

NRA NORTH WEST 85

THE MERSEY ESTUARY 1992 SURVEYS

SUMMARY OF RESULTS

Marine and Special Projects
EQ & PC
March 1993

Report: MSP-MER-93-001

THE MERSEY ESTUARY 1992 SURVEYS

SUMMARY OF RESULTS

This report summarises the routine monitoring surveys carried out on the Mersey estuary during 1992 (January to November), see Figure 1 and Table 1. Refer to report MSP-MER-001 for more information on the estuary sampling requirements.

INTERPRETATION

Overall mean concentrations for most of the parameters are listed in Table 2. Most of the results are presented in a graph format which illustrates concentrations as a function of station and month distributions. The bigger the star the bigger the concentration. The minimum and maximum concentrations are indicated for each parameter and scaling of the size of the stars directly proportional.

Stars that are circled indicate levels exceeding their environmental quality standards (EQS). Remember: compliance with many EQSs is based on annual average values.

PHYSICAL PARAMETERS

Figure 2. The pH fluctuate between 7 and 8.3, generally increasing going downstream. Suspended solids concentrations were very high in August between station 16 and 22, but otherwise fluctuate within the estuary with no discernible pattern.

Figure 3. Dissolved oxygen reach minimum levels in the summer (June and September), most noticeable upstream from station 11. In September especially, it is possible to note oxygen sags at stations 14, 16, 20-22.

NUTRIENTS

Figure 4. Phosphate levels occasionally show spatial fluctuations along the estuary with 'humps' around stations 22/21, 15/13 and 7/8, in February and April most evident. This may reflect phosphate input sources located at various points along the estuary. Ammonia levels, to a lesser extent, also show spatial fluctuations, eg. April.

Nitrate, and silicate concentrations generally decrease from station 22 to station 3 (*i.e.* going downstream). Both nutrients also show minimum levels in the summer (July), and maxima for silicate in February. In November, it can be noted that nitrate levels decrease on



either side of station 17, which may suggest anthropogenic input sources along that section of the estuary.

Figure 5. The expected nutrient profiles along the estuary would show decreasing concentration with increasing salinity. Any variations from this may indicate anthropogenic or unusual biological activity.

From November 1992, nutrient determinations have been carried out on filtered samples.

Phaeophytin readings were only recorded in November 1992. No chlorophyll data was available.

'METALS'

Most metals were only determined on four stations (7, 9, 16, 19). In January and May, samples were not taken at those stations but shifted to stations 8, 10, 17 and 20.

Figure 6. Dissolved chromium levels exceeded the EQS of 15 $\mu\text{g}/\text{l}$ at station 16 in March. High levels of chromium were found along the estuary on that date. A few dissolved copper levels exceeded the EQS of 5 $\mu\text{g}/\text{l}$, at various stations and months with no discernible pattern.

Figure 7. Alkyl lead was determined routinely at stations 10 and 16. A complete profile was available for August when three distinct peaks were detected near stations 15, 12 and 5.

Boron was determined at various stations, with highest levels measured towards the seaward end of the estuary - as boron's 'normal' distribution is closely correlated to salinity.

RUNCORN OLD QUAY

Dissolved cadmium levels were highest at station 16 (0.21 $\mu\text{g}/\text{l}$). Concentrations tend to fluctuate especially towards the mouth of the estuary. Dissolved zinc levels were also consistently higher at station 16, reaching 29 $\mu\text{g}/\text{l}$. Not enough data on total Zn was available to comment.

FIDDLERS FERRY

Figure 7. Dissolved arsenic and nickel levels showed persistently high concentrations at station 19 reaching 14.4 and 9.60 $\mu\text{g}/\text{l}$, respectively. Figure 8. Dissolved mercury shows a seasonal fluctuation, being highest in June. Total mercury concentrations, however, did not follow the same trend, with highest levels (up to 2.4 $\mu\text{g}/\text{l}$) occurring at station 19.

ORGANICS

Figure 9. Only three organic parameters were found to have levels above their detection limits. Carbon tetrachloride exceeded the EQS of 12 $\mu\text{g}/\text{l}$ at station 12 in July (level of 27 $\mu\text{g}/\text{l}$), but doubt was raised on the laboratory finding. High γ -hexachlorocyclohexane and chloroform concentrations were recorded at different stations and for different months, without noticeable trends.

Note that most γ -hexachlorocyclohexane (γ -HCH) levels exceeded the EQS of 0.02 $\mu\text{g}/\text{l}$ set for total HCH (i.e. $\alpha + \beta + \gamma$) at various stations along the Mersey. Concentrations ranged between <0.003 and 0.348 $\mu\text{g}/\text{l}$, with an overall average of 0.051 $\mu\text{g}/\text{l}$. On the 1989 screening surveys on the Mersey revealed that γ -HCH concentrations reached 0.03 and 0.06 $\mu\text{g}/\text{l}$ in the Ditton brook which flows into the Mersey just upstream of Woodyard Widnes station 16.

PCBs were not analysed for between February and June. PCB-28 levels reached 0.02 $\mu\text{g}/\text{l}$ in July and August around station 19. All organic compounds that were found to be below their respective detection limits are listed in Table 3.

CONCLUSION

This report briefly summarises routine data collected in the Mersey estuary in 1992. All data is available on the water archive.

The Mersey estuary was sampled monthly between January and November 1992. The laboratory occasionally omitted some parameters. This problem should have been resolved now that a document detailing requirements has been produced (ref: MSP-MER-001).

Both dissolved oxygen levels and nutrient distributions reflect the polluted nature of the upper Mersey estuary, (stations 11/14 to 22).

Some heavy metals concentrations were higher in the upper estuary (station 16 - Runcorn Old Quay, and station 19 - Fiddlers Ferry), and in some instances exceeded their respective EQSs.

The concentrations of most organic compounds remained below the laboratory detection limits. However γ -hexachlorocyclohexane levels consistently exceeded the EQS of 0.02 $\mu\text{g}/\text{l}$ (for total HCH) at the various stations sampled throughout the estuary.

TABLE 1: Mersey estuary - identification of sampling stations.

	STATION		S.P.N.	
	3.	Mersey estuary at bouy C1	904153	
A	4.	Mersey estuary at bouy C15	904151	
	5.	Mersey estuary at bouy C21	903958	
A	6.	River Mersey at New Brighton	903952	
***	7.	Mersey estuary at Seacombe Ferry	903950	
A	8.	Mersey estuary at Pluckington bank	903912	
***	A	9.	Mersey estuary at bouy E1	903885
A	10.	Mersey estuary at Eastham Ferry	903875	
	11.	Mersey estuary at Mount Manisty	903228	
A	12.	Mersey estuary at Stanlow Point	903088	
	13.	Mersey estuary at Oglet Point	903084	
A%	14.	Mersey estuary at Hale Head	903075	
%	15.	Mersey estuary at Woodyard Widnes	903065	
***	A	16.	Mersey estuary at Runcorn Old Lock	902932
	17.	Mersey estuary at ICI Wigg	902878	
A	18.	Mersey estuary at Randles Sluices	902860	
***	19.	Mersey estuary at Fiddlers Ferry	902850	
A	20.	Mersey estuary d/s of Sankey Brook	902842	
	21.	Mersey estuary at Baxter's Bridge	902584	
A!	22.	Mersey estuary at Monks Hall	902580	
	23.	Mersey estuary at Walton rail bridge	902578	

Extra analyses: A Atrazine

% Carbon tetrachloride and chloroform,
1,2-Dichloroethane, tetrachloroethylene,
trichloroethylene, dissolved metals (Hg, Cd)

! dissolved metals (Ni, Zn, Cr, Pb, Cu), Boron

S.P.N. Sampling Point Number

*** BASELINE MONITORING STATION

Table 2:

	Conductivity $\mu\text{S/cm at } 25^\circ\text{C}$	Calculated salinity	pH	Solids mg/l	Temperature $^\circ\text{C}$
MEAN	33445	22.18	7.69	158.9	11.35

	Nitrate mg/l	Ammonia mg/l	Silicate mg/l	Phosphate mg/l	Dissolved Oxygen mg/l	Dissolved Oxygen %
MEAN	1.66	1.30	3.37	0.27	6.57	67.29

	Dissolved Cadmium $\mu\text{g/l}$	Dissolved Chromium $\mu\text{g/l}$	Dissolved Copper $\mu\text{g/l}$	Dissolved Nickel $\mu\text{g/l}$	Dissolved Arsenic $\mu\text{g/l}$	Boron mg/l
MEAN	0.07	1.88	3.68	3.85	4.63	2.60

	Alkyl lead $\mu\text{g/l}$	Dissolved lead $\mu\text{g/l}$	Total zinc $\mu\text{g/l}$	Dissolved zinc $\mu\text{g/l}$	Total mercury $\mu\text{g/l}$	Dissolved mercury $\mu\text{g/l}$
MEAN	0.99	1.73	40.42	13.29	0.43	0.04

	Carbon tetrachloride $\mu\text{g/l}$	Chloroform $\mu\text{g/l}$	Hexachloro- cyclohexane $\mu\text{g/l}$
MEAN	1.51	1.03	0.051

Table 3: Organic compounds analysed on selected sampling sites in the Mersey.

	Detection limits
DDT-op, DDE-op, TDE-pp	<0.006
DDT-pp, aldrin	<0.001
DDE-pp, dieldrin, endrin	<0.002
Atrazine, simazine, tetrachloroethane, 1,2-dichloroethane	<1
Hexachlorobutadiene, hexachlorobenzene, α and β -hexachlorocyclohexane	<0.05
PCB-52, 118, 138, 153, 180, total	<0.01
PCB-101	<0.04
PCB-28	<0.1

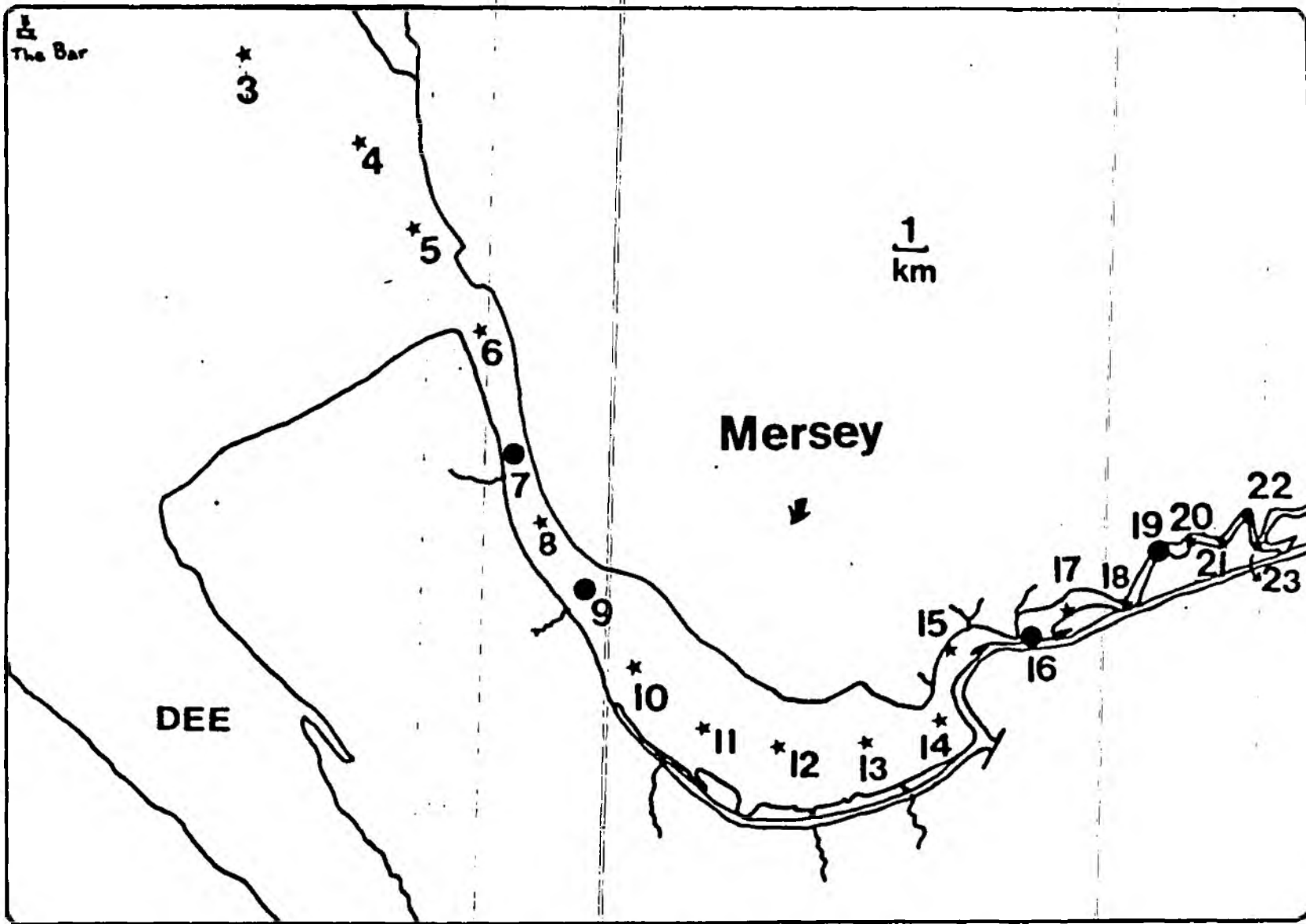


Figure 1: Location of sampling sites in the Mersey estuary (descriptions in Appendix 1).

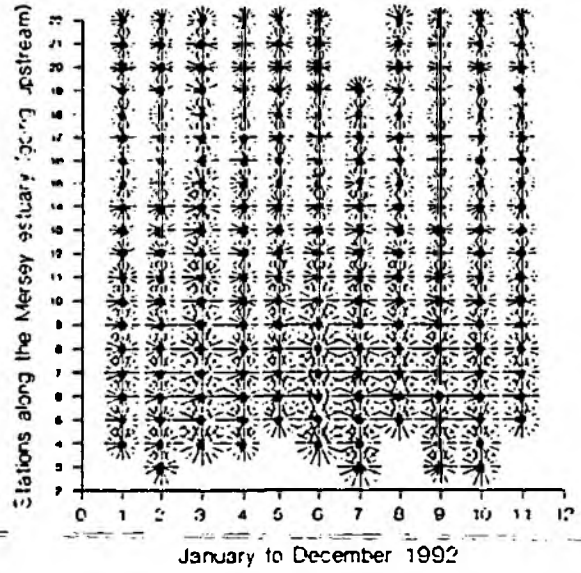
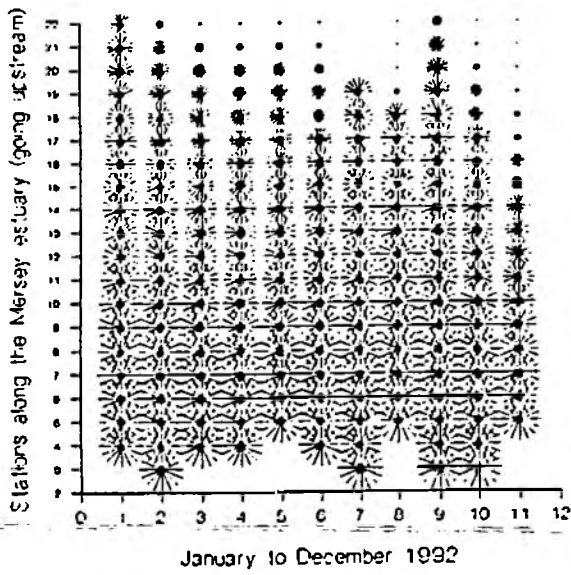
● Baseline monitoring stations

Figure 2:

Conductivity 502 to 50600 $\mu\text{S}/\text{cm}$ at 25 °C

pH 7.00 to 8.63

Calculated salinity 0.08 to 34.86



Temperature 3.8 to 18.6 °C

Suspended solids 3 to 1600 mg/l

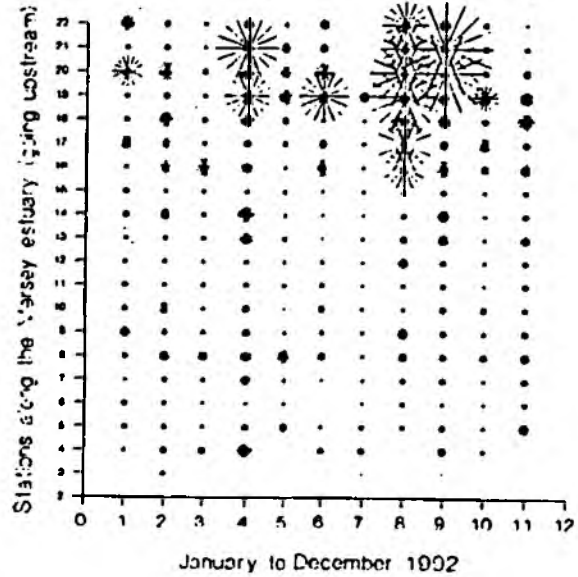
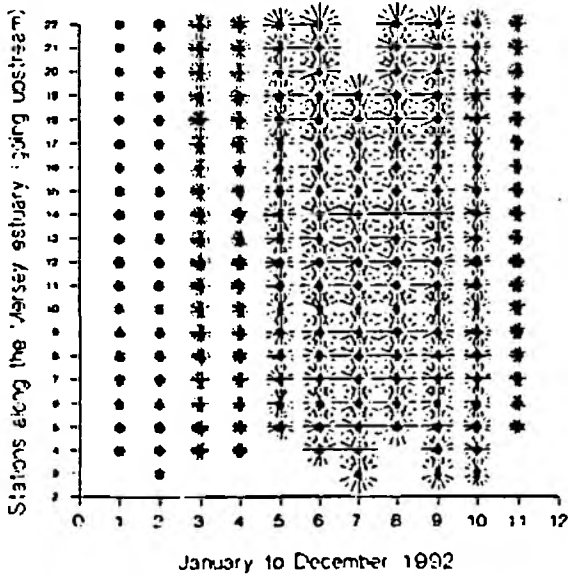
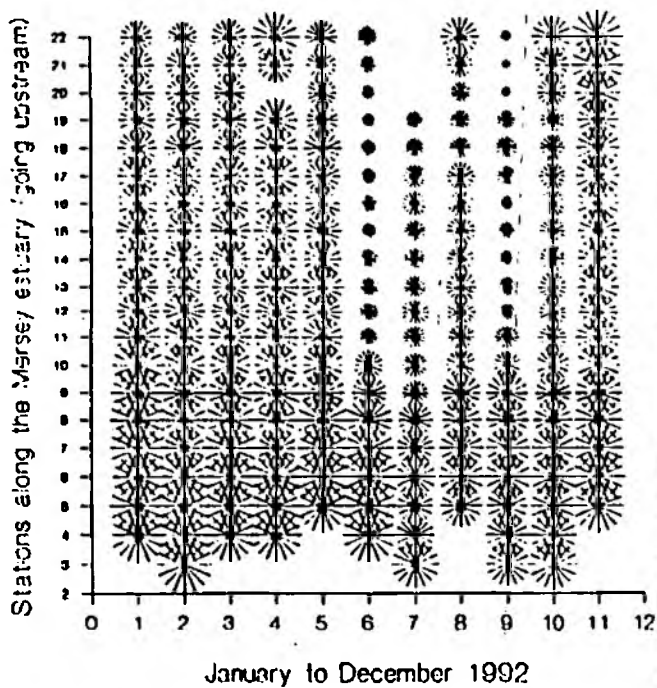


Figure 3:

Dissolved oxygen 1.43 to 10.82 mg/l



Dissolved oxygen 15.5 to 125.5 :

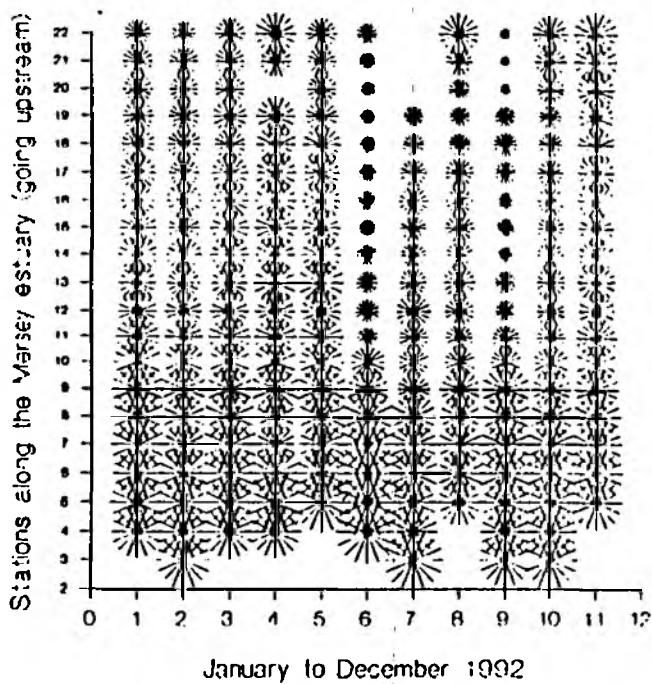
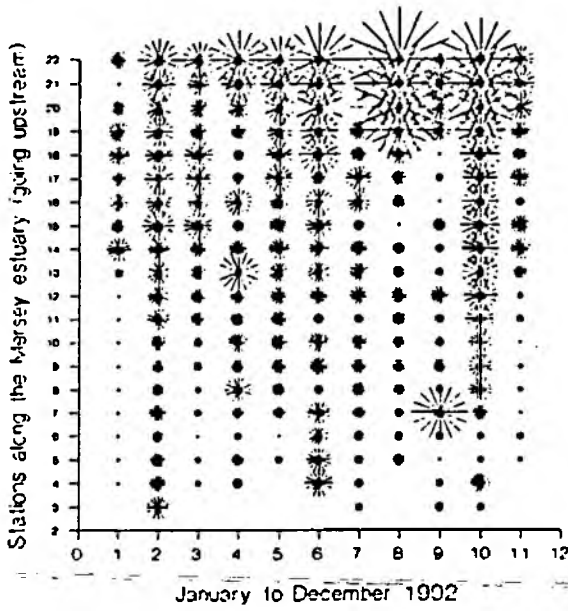
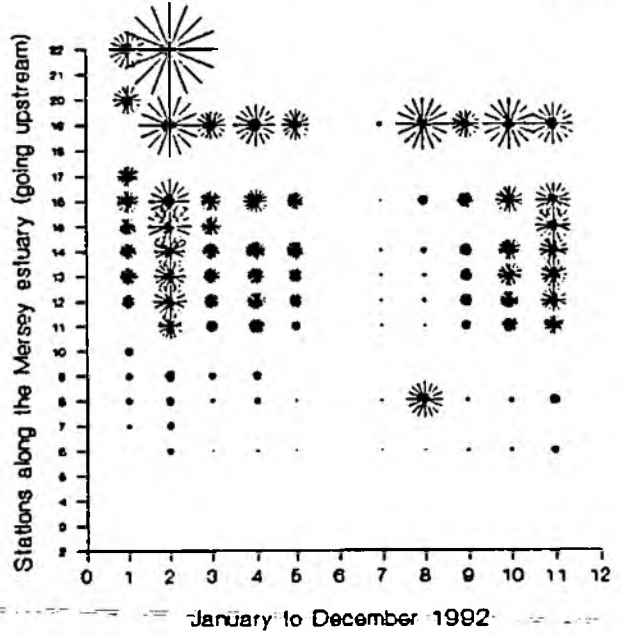


Figure 4 :

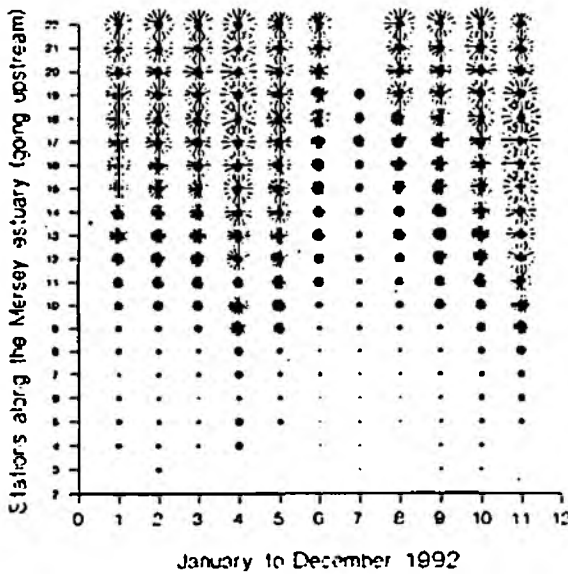
Phosphate 0.03 to 1.40 mg/l



Silicate 0.13 to 19.2 mg/l



Nitrate 0.03 to 4.22 mg/l



Ammonia 0.03 to 6.40 mg/l

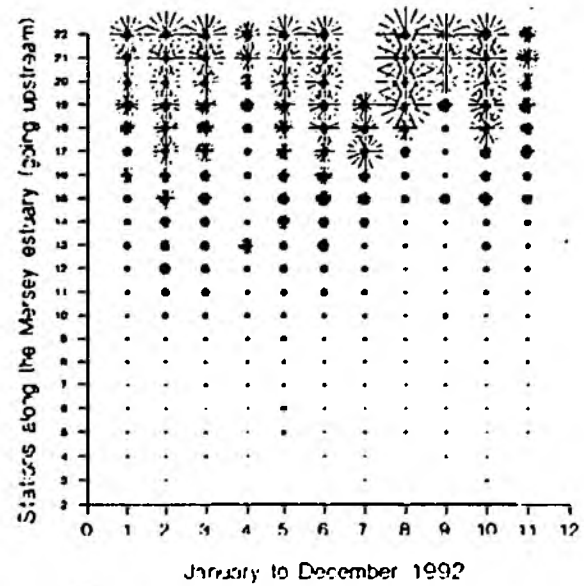
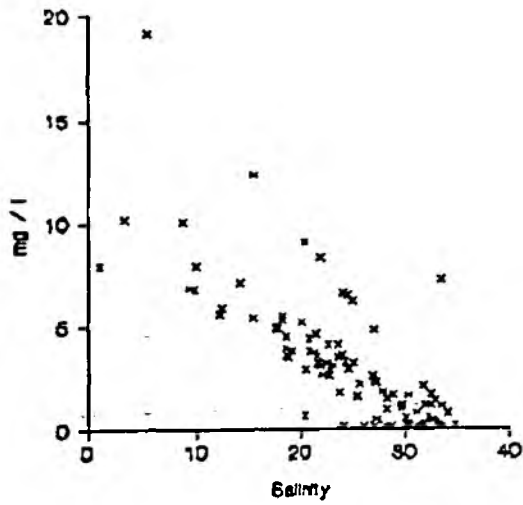
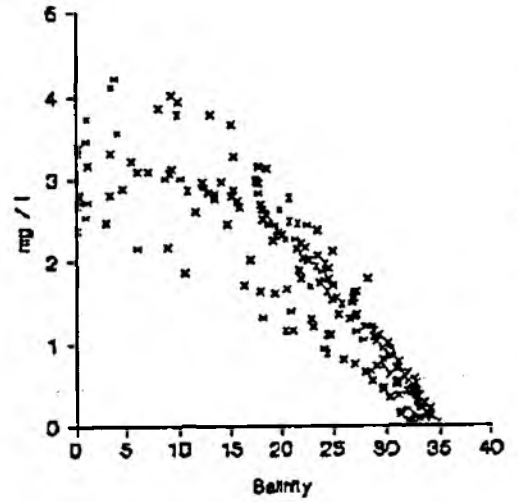


Figure 5:

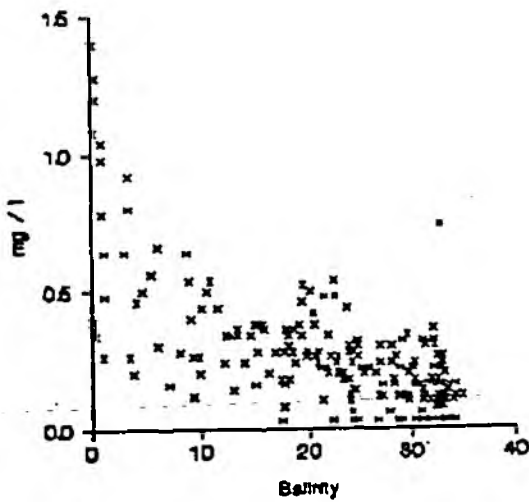
Silicate levels in the Mersey



Nitrate levels in the Mersey



Phosphate levels in the Mersey



Ammonia levels in the Mersey

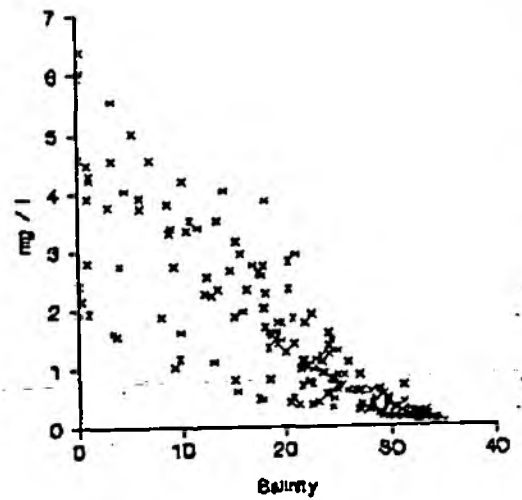


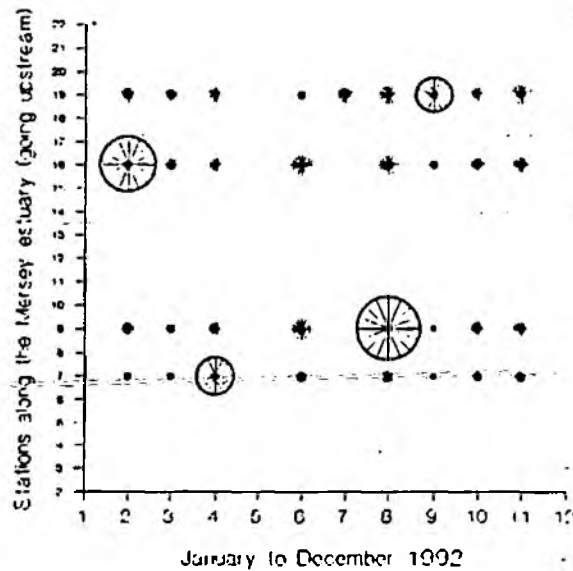
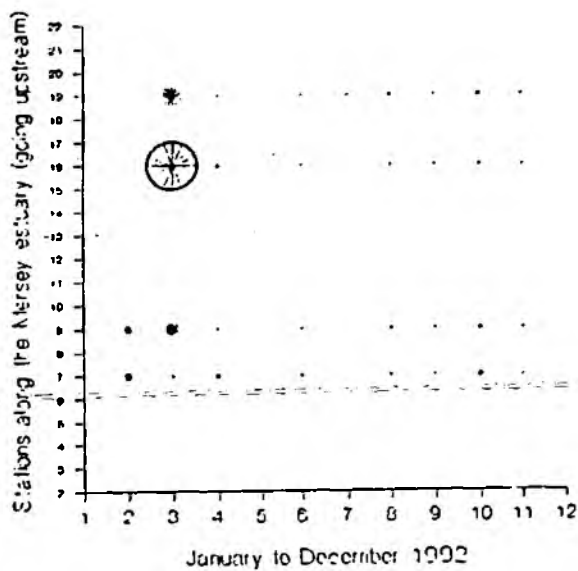
Figure 6:

Dissolved chromium 0.28 to 21.50 $\mu\text{g/l}$

Dissolved copper 1.12 to 13.40 $\mu\text{g/l}$

○ Exceed EQS of 15 $\mu\text{g/l}$

○ Exceed EQS of 5 $\mu\text{g/l}$



Dissolved nickel 0.47 to 0.60 $\mu\text{g/l}$

Dissolved cadmium 0.03 to 0.21 $\mu\text{g/l}$

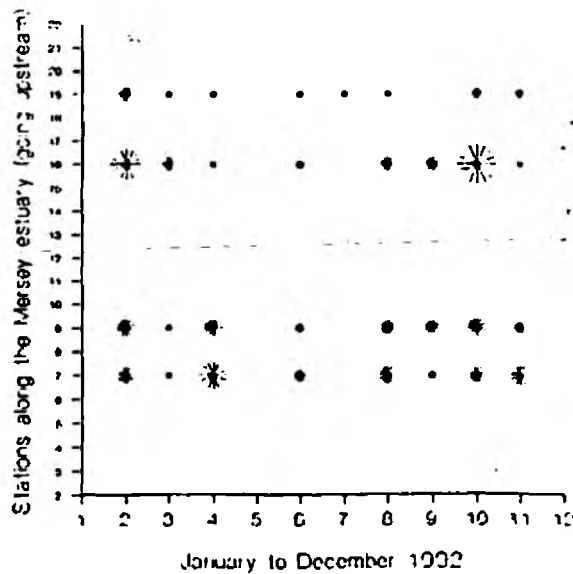
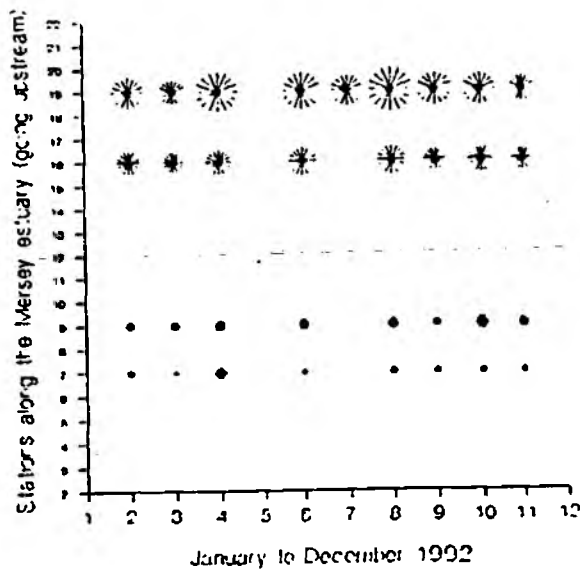
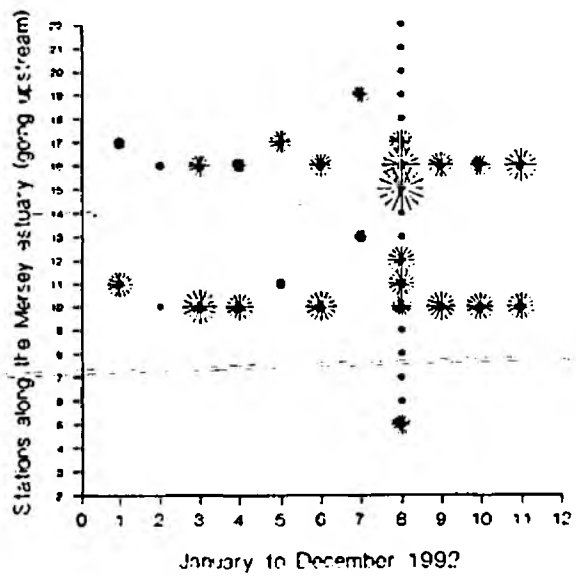
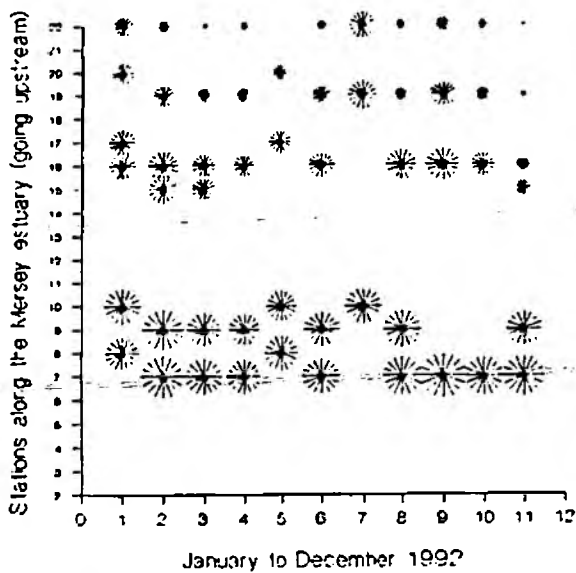


Figure 7:

Boron 0.21 to 4.65 mg/l

Alkyl lead 0.29 to 2.50 $\mu\text{g/l}$



Dissolved lead 1.50 to 2.20 $\mu\text{g/l}$

Dissolved arsenic 1.95 to 14.40 $\mu\text{g/l}$

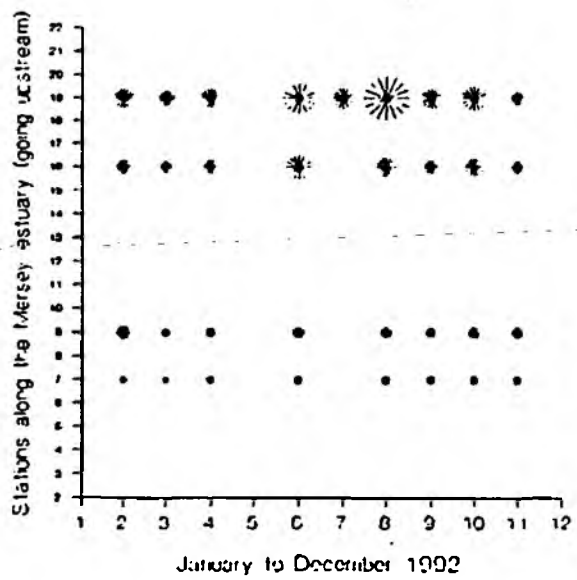
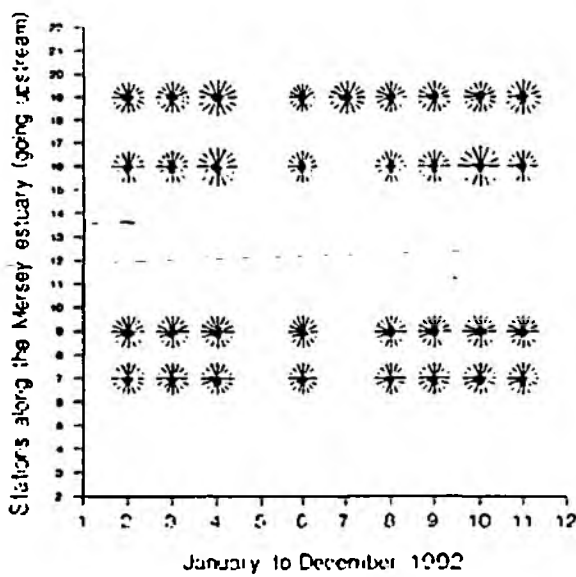
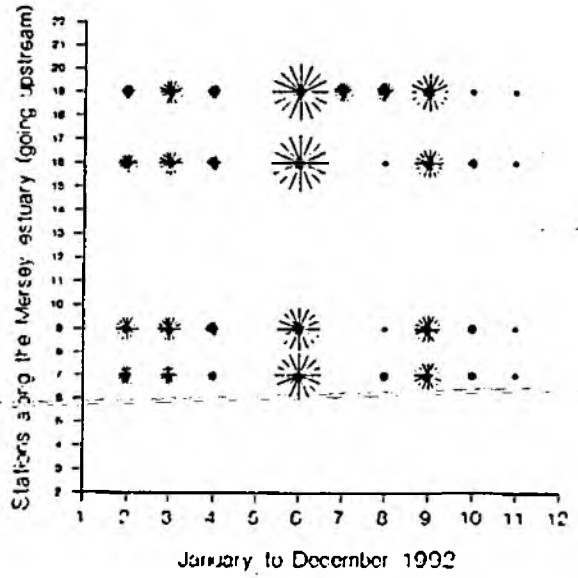
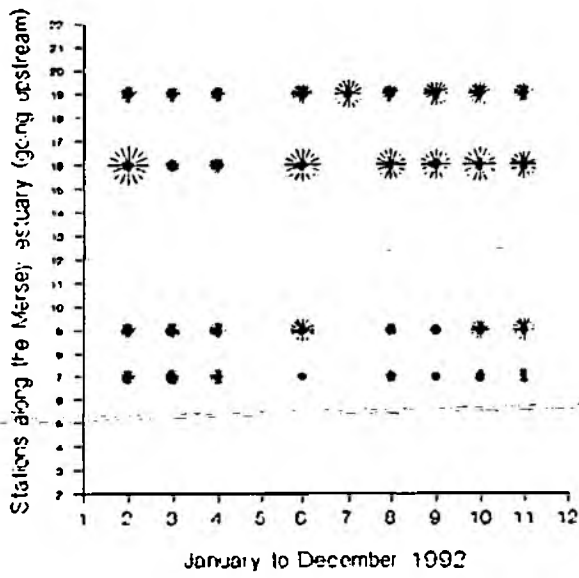


Figure 8 :

Dissolved zinc 4.9 to 29.0 $\mu\text{g/l}$

Dissolved mercury 0.01 to 0.12 $\mu\text{g/l}$



Total zinc 7.1 to 170.0 $\mu\text{g/l}$

Total mercury 0.11 to 2.40 $\mu\text{g/l}$

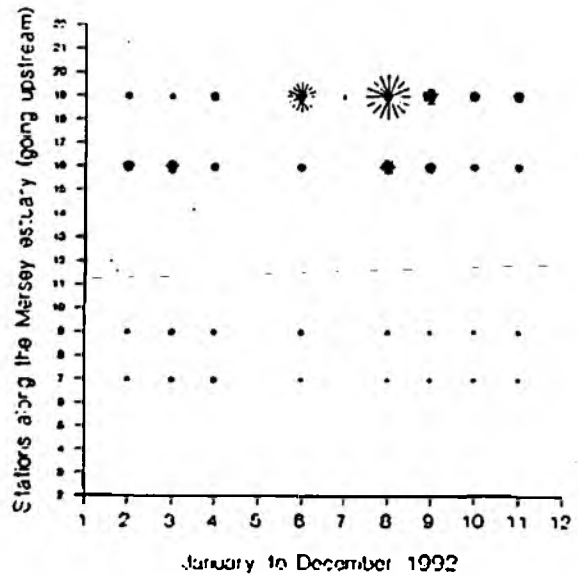
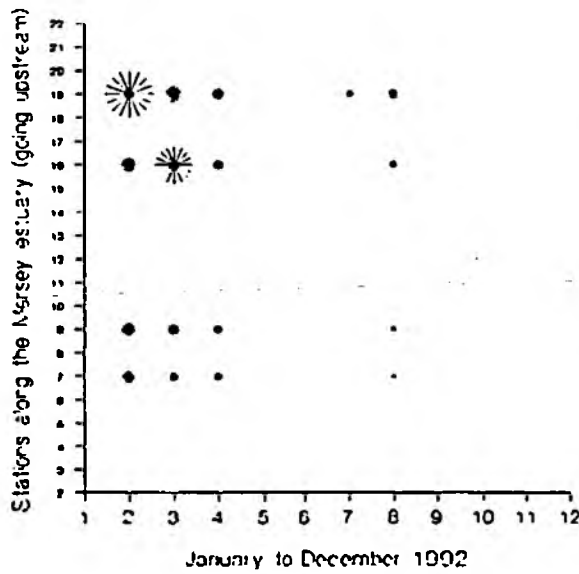
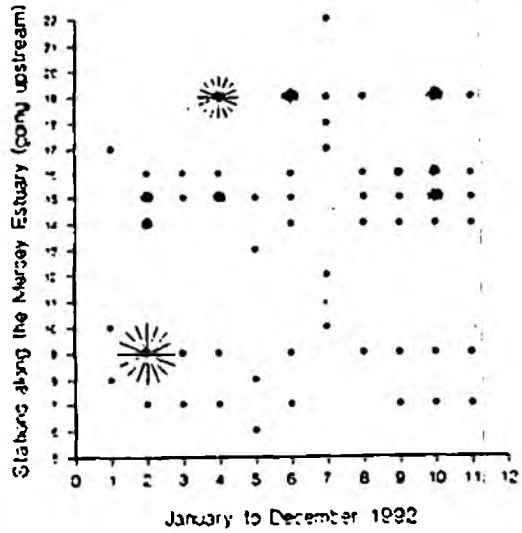
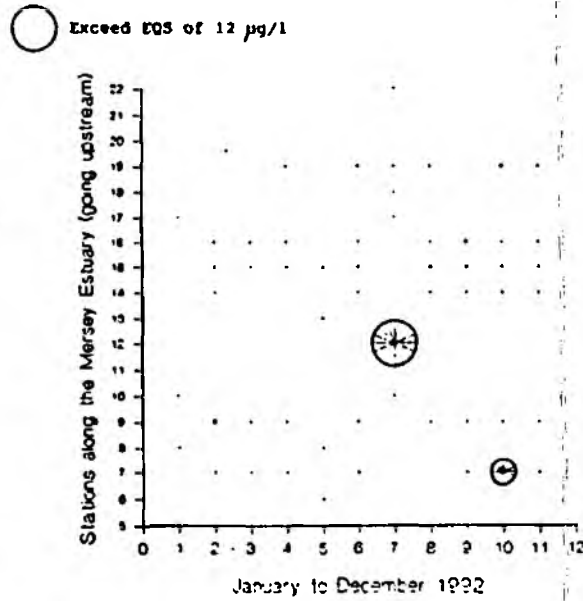


Figure 9:

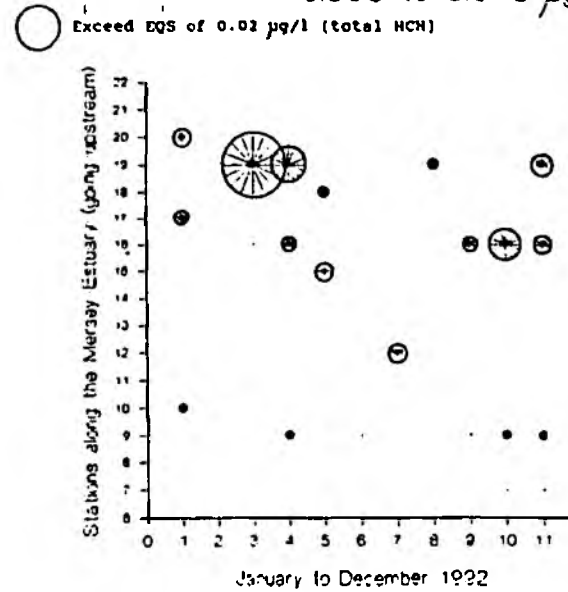
Chloroform <1 to 7 ug/l



Carbon tetrachloride <1 to 27 ug/l



Hexachlorocyclohexane(r)
<0.003 to 0.348 ug/l



○ Exceed EQS of 12 ug/l

○ Exceed EQS of 0.02 ug/l (total HCH)

	DESCRIPTION	N.G.R.	R.F.N.
	3. Mersey estuary at bouy C1	SD 231 041	69804153
	4. Mersey estuary at bouy C15	SD 269 018	69804151
	5. Mersey estuary at bouy C21	SJ 296 980	69803958
	6. River Mersey at New Brighton	SJ 315 952	69803952
***	7. Mersey estuary at Seacombe Ferry	SJ 327 908	69803950
	8. Mersey estuary at Pluckington bank	SJ 336 875	69803912
***	9. Mersey estuary at bouy E1	SJ 357 856	69803885
	10. Mersey estuary at Eastham Ferry	SJ 363 819	69803875
	11. Mersey estuary at Mount Manisty	SJ 401 808	69803228
	12. Mersey estuary at Stanlow Point	SJ 432 797	69803088
	13. Mersey estuary at Oglet Poin	SJ 450 798	69803088
	14. Mersey estuary at Hale Head	SJ 486 810	69803075
	15. Mersey estuary at Woodyard Widnes	SJ 501 837	69803069
***	16. Mersey estuary at Runcorn Old Lock	SJ 520 839	69802932
	17. Mersey estuary at ICI Wigg	SJ 538 851	69802878
	18. Mersey estuary at Randles Sluices	SJ 551 844	69802860
***	19. Mersey estuary at Fiddlers Ferry	SJ 564 867	69802850
	20. Mersey estuary d/s of Sankey Brook	SJ 575 870	69802842
	21. Mersey estuary at Baxter's Bridge	SJ 585 867	69802584
	22. Mersey estuary at Monks Hall	SJ 592 875	69802580
	23. Mersey estuary at Walton rail bridge	SJ 598 866	69802578

N.G.R. = National Grid Reference
F.R.N. = Feature Reference Number

*** BASELINE MONITORING STATION

MERSEY ESTUARY SURVEY

	STATION		S.P.N.
	3.	Mersey estuary at bouy C1	904153
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	23.	Mersey estuary at Walton rail bridge	902578

Extra analyses: A Atrazine

% Carbon tetrachloride and chloroform,
1,2-Dichloroethane, tetrachloroethylene,
trichloroethylene, dissolved metals (Hg, Cd)

! dissolved metals (Ni, Zn, Cr, Pb, Cu), Boron

S.P.N. Sampling Point Number

*** BASELINE MONITORING STATION

THE FOLLOWING PARAMETERS ARE ANALYSED

ON ALL SAMPLES

PARAMETER	UNIT	CODE
pH at 20°C		61
Temperature	°C (Field)	76
Conductivity $\mu\text{S}/\text{cm}$ at 25°C		77
Dissolved Oxygen	% saturation	81
Dissolved Oxygen	mg/l	82
Suspended Solids Total	mg/l	135
Chloride	mg/l Cl	172
Nitrate - filtered - as N	mg/l N	9853
Nitrite - filtered - as N	mg/l N	9854
Ammonia - filtered - as N	mg/l N	9855
Orthophosphate - filtered - as P	mg/l P	9856
Silicate - filtered - as SiO_2	mg/l SiO_2	9857
Salinity (calculated from conductivity and temperature)		1198

CODE = determinand code on the water archive

THE FOLLOWING PARAMETERS ARE ONLY ANALYSED
ON BASELINE MONITORING STATIONS

PARAMETER	UNIT	CODE
Lead (dissolved)	µg/l Pb	52
Mercury (dissolved)	µg/l Hg	103
Mercury	µg/l Hg	105
Cadmium (dissolved)	µg/l Cd	106
& Boron	mg/l	283
Aldrin	µg/l	483
HCH alpha	µg/l	487
HCH beta	µg/l	491
HCH gamma	µg/l	499
Dieldrin	µg/l	511
♦ Endosulphan	µg/l	519
DDT o,p'	µg/l	539
DDE p,p'	µg/l	551
DDT p,p'	µg/l	555
TDE p,p'	µg/l	559
Endrin	µg/l	562
Hexachlorobenzene	µg/l	576
DDE o,p'	µg/l	581
Chlorophyll a	µg/l	947
Phaeophytin	µg/l	950
Pentachlorophenol	µg/l	1085
Copper (dissolved)	µg/l Cu	7213
Zinc (dissolved)	µg/l Zn	7243
Arsenic (dissolved)	µg/l As	7354
Chromium (dissolved)	µg/l Cr	7373
Nickel (dissolved)	µg/l Ni	7427
% Vanadium	µg/l	7768
Chloroform	µg/l	9524
♦ Atrazine	µg/l	9632
♦ Simazine	µg/l	9633
Carbon tetrachloride	µg/l	9643
Hexachlorobutadiene	µg/l	9705
PCB CON28	µg/l	9768
PCB CON52	µg/l	9769
PCB CON101	µg/l	9770
PCB CON118	µg/l	9771
PCB CON138	µg/l	9772
PCB CON153	µg/l	9773
PCB CON180	µg/l	9774
PCB total congeners	µg/l	9807
! Tetrachloroethylene	µg/l	9706
! Trichloroethylene	µg/l	9707
!♦ Dichloroethane 1,2	µg/l	9712
!♦ Trichlorobenzene	µg/l	9713
♦ Trifluralin	µg/l	9714
% Di-tri alkyl lead	µg/l	9916

CODE = determinand code on the water archive

& = List II substance

♦ = Red List substance

! = List I substance from 1993

% = Specific to the Mersey and/or the Manchester Ship Canal

All other parameters = NRA routine baseline monitoring