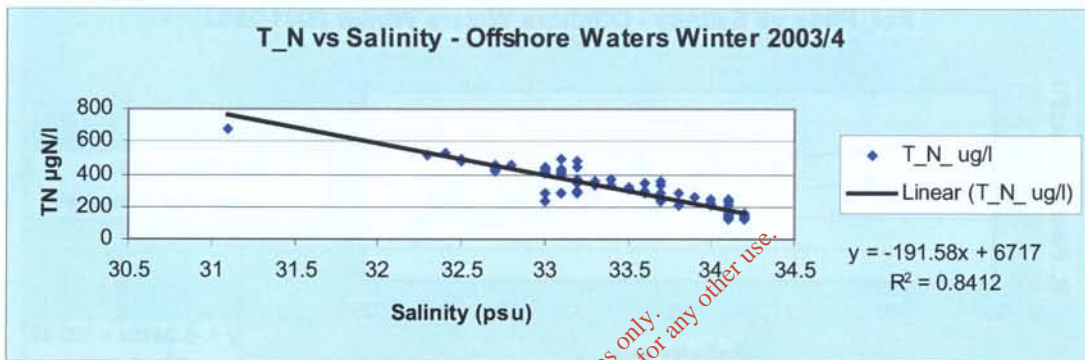
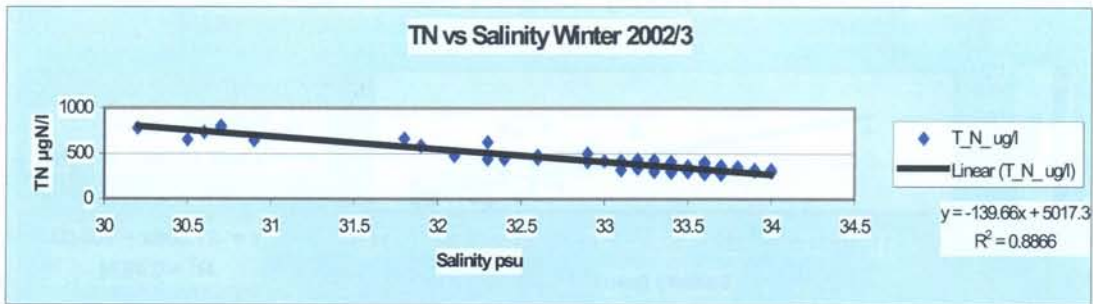


Figure 21 cont'd – Nutrient versus Salinity Plots for data recorded during the winter months in the Offshore Waters

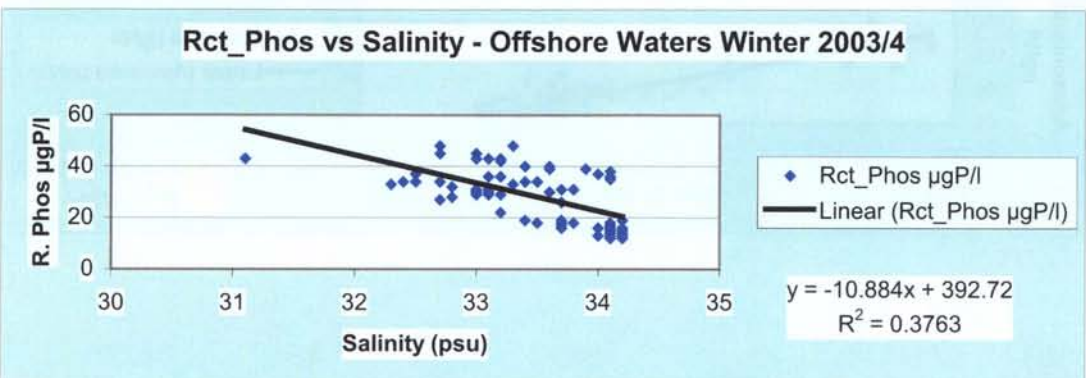
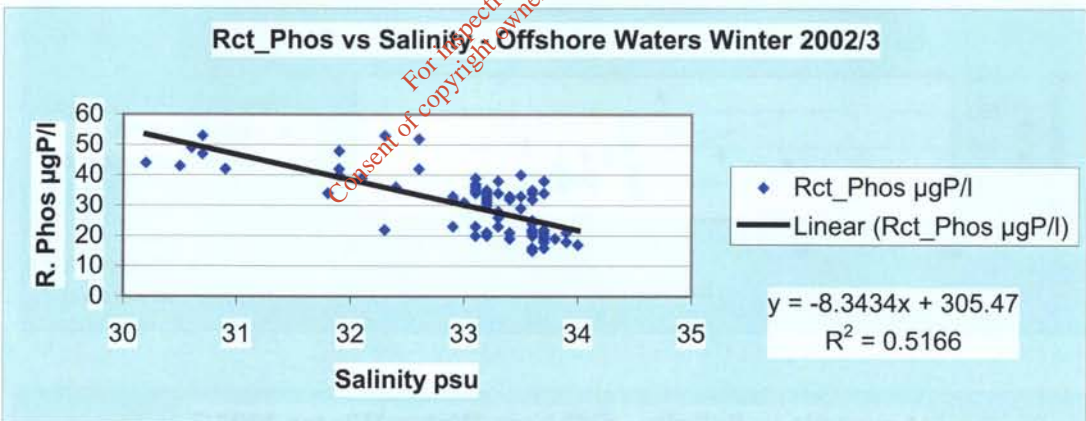
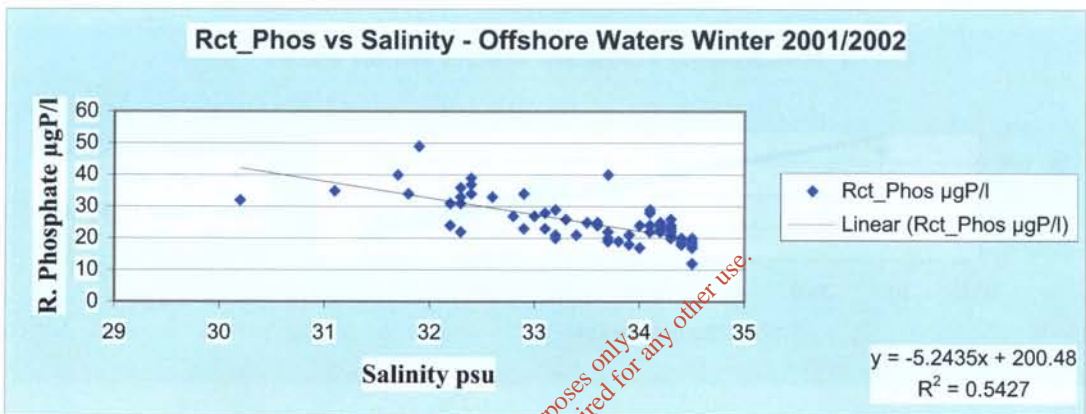
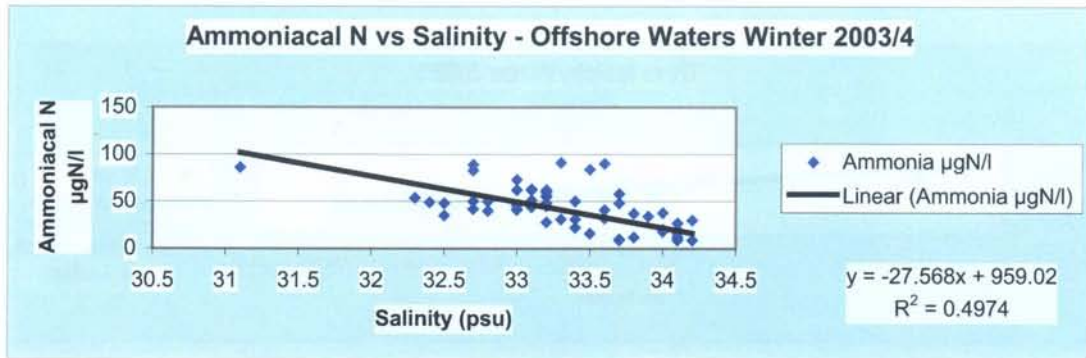
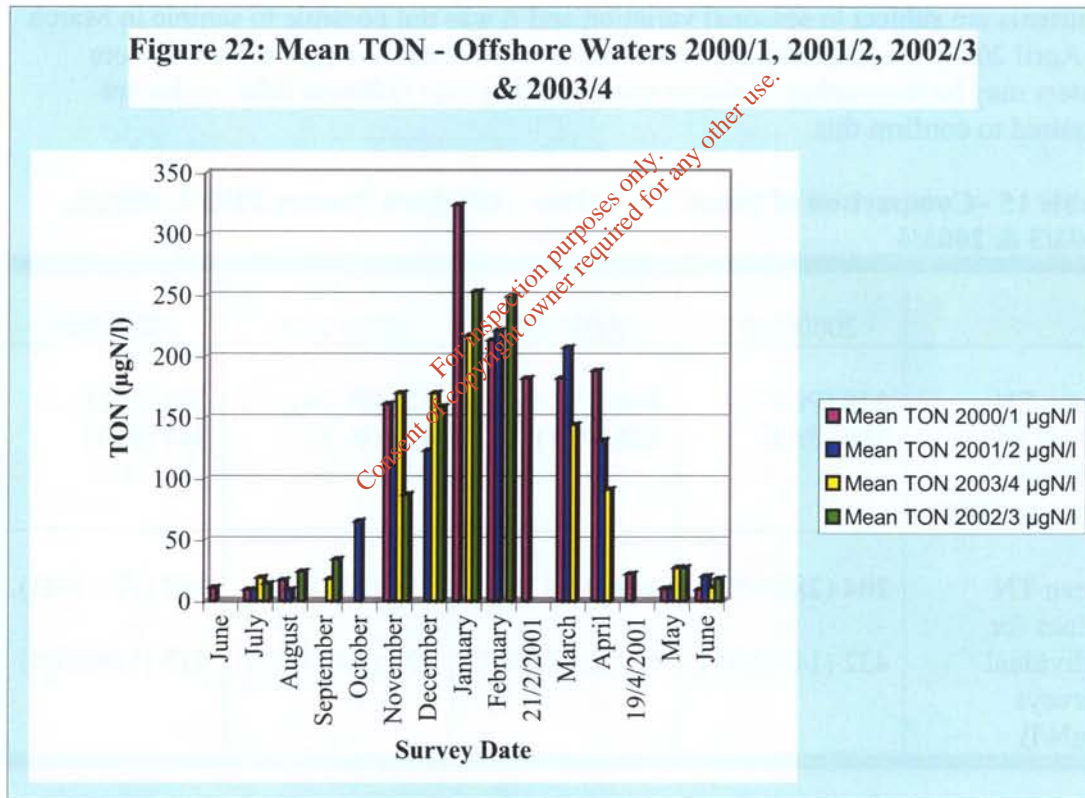


Table 14 –Comparison of Mean TON Values – Offshore Waters 2000/1, 2001/2, 2002/3 & 2003/4

	2000/2001	2001/2002	2002/2003	2003/2004
Mean TON values for Individual Sites ($\mu\text{gN/l}$)	97 (Pt 21) – 173 (Pt 2)	55 (Pt 5) – 142 (Pt 2)	67 (Pt 24) – 119 (Pt 1)	50 (Pt 27) – 128 (Pt 1)
Mean TON values for Individual Surveys ($\mu\text{gN/l}$)	<10 (27/07/00, 06/06/01) – 324 (18/01/01)	<10 (25/07/01, 02/08/01 & 15/05/02) – 221 (21/02/02)	11 (22/08/02 & 25/06/03) – 217 (23/01/03)	14 (03/07/03) – 249 (12/02/04)

Figure 22: Mean TON - Offshore Waters 2000/1, 2001/2, 2002/3 & 2003/4



The survey mean concentrations for the Dublin Bay WQMP ranged from 15 to 353 $\mu\text{gN/l}$.

7.2.6.2 Total Nitrogen (TN)

Since the commencement of the secondary treatment process at Ringsend there is some evidence that the total nitrogen levels in the offshore waters are decreasing during the summer months, whereas, the TN values recorded during the winter months were similar to values recorded prior to the upgrading of the Treatment Works. There were a number of discharges from Ringsend into the Liffey estuary prior to or around the time the surveys were carried out and these discharges may have given rise to elevated levels of total nitrogen in the offshore waters. The discharges discontinued in May 2004.

During the fourth year of the monitoring programme the mean total nitrogen values for the individual sites ranged from 203 (Point 23) to 347 $\mu\text{gP/l}$ (Point 1). These values were lower than values recorded in 2000/1, 2001/2 and 2002/3. The individual survey means ranged from 167 $\mu\text{gN/l}$ on 12/01/03 to 413 $\mu\text{gN/l}$ on 12/02/04. These values are displayed alongside the corresponding mean values for 2000/2001, 2001/2 and 2002/3 in Figure 23 below. The range of mean TN values recorded during 2002/3 are tabulated along side the values for 2000/1 and 2001/2 in Table 15 below. Nutrients are subject to seasonal variation and it was not possible to sample in March or April 2004. The indications are that the levels of total nitrogen in the offshore waters may be decreasing, however more surveys over different tidal cycles are required to confirm this.

Table 15 – Comparison of Mean TN Values – Offshore Waters 2000/1, 2001/2, 2002/3 & 2003/4

	2000/2001	2001/2002	2002/2003	2003/2004
Mean TN values for Individual Sites ($\mu\text{gN/l}$)	248 (Pt 25) – 390 (Pt 2)	224 (Pt 26) – 428 (Pt 1)	225 (Pt 24) – 403 (Pt 1)	203 (Pt23) – 347 (Pt 1)
Mean TN values for Individual Surveys ($\mu\text{gN/l}$)	204 (28/06/00) – 432 (14/03/01)	249 (11/12/01) – 457 (21/02/02)	134 (25/06/03) – 492 (13/11/02)	167 (12/11/03) – 413 (12/02/04)

If the dissolved inorganic nutrients i.e. ammonia, nitrate and nitrite are subtracted from the total nitrogen, the result is the particulate plus dissolved organic nitrogen (i.e. $\text{TN} - \text{DIN} = \text{particulate N} + \text{dissolved organic nitrogen}$). The mean particulate plus dissolved organic nitrogen values for the individual surveys are displayed in Figure 24. There has been a decrease in the particulate plus dissolved organic nitrogen levels since the upgrading of the Ringsend Treatment Works.

Figure 23: Mean TN - Offshore Waters 2000/1, 2001/2, 2002/3 & 2003/4

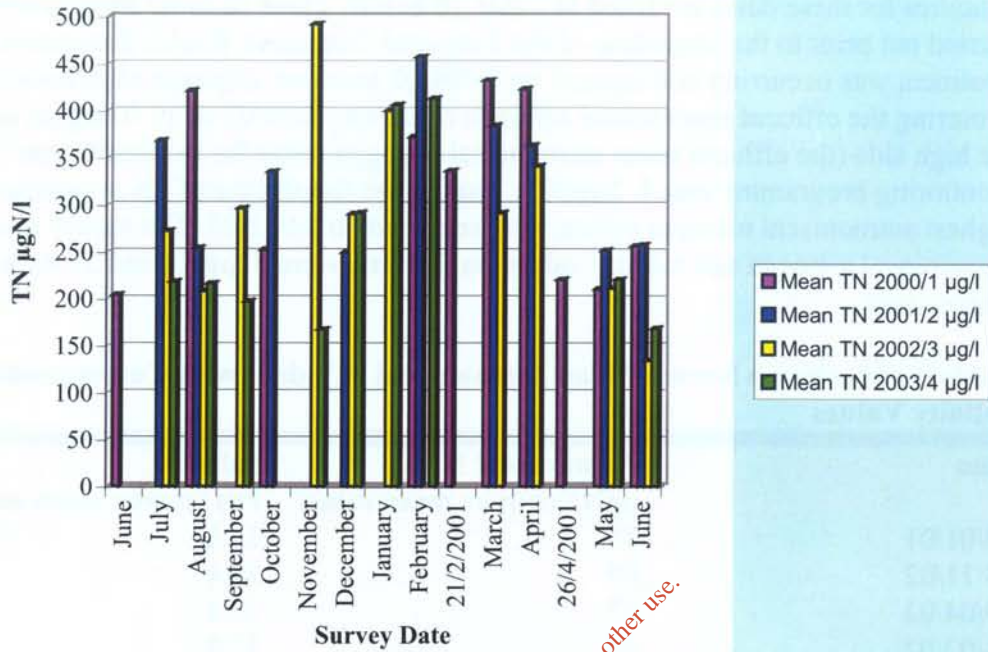
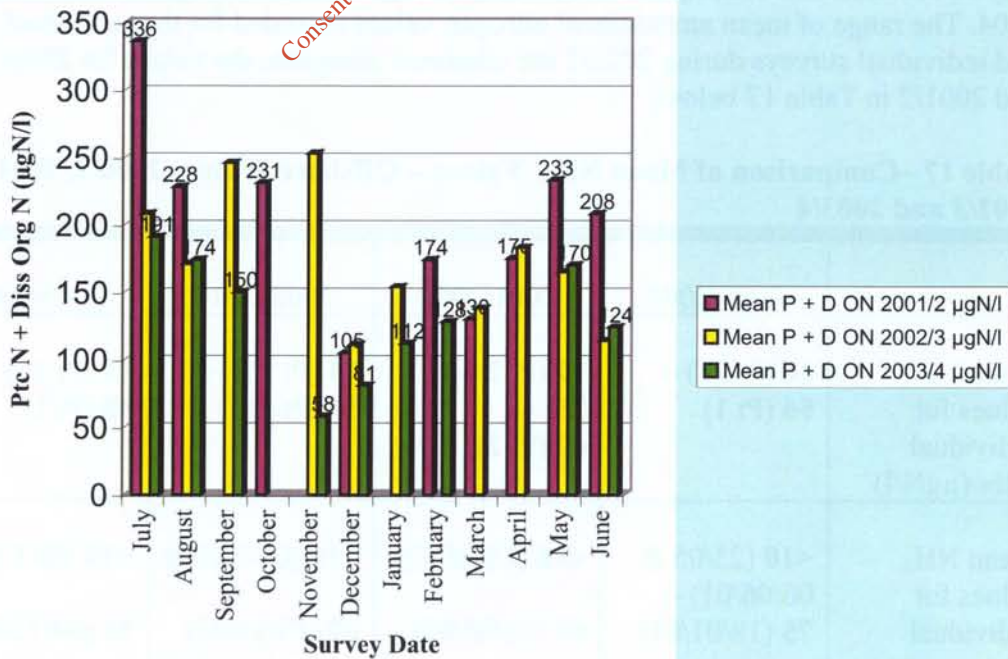


Figure 24: Mean Particulate plus Dissolved Organic Nitrogen - Offshore Waters 2001/2, 2002/3 & 2003/4



7.2.6.3 Ammoniacal Nitrogen

To date the highest ammoniacal nitrogen values have been recorded on 18/01/01, 13/11/02, 09/04/03 and 21/02/02. The survey mean ammoniacal nitrogen and salinities for these dates are listed in Table 16 below. Three of these surveys were carried out prior to the upgrading of the Ringsend Treatment Works. Secondary treatment was occurring at Ringsend on 09/04/03 however although nitrification was occurring the effluent ammoniacal nitrogen result on 09/04/03 of 11.07mgN/l was on the high side (the effluent mean ammoniacal nitrogen result for the fourth year of the monitoring programme was 4.2mgN/l). During the fourth year of the programme the highest ammoniacal nitrogen values were recorded on 04/12/03. The survey mean ammoniacal nitrogen and salinity values on this date were 51µgN/l and 33.4psu respectively.

Table16: Maximum Survey Mean Ammoniacal N Values with Corresponding Salinity Values

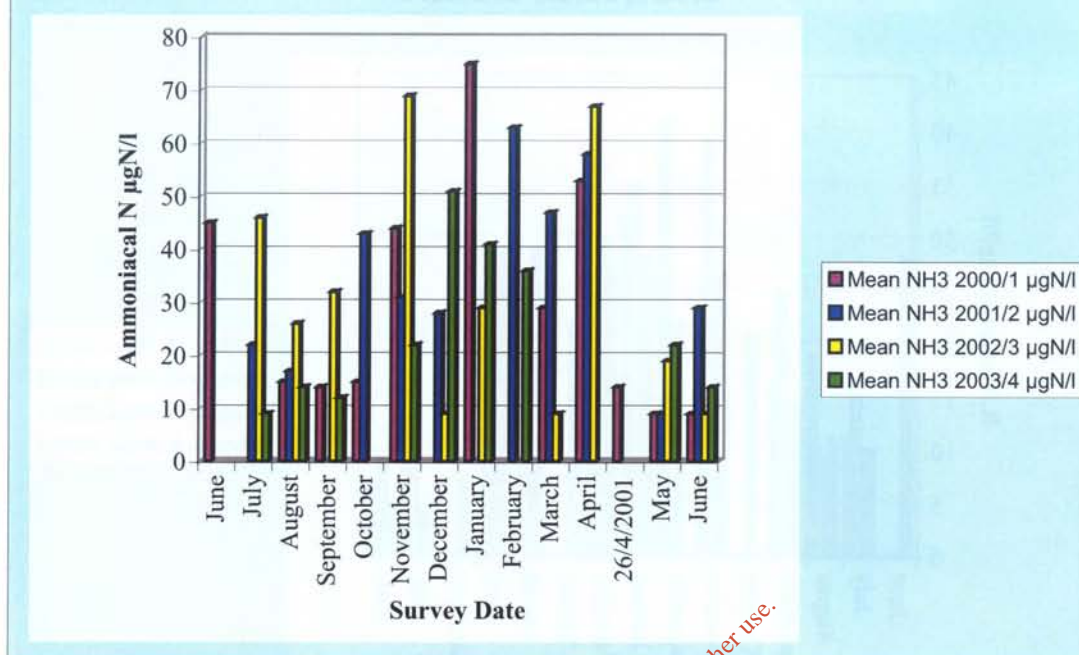
Date	Ammoniacal N µgN/l (survey mean value)	Salinity Psu (survey mean value)
18/01/01	75	33.1
13/11/02	69	32.4
09/04/03	67	33.3
21/02/02	63	32.9

During the fourth year of the programme the individual survey mean ammoniacal nitrogen values ranged from less than 10 µgN/l on 03/07/03 to 51 µgN/l on 04/12/03 (see Figure 25). The values tended to be lower than those recorded in 2000/1, 2001/2 and 2002/3. There were a number of discharges from the Ringsend Treatment Works close to the time a lot of surveys were carried out and the ammoniacal nitrogen results may be elevated as a consequence of these discharges. The discharges ceased in May 2004. The range of mean ammoniacal nitrogen values recorded for the individual sites and individual surveys during 2002/3 are tabulated alongside the values for 2000/1 and 2001/2 in Table 17 below.

Table 17 –Comparison of Mean NH₄⁺ Values – Offshore Waters 2000/1, 2001/2, 2002/3 and 2003/4

	2000/2001	2001/2002	2002/2003	2003/2004
Mean NH ₃ values for Individual Sites (µgN/l)	16 (Pt 23) – 56 (Pt 1)	17 (Pt 24 & 26) – 62 (Pt 2)	14 (Pt 25) – 58 (Pt 1)	11 (Pt 23) – 48 (Pt 1)
Mean NH ₃ values for Individual Surveys (µgN/l)	< 10 (23/05 & 06/06/01) – 75 (18/01/01)	< 10 (15/05/02) – 63 (21/02/02)	< 10 (05/12/02) – 69 (13/11/02)	< 10 (03/07/03) – 51 (04/12/03)

**Figure 25: Mean Ammoniacal Nitrogen - Offshore Waters
2000/1, 2001/2, 2002/3 & 2003/4**



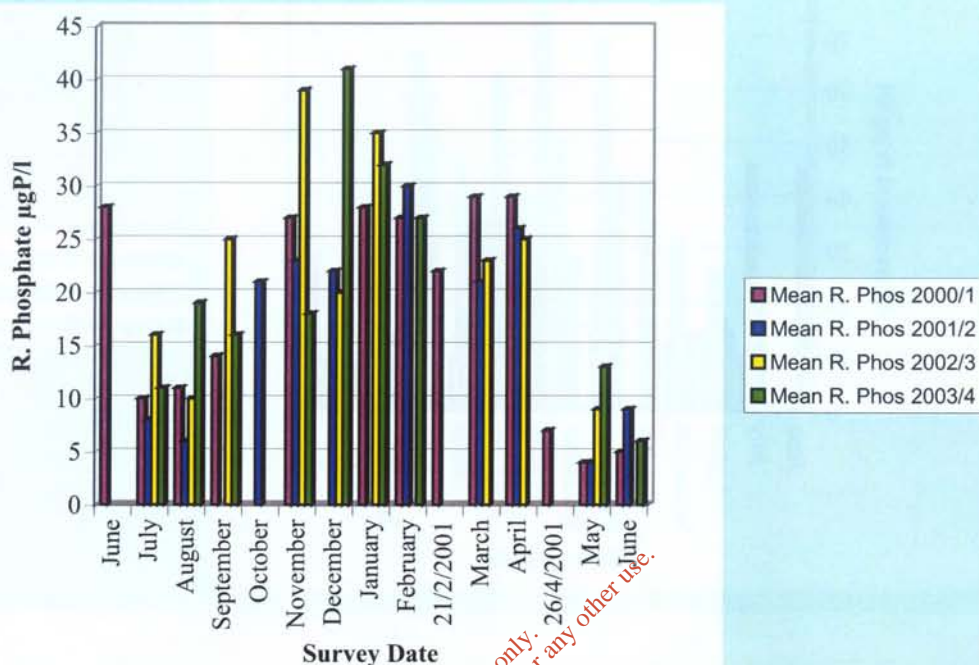
7.2.6.4 Phosphate

The mean reactive phosphate values for the individual sites ranged from 14 µgP/l (Point 27) to 24 µgP/l (Points 1 and 2). The survey mean values ranged from 6 µgP/l (30/06/04) to 41 µgP/l (04/12/03). The survey means and the means for the individual sites, which are tabulated in Table 18 below, were very similar to the values recorded in 2002/2003. The 2003/2004 individual survey mean reactive phosphate values are depicted alongside the 2000/2001, 2001/2002 and 2002/2003 mean values in Figure 26.

Table 18 – Comparison of Mean PO₄ Values – Offshore Waters 2000/1, 2001/2, 2002/3 & 2003/4

	2000/2001	2001/2002	2002/2003	2003/2004
Mean PO ₄ values for Individual Sites (µgP/l)	16 (Pts 14, 21 & 23) – 24 (Pt 1)	14 (Pts 22, 23, 24 & 26) – 23 (Pt 2)	18 (Pts 13 & 25) – 27 (Pt7)	14 (Pt 27) – 24 (Pt 1 & 2)
Mean PO ₄ values for Individual Surveys (µgP/l)	< 5 (23/05/01) – 29 (14/03/01 & 19/04/01)	< 5 (15/05/02) – 30 (21/02/02)	9 (08/05/03) – 39 (13/11/02)	6 (30/6/04) – 41 (04/12/03)

Figure 26: Mean R. Phosphate - Offshore Waters 2000/1, 2001/2, 2002/3 & 2003/4



7.2.6.5 Total Phosphorus (TP)

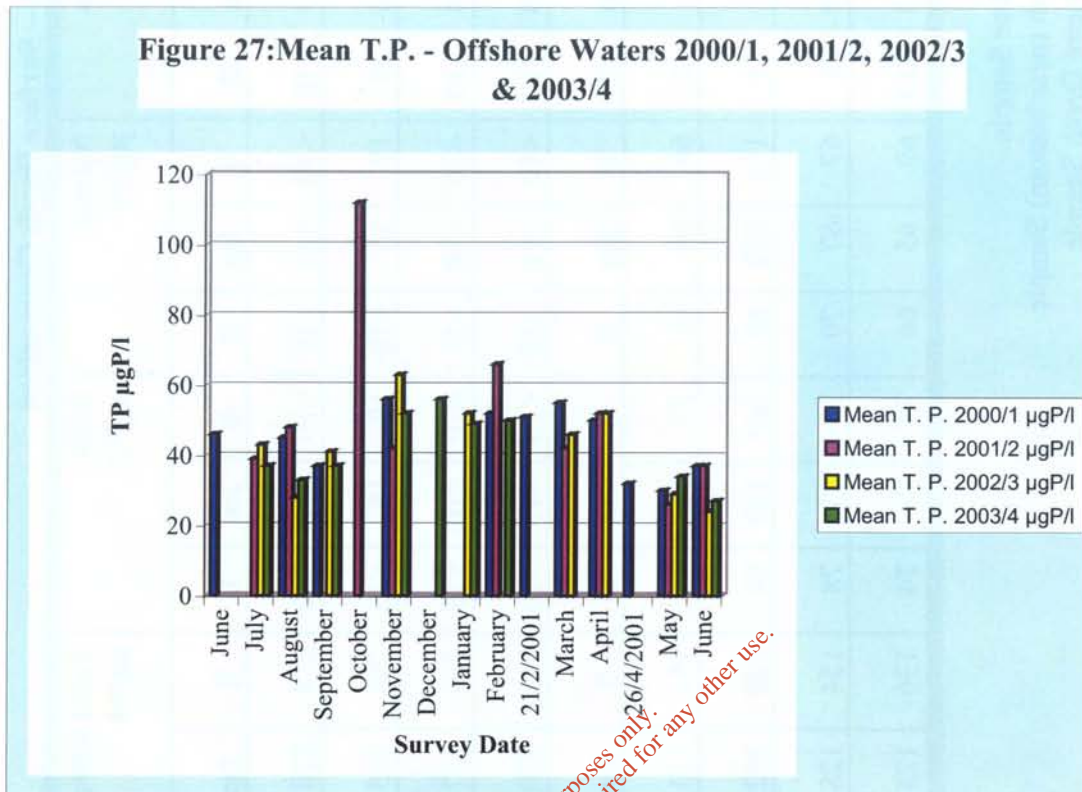
The mean total phosphorus values for the individual sites ranged from 32 (Point 25) to 53 µgP/l (Points 1 and 2). The mean values for the individual surveys ranged from 33 to 56 µgP/l on 07/08/03 and 04/12/03 respectively (see Table 19 and Figure 27) These values were similar to values recorded during the first three years of the monitoring (with the exception of the data recorded for the survey in October 2001).

Table 19 – Comparison of Mean TP Values – Offshore Waters 2000/1, 2001/2, 2002/3 & 2003/4

	2000/2001	2001/2002	2002/2003	2003/2004
Mean TP values for Individual Sites (µgP/l)	33 (Pt 23) – 54 (Pt 2 & 3)	35 (Pt 23) – 61 (Pt 2)	34 (Pt 25) – 53 (Pt 1)	32 (Pt 25) – 53 (Pt 1 & Pt 2)
Mean TP values for Individual Surveys (µgP/l)	22 (27/07/00) – 56 (23/11/01)	26 (15/05/02) – 117 (11/10/02)	24 (25/06/03) – 63 (13/11/02)	33 (07/08/03) – 56 (04/12/03)

The survey mean value on 29/04/93 (Stride Research programme) was 68 µgP/l. Total phosphorus was not measured for the Dublin Bay WQMP surveys.

Figure 27: Mean T.P. - Offshore Waters 2000/1, 2001/2, 2002/3 & 2003/4



7.2.6.6 Depth Samples

Surface samples and near bottom (depth) samples were taken from four of the sampling locations in addition to the 2m depth samples. The four sampling points chosen were Points 3 and 27 which are in the vicinity of the Liffey Estuary and Points 13 and 24 which are near Howth and Dun Laoghaire respectively. These samples were analysed for nutrients. The results for four of the surveys are listed in Table 20 below.

As in previous years surface and 2 metres depth samples taken from Points 3 and 27 tended to have higher levels of nutrients than the near bottom (depth) samples indicating that in the vicinity of the Liffey estuary the sewage layer occupies the top few metres. The dissolved inorganic nutrient results for samples taken at the locations near Howth and Dun Laoghaire were similar at all three depths indicating that the water body is well mixed.

Table 20 – Surface Depth Comparison

	Ammonia µgN/l			Nitrate µgN/l			TON µgN/l			Total Nitrogen µgN/l			R. Phosphate µgP/l			Total Phosphorus µgP/l			Ptc + Dissolved Org. Nitrogen µgN/l			Salinity		
	S	2m	D	S	2m	D	S	2m	D	S	2m	D	S	2m	D	S	2m	D	S	2m	D	S	2m	D
03/07/ 2003	S	2m	D	S	2m	D	S	2m	D	S	2m	D	S	2m	D	S	2m	D	S	2m	D	S	2m	D
Pt. 3	<10	<10	<10	<10	<10	<10	<10	<10	<10	214	228	206	9	10	8	34	44	41	196	210	188	33.6	33.7	33.9
Pt. 13	14	<10	10	19	15	<10	19	15	<10	2888	265	287	14	14	11	42	39	40	255	241	269	33.4	33.4	33.7
Pt. 24	<10	<10	<10	<10	<10	<10	<10	<10	<10	163	157	185	7	6	6	31	29	32	145	157	167	34	34	34
Pt. 27	<10	<10	<10	<10	<10	<10	<10	<10	<10	219	220	159	8	8	7	35	36	32	201	202	141	33.7	33.6	34
12/11/ 2003	S	2m	D	S	2m	D	S	2m	D	S	2m	D	S	2m	D	S	2m	D	S	2m	D	S	2m	D
Pt. 3	14	16	12	68	68	68	77	76	76	151	135	175	15	17	13	44	43	76	60	43	87	34.1	34	34.1
Pt. 13	79	84	74	151	132	88	169	149	99	320	302	288	35	34	16	73	74	86	72	69	115	33.1	33.5	34
Pt. 24	<10	<10	21	67	67	70	75	75	78	154	128	189	13	13	12	43	43	55	70	44	90	34.1	34.2	34.1
Pt. 27	13	<10	<10	69	65	66	77	73	74	136	125	140	19	12	12	44	43	74	46	43	57	34.1	34.1	34.2

S = Surface Sample

D = Depth (near bottom) Sample

2m = 2 metre Depth Sample

Table 20 cont'd - Surface Depth Comparison

	Ammonia µgN/l		Nitrate µgN/l		TON µgN/l		Total Nitrogen µgN/l		R. Phosphate µgP/l		Total Phosphorus µgP/l		Ptc + Dissolved Org. Nitrogen µgN/l		Salinity		
	S	2m	S	2m	S	2m	S	2m	S	2m	S	2m	S	2m	S	2m	
12/02/ 2004																	
Pt.3	59	22	14	348	200	177	183	357	208	183	206	177	357	208	183	206	177
Pt. 13	83	63	45	288	253	206	214	299	263	214	206	263	299	263	214	206	263
Pt. 24	11	<10	17	176	179	177	184	184	187	184	177	184	184	187	184	177	184
Pt. 27	11	10	16	178	178	178	185	185	184	187	178	185	185	184	187	178	185
12/05/ 2004																	
Pt.3	21	17	12	43	39	10	43	39	39	10	10	43	39	39	10	10	43
Pt. 13	<10	16	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Pt. 24	<10	<10	<10	<10	<10	<10	147	129	129	154	<5	18	16	21	129	111	136
Pt. 27	<10	<10	<10	<10	<10	<10	189	218	218	132	8	27	32	22	171	200	114

S = Surface Sample
D = Depth (near bottom) Sample
2m = 2 metre Depth Sample

7.3 Bathing Waters

The bathing season in Ireland is defined as extending from mid-May until the end of August. In order for bathing waters to comply with the EU Directive, 95% of at least 20 samples, taken at weekly intervals during the bathing season must not exceed 10,000 and 2,000 per 100ml total coliform and faecal coliform bacteria respectively (mandatory limits). Guideline criteria (used for blue flag awards) are stricter than this requiring 80% of samples to be less than or equal to 500 total coliforms and 100 faecal coliforms per 100 ml (see table 5). In addition to the EU Directive Ireland has it's own National Regulations S.I. No. 155 (1992) which state that 80% of samples must not exceed 5,000 and 1,000 per 100ml total and faecal coliform bacteria respectively.

During the 2004 bathing season at least twenty samples were taken from the designated bathing waters namely Seapoint, Killiney Dollymount, Merrion and Sandymount. The remaining bathing water locations (see Table 3) i.e. the non-designated bathing areas in Dublin Bay were sampled approximately weekly during the bathing season. The microbiological results for the bathing waters sampled during 2004 are summarised in Table 21 below. All non-compliances are highlighted in blue.

During the 2003 bathing season the water quality at Dollymount Middle complied with the blue flag limit values. In 2004 the total and faecal coliform results for samples taken from Dollymount Middle/Bathing Zone during the bathing season complied with the blue flag limit values. However, three of the twenty-one faecal streptococci results exceeded the blue flag limit of 100cfu/100ml. The dates and faecal streptococci results are listed below.

Date	Faecal Streptococci cfu/100ml
23/06/04	102
04/08/04	110
18/08/04	810

The samples taken on 23/06/04 and 18/08/04 were as a result of sampling immediately after heavy rain. According to the Met Office's site approximately 22.3mm and 32.8mm of rain fell on 22/06/04 and the early hours of 18/08/04 respectively. The Dollymount sample was taken at 12:30 on 18/08/04 and the rain stopped at about 12:00. The faecal streptococci result of 110cfu/100ml recorded on 04/08/04 was not due to rain/runoff and may be associated with faecal matter from dogs or birds. This requires further investigation. The water quality at Dollymount North and Dollymount South complied with the blue flag limit values. Both locations were not sampled on 23/06/04 or 18/08/04.

Water quality at Blackrock, Seapoint and Killiney complied with the blue flag limit values. Seapoint and Killiney were sampled on 23/06/04 and the faecal streptococci counts at both locations exceeded 100cfu/100ml. Samples were not taken from either location on 18/08/04. Blackrock was not sampled on either 23/06/04 or 18/08/04.

There has been a significant improvement in the bacteriological quality of samples taken from the Bull Wall and Dollymount South since the commencement of the

secondary treatment process at Ringsend Treatment Works. This upgrading involves the provision of uv sterilisation of the effluent during the bathing season. The percent compliance of bacteriological results with mandatory, national and blue flag limits for samples taken from Poolbeg, the Bull Wall and Dollymount South during 2000, 2001, 2002, 2003 and 2004 are displayed in Figures 28 to 30. During 2003 only one of the eighteen samples taken from the Bull Wall failed to comply with the mandatory and national limits for total coliforms, faecal coliforms and faecal streptococci. This one sample was taken on 01/07/03 after very heavy rain on 30/06/04. During the 2004 bathing season three of the eighteen samples taken from off the Bull Wall breached the mandatory limit for total coliforms. Two of these exceedances were as a result of sampling immediately after heavy rain i.e. on 23/06/04 and 18/08/04 (see above). The third sample that failed to comply with the mandatory limit values was taken on 29/06/04. This sample was not taken after heavy rain and the cause of the pollution has not been identified.

The Poolbeg sampling station is not a bathing area. It is situated downstream of the effluent discharge point from Ringsend. Prior to the upgrading of the Ringsend Sewage Treatment Works, all of the total and faecal coliform results for samples taken from this location exceeded the mandatory limits during the 2000, 2001 and 2002 bathing seasons. Of the sixteen samples taken during the 2003 bathing season only four exceeded the mandatory limits for total and faecal coliforms. The high total and faecal coliform and faecal streptococci values recorded on 02/07/03 were probably related to the very heavy rain on 30/06/03. The three other occasions when the mandatory limits were breached related to discharges from Ringsend. During 2004 seven of the thirteen total coliform and eight of the thirteen faecal coliform results exceeded the mandatory limit values. The water quality at this site was not as good as the quality in 2003 even though the discharges from Ringsend had discontinued in May 2004.

Water quality at Sandymount and Merrion complied with the mandatory limit values during the 2004 bathing season but not the National Limit Value for faecal streptococci or the blue flag limits for total coliform, faecal coliform and faecal streptococci. The bacteriological results for samples taken from Sandymount and Merrion during the 2004 bathing season are listed in Tables 22 and 23 below. The samples taken on 23/06/04 and 24/08/04 were taken after heavy rain. There was approx. 22.3mm and 18mm of rain on 22/06/04 and 23/08/04 respectively. There are a number of potential sources of pollution in the Sandymount/Merrion area including the Saint Alban's overflow pipe which has been linked to the Drainage telemetry and discharged onto the beach at Sandymount on 23/06/04. The Elm Park Stream flows onto the beach at Merrion close to the sampling station. A gauge which is linked to the telemetry was installed in an overflow pipe upstream of the beach in July 2004 to record storm or spill events into the stream. The gullies on the road in the Sandymount area discharge onto the beach after rain. There is also a problem with faecal matter from dogs on the beach at Sandymount. Investigations are still underway to try to identify and eliminate sources of pollution in the Sandymount/Merrion area.

Table 22 - Bacteriological Results for samples taken from Sandymount during the 2004 Bathing Season

Date	Sample		Salinity cfu100m	T_Coli cfu100m	F_Coli cfu100m
	No	F_Strep cfu100ml			
18/5/2004	460356	5	34.7	< 9	18
19/5/2004	460617	2	34.7	< 9	< 9
25/5/2004	461231	8	34.5	200	< 9
26/5/2004	461360	<1	34.9	< 9	< 9
01/6/2004	462134	1230	32	800	600
02/6/2004	462266	25	34.2	27	9
08/6/2004	462559	1	34	9	9
09/6/2004	462735	1	34.3	< 9	< 9
15/6/2004	463434	<1	34.8	< 9	< 9
16/6/2004	463638	2	35.2	< 9	< 9
22/6/2004	464322	63	34.4	182	100
23/6/2004	464654	1040	28.1	11200	3800
29/6/2004	465044	43	33	440	240
30/6/2004	465383	200	33.3	420	73
06/7/2004	465819	9	31.9	9	9
13/7/2004	466624	4	33.3	18	< 9
20/7/2004	467393	108	33.4	32	91
27/7/2004	468075	10	34	63	36
03/8/2004	468563	380	34	64	36
10/8/2004	469160	11	33.5	27	18
17/8/2004	469981	66	32.9	280	200
24/8/2004	470641	45	30.5	720	145

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Table 23 - Bacteriological Results for samples taken from Merrion during the 2004 Bathing Season

Date	Sample No	F_Strep cfu100ml	Salinity cfu100m	T_Coli cfu100m	F_Coli cfu100m
18/5/2004	460357	20	33.8	< 9	< 9
19/5/2004	460618	2	33.9	< 9	< 9
25/5/2004	461232	5	31.6	145	< 9
26/5/2004	461361	1	34.3	82	< 9
01/6/2004	462135	140	32.8	450	280
02/6/2004	462267	14	33.4	9	< 9
08/6/2004	462560	1	33.8	< 9	< 9
09/6/2004	462736	4	34.6	< 9	< 9
15/6/2004	463435	2	34.7	< 9	< 9
16/6/2004	463639	1	34.5	< 9	< 9
22/6/2004	464323	33	33.3	400	290
23/6/2004	464655	480	30	8200	1091
29/6/2004	465045	38	32.5	420	91
30/6/2004	465384	68	33.6	1565	73
06/7/2004	465820	1	33.6	< 9	< 9
13/7/2004	466625	2	33.9	9	< 9
20/7/2004	467394	106	33.3	318	136
27/7/2004	468076	27	34.1	109	< 9
03/8/2004	468564	320	34.1	227	118
10/8/2004	469161	37	33.3	100	18
17/8/2004	469982	21	32.9	300	55
24/8/2004	470642	220	31.9	3700	470

Twelve samples were taken from the Half Moon bathing station. The bacteriological results were generally satisfactory. The faecal streptococci and faecal coliform results complied with the blue flag limit values. Three of the total coliform results (25%) exceeded the blue flag limit value. Samples were not taken from the Half Moon on the 23/06/04 or 18/08/04.

In conclusion, there has been an improvement in the bacteriological quality of the water at all locations in Dollymount since the upgrading of the Ringsend Treatment Works. However, there are problems with the water quality immediately after heavy rain due to combined sewer overflows discharging into the river Liffey, runoff from the land in addition to overflows from Ringsend. The water quality at Half Moon and Blackrock, Seapoint and Killiney is satisfactory although again there may be problems after heavy rain. Merrion and Sandymount require further investigation due to the nature of the catchment.

Table 21 – Summary of Microbiological Results for Bathing Waters Sampled during Year 2004 Bathing Season

Beach	Total Coliforms All counts per 100 ml						Faecal Coliforms All counts per 100 ml						Faecal Streptococci All counts per 100 ml					
	No. Of Samp.	No. > 10000 cfu	% Comp	No. > 5000 cfu	% Comp	No. > 500 cfu	No. of samp	No. > 2000 cfu	% Comp	No. > 1000 cfu	% Comp	No. > 100 cfu	% Comp	No. of sample	No. > 300 cfu	% Comp	No. > 100 cfu	% Comp
DN	10	0	100	0	100	0	10	0	100	0	100	2	80	10	0	100	0	100
DM	21	0	100	0	100	3	21	0	100	1	95	3	86	21	2	90	3	86
DM BZ	21	0	100	0	100	1	21	0	100	1	95	2	90	21	1	95	3	86
DS	13	0	100	1	92	12	13	0	100	0	100	1	92	13	1	92	1	92
BW	18	3	83	3	83	9	18	89	30	83	9	50	18	2	89	4	78	
PB	13	7	46	10	23	13	13	38	11	15	13	0	13	9	31	12	8	
HM	12	0	100	0	100	3	12	100	0	100	2	83	12	0	100	0	100	
SM	22	1	95	1	95	3	22	95	1	95	5	77	22	3	86	5	77	
Mer	22	0	100	1	95	3	22	100	1	95	6	73	22	2	91	5	77	
B'rock	13	0	100	0	100	2	13	100	0	100	2	85	13	0	100	0	100	
S'point	22	0	100	0	100	1	22	100	1	95	2	91	22	0	100	1	95	
S'cove	15	0	100	1	93	2	15	100	0	100	2	87	15	0	100	2	87	
Cmore	15	2	87	4	73	13	15	73	8	47	15	0	15	3	80	8	47	
Kill'y	22	0	100	0	100	2	22	100	0	100	4	82	22	0	100	1	95	
C'hawn	15	0	100	0	100	4	15	100	0	100	3	80	15	0	100	1	93	

Figure 28: % Compliance of Total Coliform Results with limits in Bathing Water Regulations

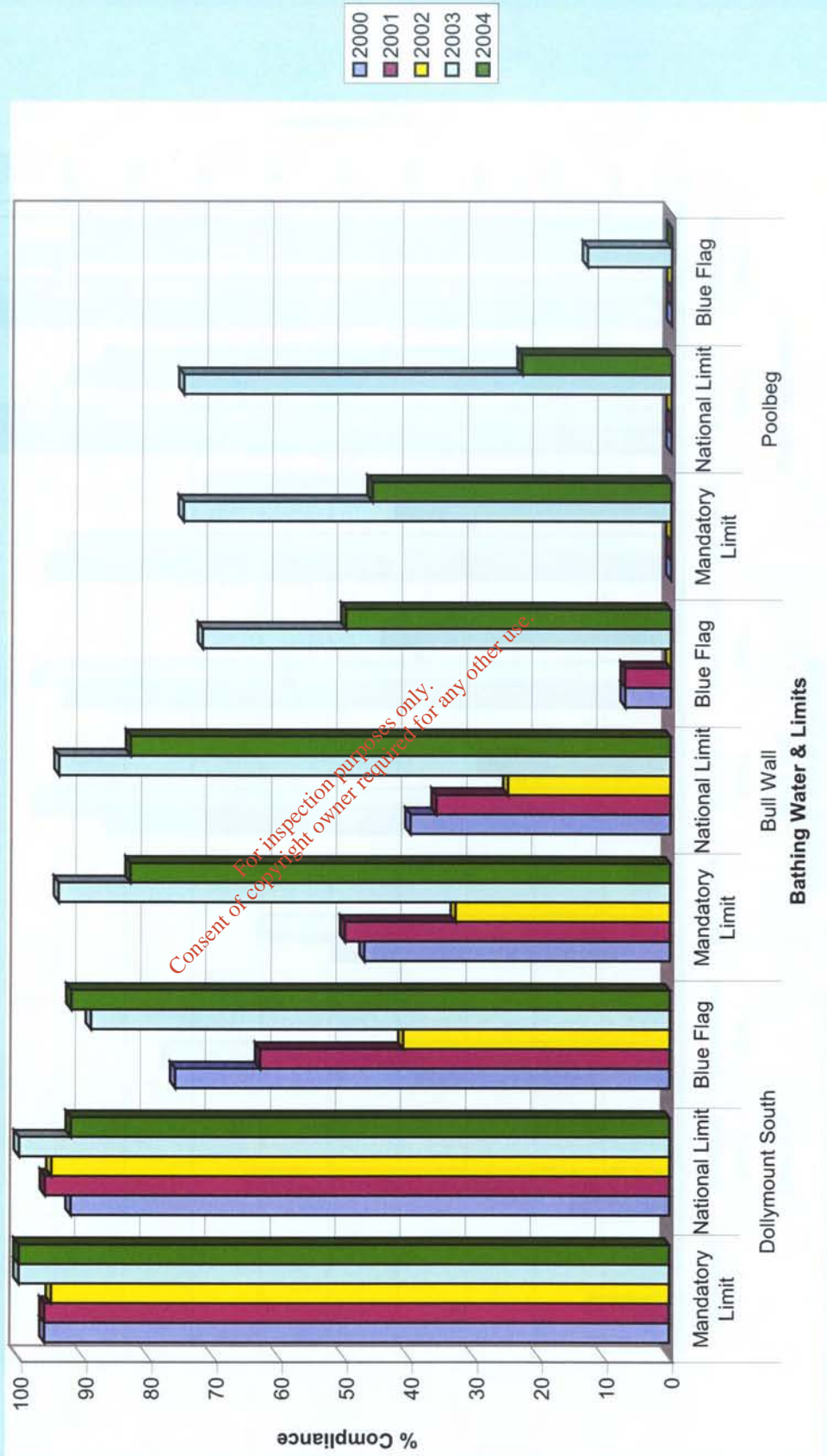


Figure 29: % Compliance of Faecal Coliform Results with Limits in Bathing Water Regulations

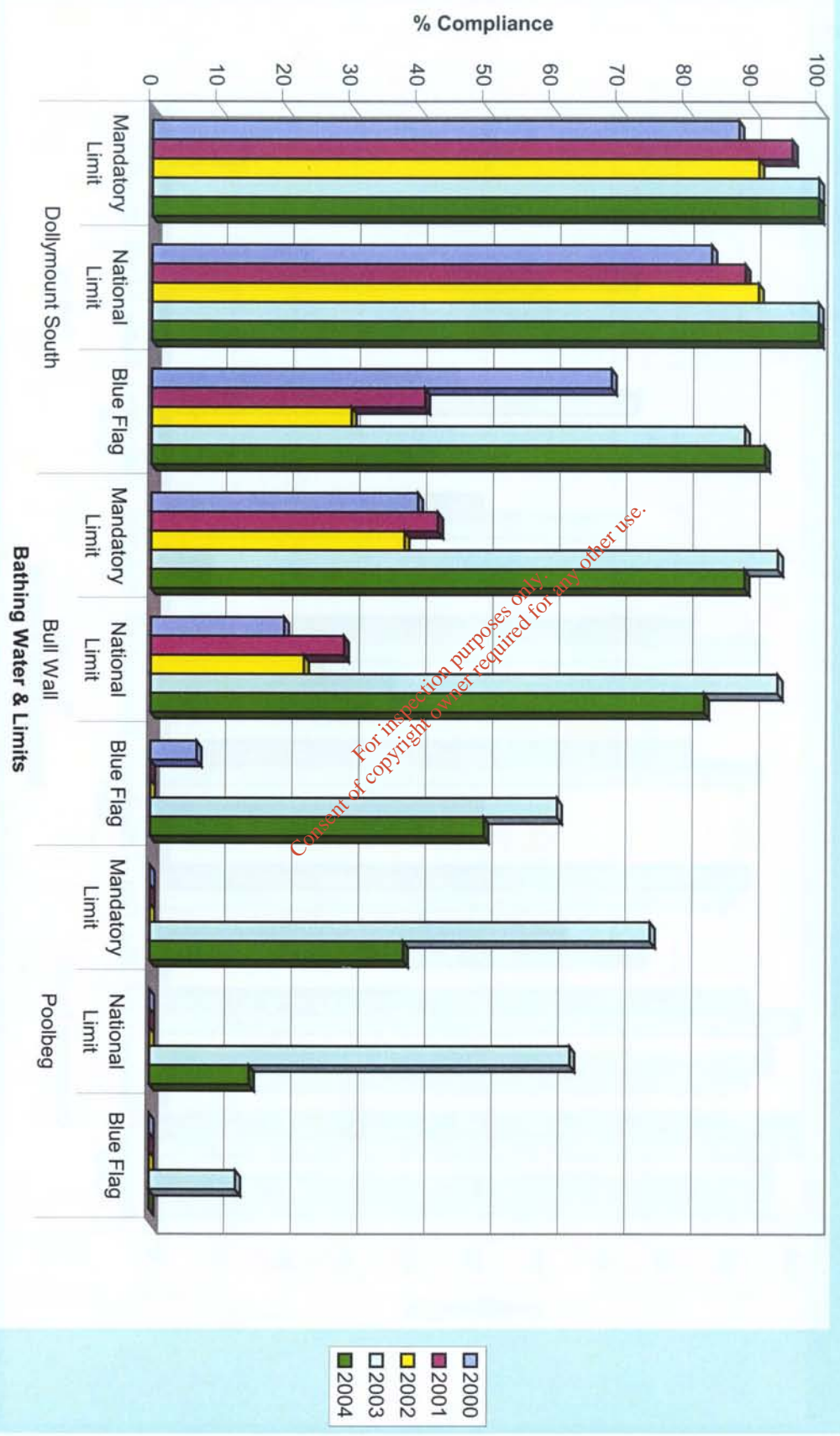


Figure 30: % Compliance of Faecal Streptococci Results with Limits in Bathing Water Regulations

