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MONTHLY MEAN VALUES OF POTENTIAL  
TEMPERATURE, SALINITY AND SIGMA-THETA  
AT OCEAN WEATHER SHIPS BRAVO,  
CHARLIE, DELTA, AND ECHO

by

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ABSTRACT

Lazier, J.R.N. and Hackett, J.R. 1986. Monthly mean values of potential temperature, salinity and sigma-theta at ocean weather ships Bravo, Charlie, Delta, and Echo. Can. Data Rep. Hydrogr. Ocean Sci. No. 44: iv + 34 p.

Values of monthly mean potential temperature, salinity and sigma-theta at 11 depths, at and above 1500 m, from ocean weather ships Bravo, Charlie, Delta and Echo are presented in tables accompanied by graphs of some of the temperature and salinity values down to 1000 m.

RESUME

Lazier, J.R.N. and Hackett, J.R. 1986. Monthly mean values of potential temperature, salinity and sigma-theta at ocean weather ships Bravo, Charlie, Delta, and Echo. Can. Data Rep. Hydrogr. Ocean Sci. No. 44: iv + 34 p.

Les valeurs mensuelles moyennes potentielles de la température, de la salinité et de sigma-théta pour 11 profondeurs au-dessus de 1 500 m obtenues des navires météorologiques Bravo, Charlie, Delta et Echo sont présentées sous forme de tableaux et accompagnées de graphiques pour certaines valeurs de la température et la salinité jusqu'à 1 000 m.

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## INTRODUCTION

Ocean Weather Ships (O.W.S.) Bravo, Charlie, Delta and Echo, Fig. 1, collected oceanographic data from January 5, 1964, to June 30, 1974; June 14, 1964, to December 31, 1973; March 28, 1963, to June 30, 1973; and June 29, 1963, to June 30, 1973, respectively. Details of the sampling procedures at the four stations have been published by Shuhay (1978), Hannon (1979), Jones (1979) and Longacre (1977).

The data were obtained from the National Oceanographic Data Centre, Washington, D.C. in 1974 and 75, and stored at B.I.O. in a compact non-standard format. Recently, the data were converted to the Atlantic Oceanographic Lab. Current Meter/C.T.D. format to make the data more accessible. The same aim motivated this report, which is a compilation of the monthly means of potential temperature, salinity and sigma-theta at 0, 25, 50, 75, 100, 200, 400, 600, 800, 1000, 1500 m for each month of the year for the four stations. The statistics were computed by summing all observations available for each month rather than by summing monthly averages. The data are listed, along with the standard deviations and the numbers of observations in the tables on pages 11-35. Plots, Figs. 2-7, of some of these data are presented to illustrate the seasonal changes at each location.

## ILLUSTRATIONS

Monthly mean surface values of temperature and salinity are plotted against each other, in Fig. 2, to compare the yearly excursions of these parameters and to show the relative positions of each station on the t-s plane. Stations Bravo and Charlie, both north of the "Polar Front", have surface

salinities less than 34.8 throughout the year. In winter the salinities differ by only 0.1, but Bravo has the larger annual excursion of 0.35, as opposed to 0.2 at Charlie, and in summer Bravo is 0.3 less than Charlie. The difference in range is presumably due to Bravo being closer to the seasonal low salinity outflow from the arctic in the Labrador Current.

Stations Delta and Echo, south of the "Polar Front", exhibit water properties of the subtropical gyre with surface salinities and temperatures above 35.2 and 14°C, respectively. The salinity range at Delta, 0.6, is the largest of all four stations and may indicate it is the most influenced by the low salinity waters of the Labrador Current moving into the deep ocean east of the Grand Banks of Newfoundland.

The annual temperature range at the first three stations are roughly the same, 6.3, 5.4 and 6.2°C. Echo is significantly higher at 8.2°C.

Fig. 3 presents the t-s curves for March, June, September and December at the four stations with the standard t-s curve of the western half of the subtropical gyre constructed by Armi and Bray (1982). At stations Delta and Echo the standard curve is followed below 100 m at all seasons, but at Bravo and Charlie all observations to 1500 m are lower in salinity than the standard curve.

The remaining four diagrams show monthly mean temperature and salinity vs depth curves at the end of the cooling season (March), the end of the heating season (September) and at the two intermediate months June and December, and time series plots of monthly mean temperature and salinity at 0, 50, 100, 200, 400 and 1000 m.

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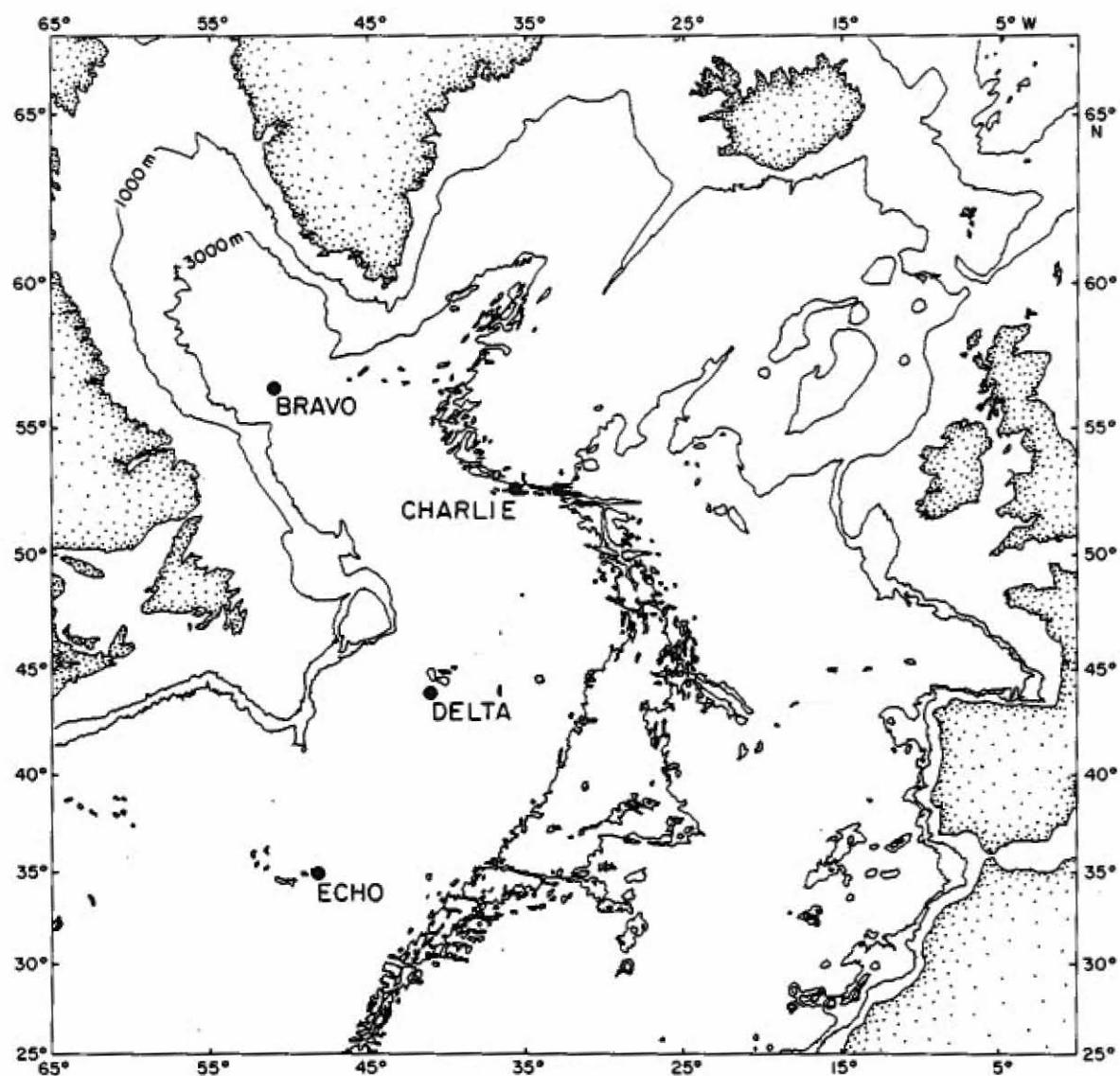


Fig. 1. Positions of ocean weather ships Bravo, Charlie, Delta and Echo.

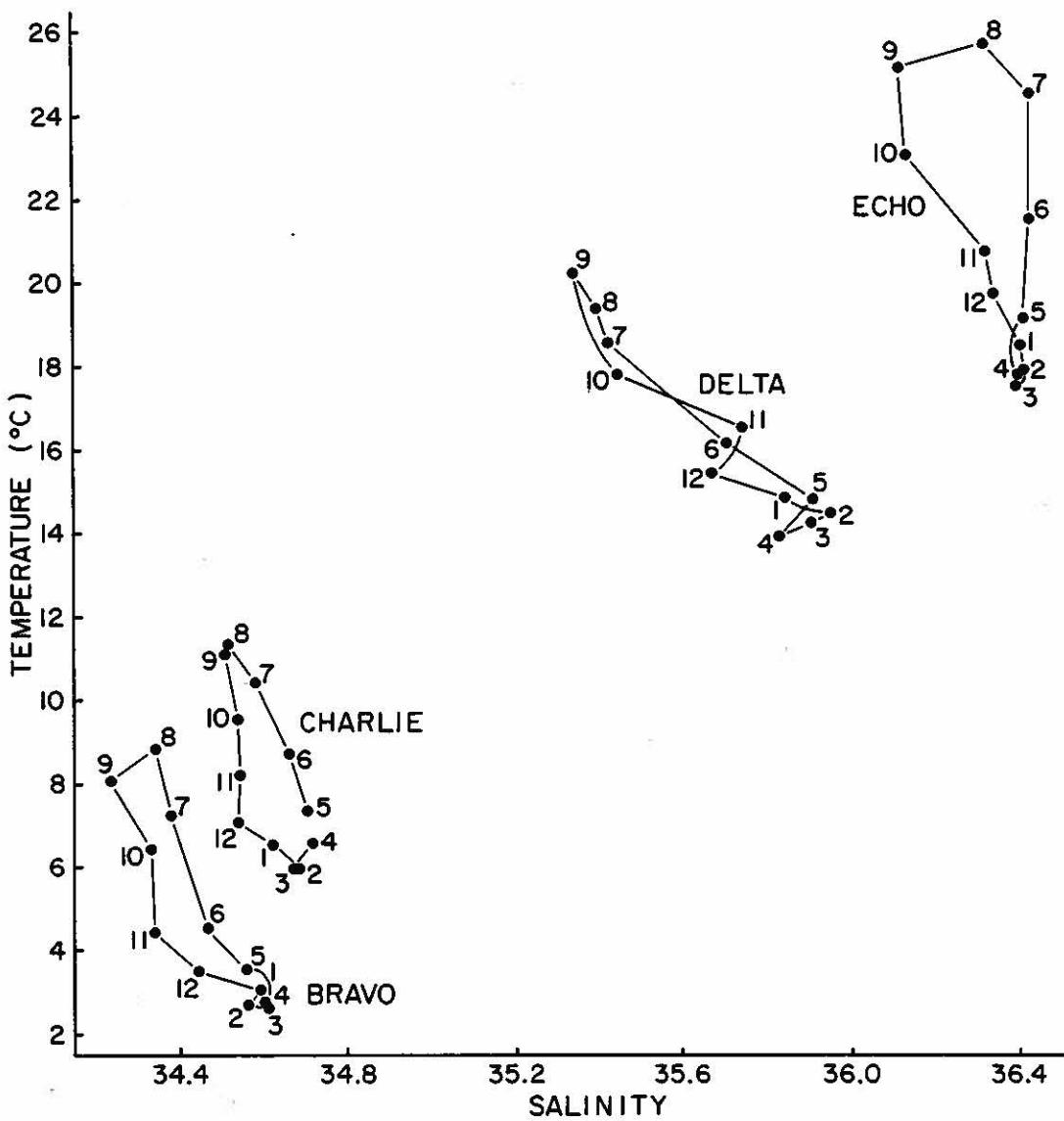
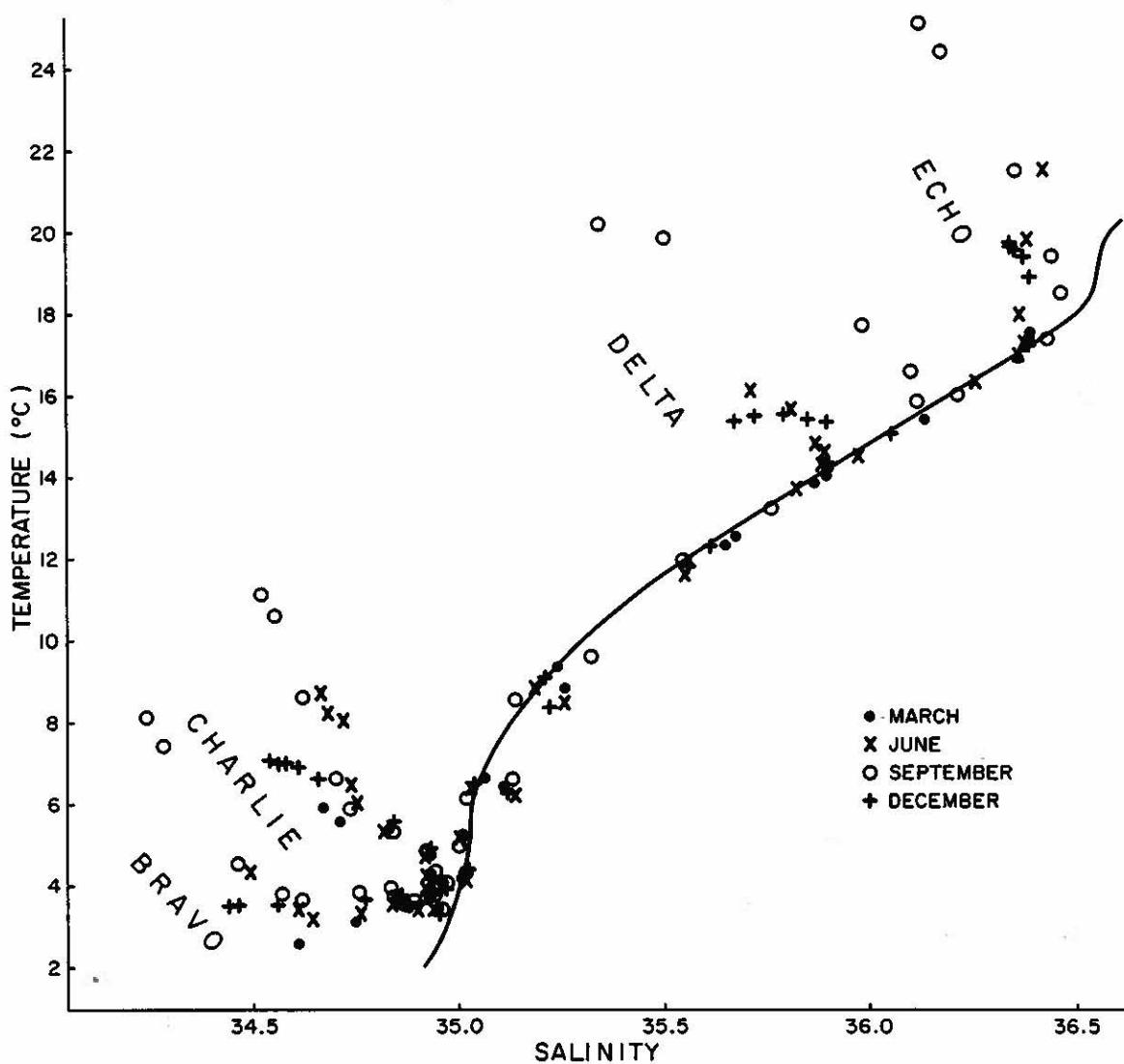


Fig. 2. Mean monthly (January = 1, December = 12) surface temperature and salinity values at the four weather ships.



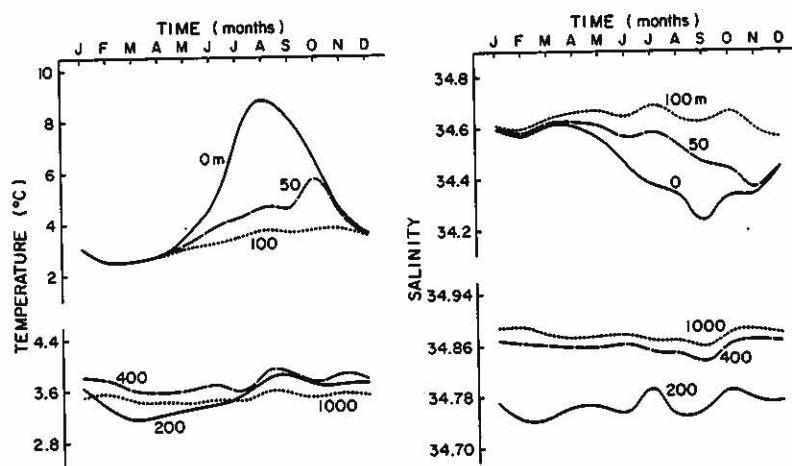
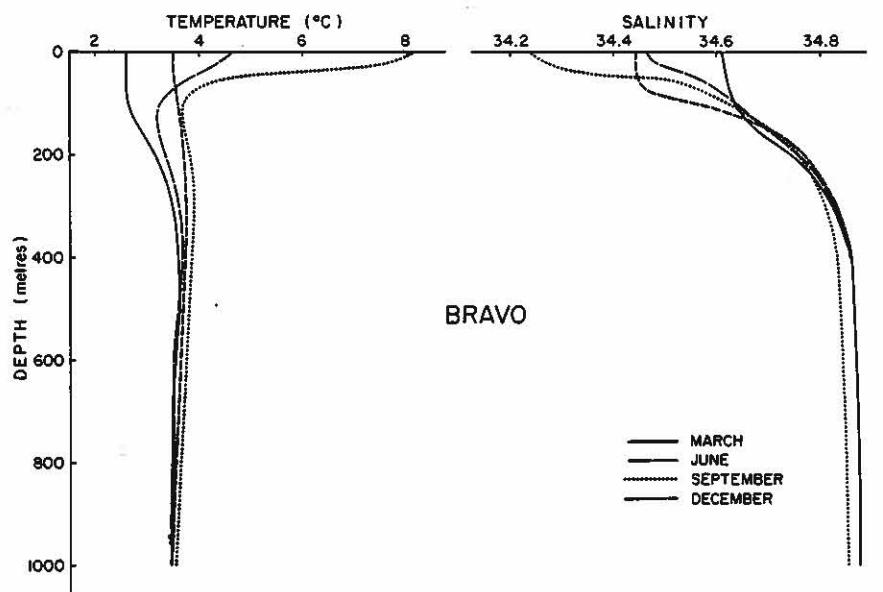


Fig. 4. Upper - monthly mean temperature and salinity at O.W.S. Bravo during March, June, September and December vs depth.  
Lower - monthly mean temperature and salinity at 0, 50, 100, 200, 400 and 1000 m vs time.

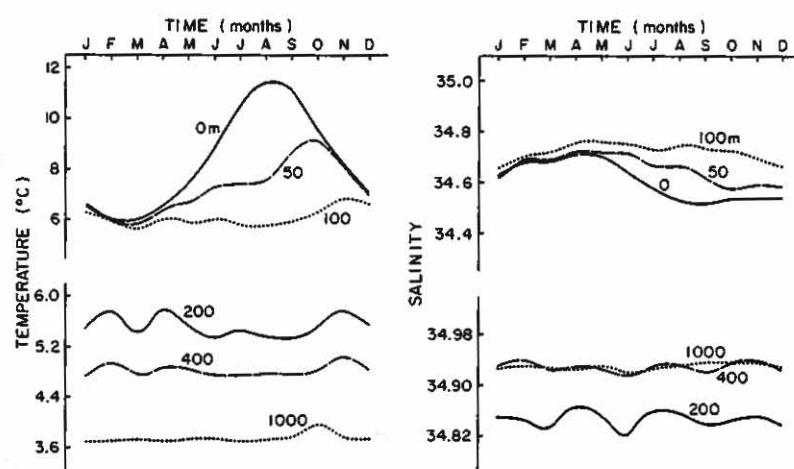
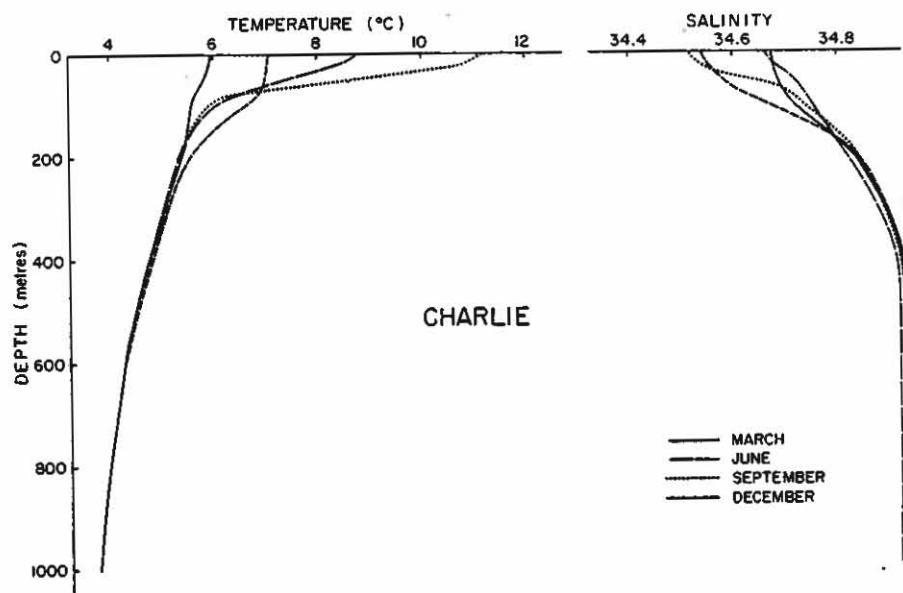


Fig. 5. Upper - monthly mean temperature and salinity at O.W.S. Charlie during March, June, September and December vs depth.  
 Lower - monthly mean temperature and salinity at 0, 50, 100, 200, 400 and 1000 m vs time.

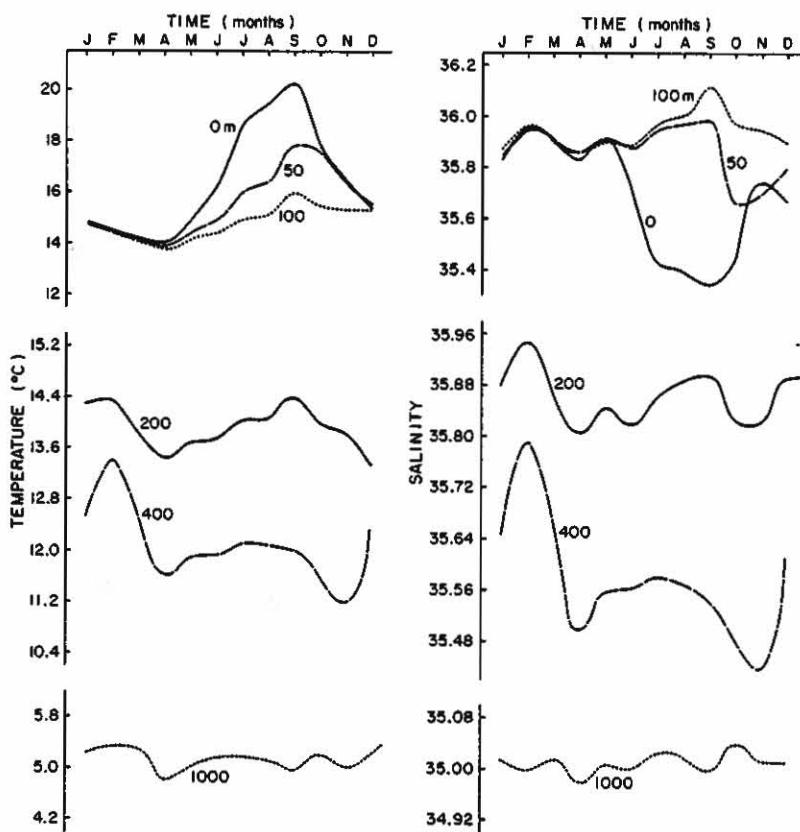
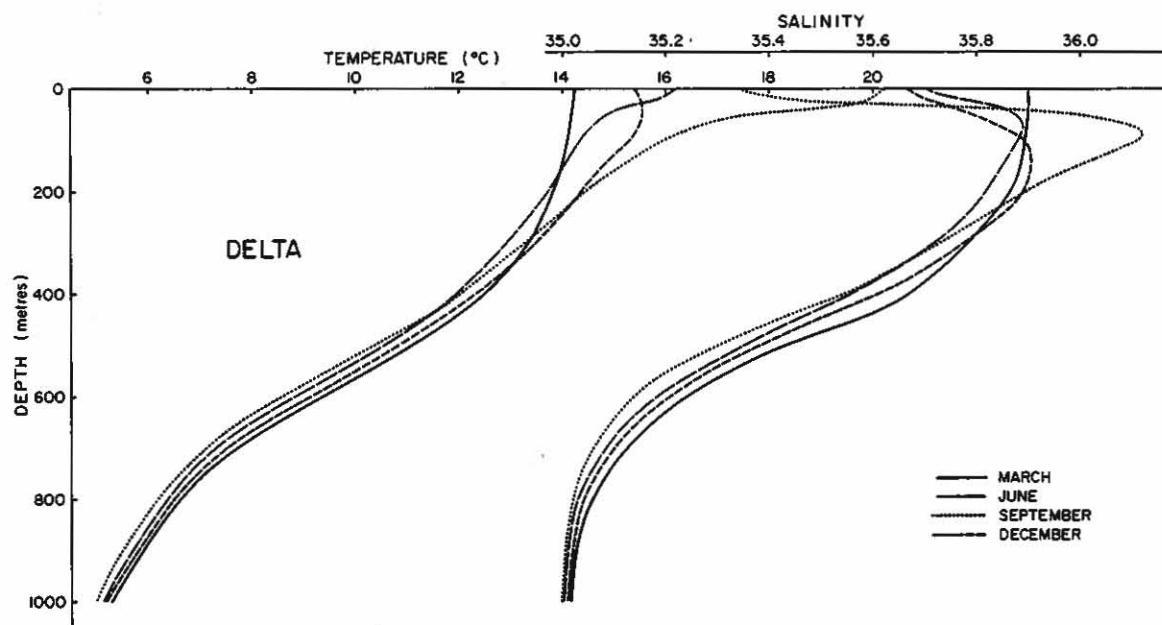


Fig. 6. Upper - monthly mean temperature and salinity at O.W.S. Delta during March, June, September and December vs depth.

Lower - monthly mean temperature and salinity at 0, 50, 100, 200, 400 and 1000 m vs time.

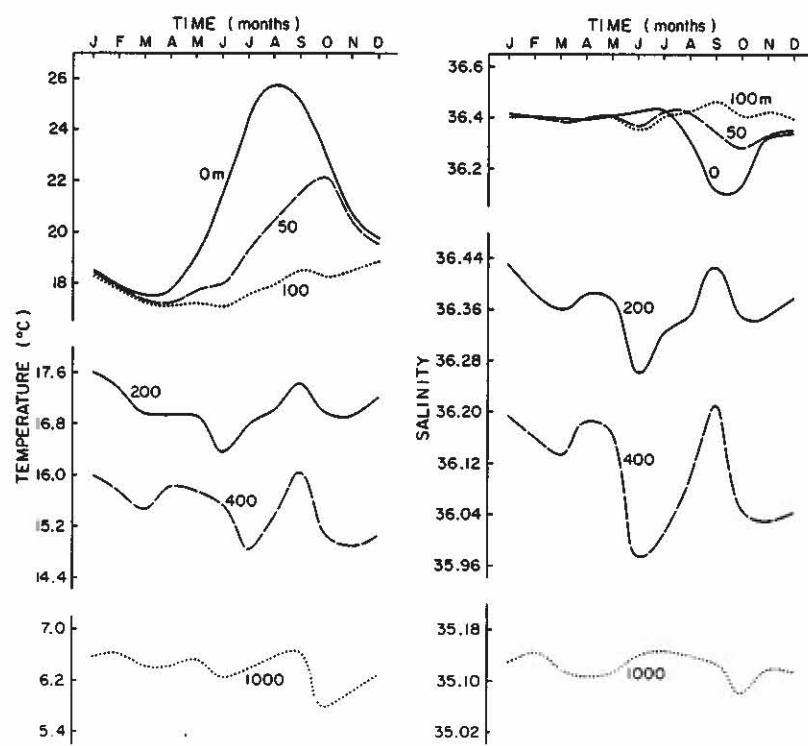
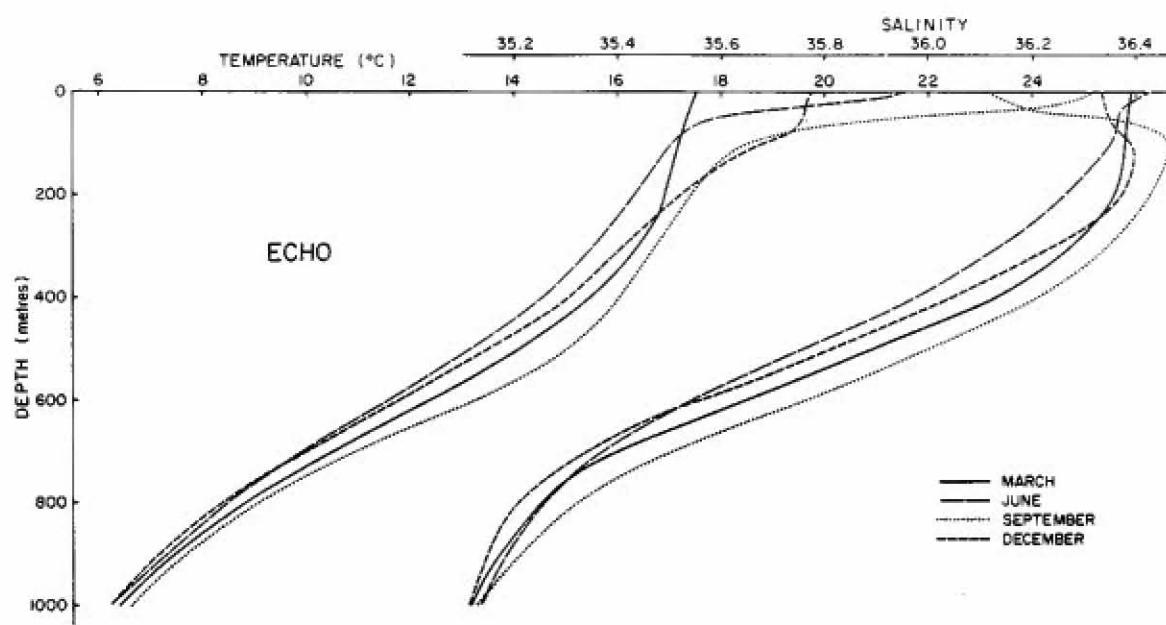


Fig. 7. Upper - monthly mean temperature and salinity at O.W.S. Echo during March, June, September and December vs depth.  
Lower - monthly mean temperature and salinity at 0, 50, 100, 200, 400 and 1000 m vs time.

MONTHLY BOTTLE DATA STATISTICS FOR OWS - BRAVO

DEPTH	PARAMETER : THETA											
	0	25	50	75	100	200	400	600	800	1000	1500	
JAN												
AVE SDEV N	3.065 .701 113	3.068 .692 114	3.061 .703 115	3.074 .708 115	3.107 .704 115	3.663 .455 115	3.816 .201 112	3.687 .180 110	3.590 .159 108	3.514 .125 104	3.430 .107 64	
FEB												
AVE SDEV N	2.476 .595 74	2.504 .593 76	2.517 .594 77	2.557 .608 77	2.591 .620 77	3.320 .510 76	3.769 .363 75	3.731 .234 74	3.630 .215 71	3.554 .155 70	3.498 .091 51	
MAR												
AVE SDEV N	2.609 .555 140	2.613 .543 142	2.617 .542 142	2.617 .531 141	2.631 .537 141	3.140 .451 141	3.596 .377 138	3.536 .285 139	3.473 .231 137	3.423 .176 134	3.423 .150 108	
APR												
AVE SDEV N	2.764 .465 224	2.747 .453 224	2.735 .463 223	2.749 .468 223	2.764 .492 222	3.209 .443 221	3.581 .396 221	3.523 .310 218	3.472 .239 217	3.420 .196 213	3.448 .120 165	
MAY												
AVE SDEV N	3.540 .765 236	3.369 .624 236	3.209 .491 236	3.101 .447 236	3.034 .437 236	3.291 .376 235	3.591 .380 233	3.510 .311 233	3.452 .258 232	3.403 .214 221	3.391 .158 180	
JUN												
AVE SDEV N	4.592 .941 222	4.299 .867 218	3.796 .708 218	3.439 .540 218	3.217 .438 218	3.335 .308 217	3.677 .313 217	3.584 .270 216	3.518 .221 213	3.453 .170 210	3.458 .146 178	
JUL												
AVE SDEV N	7.264 .909 180	6.091 .872 175	4.216 .657 175	3.671 .522 175	3.441 .445 175	3.466 .352 175	3.563 .313 175	3.523 .287 174	3.480 .236 174	3.430 .172 171	3.410 .120 128	
AUG												
AVE SDEV N	8.853 .763 190	7.556 1.240 184	4.677 1.362 184	4.038 1.348 184	3.738 1.357 182	3.716 1.231 181	3.868 .978 181	3.744 .811 180	3.646 .636 180	3.550 .459 178	3.476 .092 149	
SEP												
AVE SDEV N	8.145 .987 175	7.427 1.058 173	4.566 1.493 174	3.879 1.306 174	3.671 1.260 174	3.811 1.096 174	3.864 .915 174	3.737 .776 174	3.637 .634 172	3.543 .501 162	3.465 .258 124	
OCT												
AVE SDEV N	6.465 .885 115	6.358 .917 115	5.734 1.090 115	4.498 .919 115	3.757 .584 114	3.650 .286 112	3.692 .238 108	3.596 .217 108	3.534 .201 107	3.472 .164 104	3.425 .143 72	
NOV												
AVE SDEV N	4.453 .688 108	4.441 .683 108	4.414 .664 108	4.096 .566 108	3.775 .511 108	3.663 .344 108	3.817 .206 108	3.698 .189 102	3.609 .172 99	3.526 .129 96	3.481 .087 78	
DEC												
AVE SDEV N	3.514 .638 91	3.510 .633 91	3.514 .622 91	3.527 .622 90	3.578 .614 90	3.684 .309 91	3.739 .182 90	3.642 .172 89	3.575 .163 85	3.497 .124 80	3.493 .074 68	

MONTHLY BOTTLE DATA STATISTICS FOR OWS - BRAVO

<u>PARAMETER</u>	<u>SALINITY</u>											
DEPTH	0	25	50	75	100	200	400	600	800	1000	1500	
JAN												
AVE N	34.595 .155 113	34.594 .156 114	34.598 .153 115	34.605 .150 115	34.617 .145 115	34.771 .085 115	34.869 .022 112	34.880 .018 110	34.883 .019 108	34.886 .017 104	34.901 .019 64	
FEB												
AVE N	34.566 .160 74	34.576 .158 76	34.578 .157 77	34.589 .156 77	34.597 .155 77	34.743 .101 76	34.863 .046 75	34.884 .025 74	34.889 .025 71	34.889 .021 70	34.910 .020 51	
MAR												
AVE N	34.611 .163 140	34.616 .155 142	34.620 .152 142	34.627 .146 141	34.638 .141 141	34.747 .090 141	34.860 .039 138	34.872 .031 139	34.876 .030 137	34.876 .025 134	34.900 .026 108	
APR												
AVE N	34.604 .162 224	34.613 .159 224	34.626 .156 223	34.643 .151 223	34.661 .144 222	34.764 .088 221	34.857 .038 221	34.867 .035 218	34.871 .031 217	34.872 .029 213	34.903 .021 165	
MAY												
AVE N	34.560 .157 236	34.583 .141 236	34.614 .132 236	34.642 .126 236	34.667 .123 236	34.764 .078 235	34.858 .035 233	34.868 .035 233	34.873 .032 232	34.875 .029 221	34.899 .032 180	
JUN												
AVE N	34.467 .195 222	34.494 .186 218	34.563 .146 218	34.608 .132 218	34.642 .127 218	34.755 .076 217	34.863 .031 217	34.873 .031 216	34.877 .029 213	34.877 .025 210	34.902 .027 178	
JUL												
AVE N	34.379 .286 180	34.467 .217 175	34.589 .145 175	34.656 .123 175	34.695 .120 175	34.791 .079 175	34.850 .042 175	34.859 .038 174	34.865 .034 174	34.867 .027 171	34.885 .026 128	
AUG												
AVE N	34.345 .175 190	34.403 .159 184	34.535 .159 184	34.602 .149 184	34.643 .155 182	34.750 .144 181	34.848 .121 181	34.859 .102 180	34.865 .081 180	34.869 .060 178	34.904 .020 149	
SEP												
AVE N	34.238 .133 175	34.281 .133 173	34.467 .152 174	34.574 .150 174	34.624 .158 174	34.759 .150 174	34.833 .135 174	34.844 .116 174	34.852 .097 172	34.855 .078 162	34.890 .049 124	
OCT												
AVE N	34.335 .201 115	34.359 .192 115	34.445 .191 115	34.585 .145 115	34.666 .120 114	34.789 .062 112	34.862 .023 108	34.871 .023 108	34.876 .025 107	34.879 .022 104	34.899 .026 72	
NOV												
AVE N	34.341 .172 108	34.347 .171 108	34.363 .163 108	34.475 .159 108	34.601 .144 108	34.774 .070 108	34.867 .022 108	34.878 .022 102	34.883 .025 99	34.882 .023 96	34.904 .025 78	
DEC												
AVE N	34.445 .136 91	34.443 .125 91	34.448 .120 91	34.468 .122 90	34.563 .125 90	34.772 .062 91	34.864 .029 90	34.874 .029 89	34.877 .025 85	34.877 .023 80	34.900 .021 68	

MONTHLY BOTTLE DATA STATISTICS FOR OWS - BRAVO

DEPTH	PARAMETER : SIG-THETA											
	0	25	50	75	100	200	400	600	800	1000	1500	
JAN												
AVE	27.574	27.573	27.576	27.581	27.587	27.659	27.722	27.744	27.756	27.766	27.786	
SDEV	.079	.080	.078	.074	.069	.038	.022	.017	.014	.012	.011	.64
N	113	114	115	115	115	115	112	110	108	104		
FEB												
AVE	27.604	27.609	27.610	27.615	27.619	27.669	27.721	27.742	27.756	27.764	27.787	
SDEV	.087	.082	.081	.079	.078	.052	.024	.016	.013	.010	.011	.51
N	74	76	77	77	77	76	75	74	71	70		
MAR												
AVE	27.629	27.632	27.636	27.641	27.648	27.690	27.737	27.753	27.761	27.767	27.786	
SDEV	.093	.089	.086	.082	.077	.051	.019	.013	.011	.011	.011	.108
N	140	142	142	141	141	141	138	139	137	134		
APR												
AVE	27.610	27.619	27.631	27.642	27.655	27.697	27.736	27.750	27.758	27.764	27.786	
SDEV	.107	.104	.098	.091	.081	.052	.026	.020	.017	.016	.014	.165
N	224	224	223	223	222	221	221	218	217	213		
MAY												
AVE	27.500	27.537	27.577	27.610	27.637	27.689	27.735	27.752	27.761	27.768	27.788	
SDEV	.122	.101	.096	.087	.078	.049	.019	.015	.010	.009	.014	.180
N	236	236	236	236	236	235	233	233	232	221		
JUN												
AVE	27.314	27.369	27.478	27.550	27.600	27.679	27.731	27.748	27.758	27.764	27.784	
SDEV	.155	.141	.116	.099	.087	.049	.019	.012	.009	.009	.011	.178
N	222	218	218	218	218	217	216	216	213	210		
JUL												
AVE	26.909	27.134	27.454	27.565	27.620	27.694	27.732	27.743	27.752	27.759	27.776	
SDEV	.256	.182	.110	.096	.095	.072	.053	.042	.033	.024	.014	.128
N	180	175	175	175	175	175	174	174	171			
AUG												
AVE	26.646	26.877	27.353	27.476	27.539	27.628	27.693	27.715	27.732	27.745	27.784	
SDEV	.185	.235	.257	.263	.271	.262	.228	.189	.149	.108	.011	.149
N	190	184	184	184	182	181	181	180	180	178		
SEP												
AVE	26.669	26.803	27.309	27.471	27.532	27.627	27.682	27.705	27.722	27.735	27.773	
SDEV	.195	.204	.272	.259	.262	.255	.225	.190	.156	.124	.064	.124
N	175	173	174	174	174	174	174	174	172	162		
OCT												
AVE	26.984	27.016	27.161	27.415	27.564	27.675	27.729	27.746	27.756	27.764	27.785	
SDEV	.153	.152	.209	.115	.151	.088	.039	.017	.014	.012	.011	.72
N	115	115	115	115	114	112	108	108	107	104		
NOV												
AVE	27.233	27.239	27.254	27.378	27.511	27.661	27.720	27.741	27.754	27.761	27.783	
SDEV	.152	.152	.142	.127	.106	.037	.018	.016	.014	.013	.015	.78
N	108	108	108	108	108	108	108	102	99	96		
DEC												
AVE	27.413	27.411	27.415	27.430	27.500	27.658	27.726	27.743	27.753	27.761	27.780	
SDEV	.129	.118	.115	.116	.108	.052	.026	.021	.018	.016	.013	.68
N	91	91	91	90	90	91	89	85	80			

MONTHLY BOTTLE DATA STATISTICS FOR OWS - CHARLIE

DEPTH	PARAMETER : THETA											
	0	25	50	75	100	200	400	600	800	1000	1500	
JAN												
AVE N	6.608 .895 49	6.627 .865 48	6.564 .759 48	6.425 .533 48	6.286 .497 48	5.504 .474 47	4.720 .298 47	4.216 .159 47	3.896 .095 45	3.697 .064 42	3.416 .034 31	
FEB												
AVE N	5.964 .457 76	5.971 .441 74	5.958 .411 74	5.954 .383 74	5.942 .370 74	5.750 .319 74	4.943 .254 74	4.348 .162 74	3.948 .099 72	3.712 .064 70	3.403 .031 58	
MAR												
AVE N	5.967 .779 109	5.923 .750 110	5.825 .687 110	5.675 .603 110	5.575 .548 110	5.406 .565 108	4.758 .285 108	4.272 .173 108	3.945 .106 107	3.736 .062 106	3.443 .046 88	
APR												
AVE N	6.533 .505 144	6.457 .511 142	6.326 .482 142	6.164 .459 142	5.998 .450 142	5.795 .505 143	4.867 .238 143	4.310 .150 141	3.937 .114 138	3.703 .088 137	3.398 .061 112	
MAY												
AVE N	7.338 .813 161	7.107 .747 158	6.652 .709 159	6.110 .563 159	5.851 .570 159	5.526 .588 158	4.838 .270 156	4.332 .155 156	3.969 .103 150	3.739 .072 140	3.416 .053 118	
JUN												
AVE N	8.767 .868 188	8.242 .798 188	7.291 .913 188	6.473 .896 188	6.004 .803 188	5.323 .590 186	4.737 .394 186	4.253 .255 186	3.945 .187 185	3.754 .134 183	3.450 .063 152	
JUL												
AVE N	10.415 .963 149	9.258 .873 147	7.391 .659 147	6.284 .557 147	5.794 .516 147	5.458 .645 146	4.749 .336 146	4.246 .217 146	3.912 .135 143	3.703 .094 137	3.398 .053 98	
AUG												
AVE N	11.391 .611 168	10.251 1.221 163	7.498 1.209 163	6.223 .809 163	5.746 .730 163	5.351 .790 163	4.764 .431 163	4.290 .200 162	3.946 .130 160	3.725 .088 158	3.399 .053 136	
SEP												
AVE N	11.164 .536 120	10.634 1.114 96	8.615 1.592 96	6.609 .980 95	5.914 .913 95	5.335 .909 95	4.748 .654 92	4.303 .470 90	3.986 .365 88	3.765 .275 86	3.436 .130 65	
OCT												
AVE N	9.587 .581 144	9.543 .554 143	9.123 .744 143	7.148 .946 143	6.281 .731 143	5.490 .585 143	4.833 .365 141	4.312 .201 140	3.977 .133 140	3.973 2.667 137	3.411 .061 124	
NOV												
AVE N	8.260 .508 79	8.188 .516 77	8.089 .505 77	7.519 .719 77	6.815 .764 77	5.763 .619 77	5.040 .468 76	4.449 .324 74	4.036 .242 74	3.779 .182 74	3.403 .057 55	
DEC												
AVE N	7.066 .746 47	7.025 .714 47	7.004 .663 47	6.884 .607 47	6.616 .684 47	5.557 .631 47	4.843 .435 46	4.288 .222 45	3.959 .137 44	3.746 .096 44	3.458 .092 23	

## MONTHLY BOTTLE DATA STATISTICS FOR OWS - CHARLIE

PARAMETER :	SALINITY												
DEPTH	0	25	50	75	100	200	400	600	800	1000	1500		
JAN													
AVE	34.624	34.623	34.619	34.619	34.659	34.849	34.932	34.934	34.928	34.927	34.948		
SDEV	.090	.089	.084	.070	.053	.036	.019	.017	.013	.011	.013		
N	59	48	48	48	48	47	47	47	45	42	31		
FEB													
AVE	34.682	34.683	34.688	34.693	34.702	34.847	34.941	34.945	34.935	34.930	34.958		
SDEV	.046	.043	.038	.037	.039	.059	.027	.021	.017	.015	.014		
N	76	74	74	74	74	74	74	74	72	70	58		
MAR													
AVE	34.677	34.679	34.687	34.695	34.714	34.833	34.925	34.931	34.928	34.927	34.949		
SDEV	.045	.047	.050	.055	.057	.062	.026	.018	.016	.013	.014		
N	109	110	110	110	110	108	108	108	107	106	88		
APR													
AVE	34.710	34.719	34.724	34.740	34.759	34.865	34.931	34.939	34.931	34.927	34.952		
SDEV	.100	.058	.058	.058	.061	.062	.024	.019	.017	.016	.016		
N	144	142	142	142	142	143	143	141	138	137	112		
MAY													
AVE	34.706	34.710	34.718	34.736	34.757	34.856	34.927	34.943	34.936	34.932	34.951		
SDEV	.052	.052	.054	.054	.059	.060	.029	.021	.018	.016	.013		
N	161	158	159	159	159	158	156	156	150	140	118		
JUN													
AVE	34.664	34.680	34.719	34.738	34.750	34.820	34.915	34.924	34.921	34.921	34.939		
SDEV	.101	.104	.096	.090	.078	.057	.033	.027	.023	.018	.012		
N	188	188	188	188	188	186	186	186	185	183	152		
JUL													
AVE	34.581	34.606	34.662	34.700	34.727	34.859	34.931	34.936	34.931	34.929	34.948		
SDEV	.080	.064	.052	.053	.052	.073	.038	.023	.020	.018	.018		
N	149	147	147	147	147	146	146	146	143	137	98		
AUG													
AVE	34.529	34.565	34.665	34.718	34.747	34.859	34.934	34.943	34.936	34.933	34.951		
SDEV	.092	.081	.080	.057	.050	.067	.045	.029	.021	.015	.013		
N	168	163	163	163	163	163	163	162	160	158	136		
SEP													
AVE	34.518	34.545	34.622	34.702	34.735	34.840	34.922	34.941	34.938	34.938	34.963		
SDEV	.090	.091	.085	.074	.076	.072	.067	.064	.067	.073	.098		
N	120	96	96	95	95	95	92	90	88	86	65		
OCT													
AVE	34.539	34.551	34.577	34.666	34.726	34.845	34.936	34.947	34.942	34.937	34.954		
SDEV	.097	.091	.084	.073	.065	.054	.031	.022	.018	.016	.017		
N	144	143	143	143	143	143	141	140	137	124			
NOV													
AVE	34.541	34.562	34.590	34.640	34.698	34.852	34.940	34.951	34.943	34.937	34.956		
SDEV	.120	.104	.084	.069	.075	.067	.046	.030	.022	.017	.018		
N	79	77	77	77	77	77	76	74	74	55			
DEC													
AVE	34.543	34.558	34.582	34.610	34.666	34.840	34.928	34.938	34.932	34.929	34.946		
SDEV	.114	.098	.084	.080	.074	.060	.034	.020	.015	.019	.017		
N	47	47	47	47	47	47	46	45	44	23			

MONTHLY BOTTLE DATA STATISTICS FOR OWS - CHARLIE

PARAMETER : SIG-THETA

DEPTH	0	25	50	75	100	200	400	600	800	1000	1500
JAN											
AVE N	27.192 .092 49	27.189 .087 48	27.195 .078 48	27.216 .058 48	27.265 .056 48	27.515 .052 47	27.674 .022 47	27.731 .012 47	27.761 .008 45	27.780 .007 42	27.825 .011 31
FEB											
AVE N	27.326 .077 76	27.326 .072 74	27.331 .069 74	27.336 .067 74	27.345 .066 74	27.483 .029 74	27.656 .020 74	27.726 .013 74	27.761 .011 72	27.782 .011 70	27.834 .012 58
MAR											
AVE N	27.319 .118 109	27.327 .114 110	27.346 .105 110	27.371 .093 110	27.399 .080 110	27.514 .045 108	27.664 .023 108	27.723 .015 108	27.755 .011 107	27.776 .010 106	27.823 .013 88
APR											
AVE N	27.273 .112 144	27.291 .086 142	27.312 .077 142	27.346 .069 142	27.382 .060 142	27.491 .044 143	27.657 .022 143	27.726 .014 141	27.759 .013 138	27.780 .012 137	27.830 .014 112
MAY											
AVE N	27.157 .123 161	27.192 .113 158	27.262 .104 159	27.349 .079 159	27.398 .073 159	27.517 .039 158	27.656 .025 156	27.726 .013 156	27.760 .010 150	27.780 .009 140	27.827 .011 118
JUN											
AVE N	26.908 .156 188	27.002 .129 188	27.172 .113 188	27.300 .099 188	27.371 .086 188	27.513 .058 186	27.658 .046 186	27.720 .035 186	27.750 .028 185	27.770 .022 183	27.814 .012 152
JUL											
AVE N	26.568 .205 149	26.782 .165 147	27.115 .096 147	27.298 .070 147	27.382 .057 147	27.528 .052 146	27.670 .030 146	27.730 .022 146	27.762 .016 143	27.781 .014 137	27.827 .016 98
AUG											
AVE N	26.354 .166 168	26.578 .226 163	27.094 .203 163	27.318 .110 163	27.402 .084 163	27.539 .056 163	27.669 .032 163	27.731 .019 162	27.762 .014 160	27.782 .011 158	27.829 .012 136
SEP											
AVE N	26.389 .137 120	26.498 .217 96	26.885 .284 96	27.249 .158 95	27.370 .132 95	27.524 .121 95	27.660 .108 92	27.726 .095 90	27.757 .081 88	27.781 .071 86	27.835 .066 65
OCT											
AVE N	26.680 .132 144	26.696 .123 143	26.783 .134 143	27.150 .146 143	27.318 .096 143	27.513 .047 143	27.663 .028 141	27.731 .013 140	27.763 .011 140	27.723 .009 137	27.830 .015 124
NOV											
AVE N	26.893 .140 79	26.920 .127 77	26.957 .112 77	27.078 .119 77	27.223 .132 77	27.483 .091 77	27.642 .076 76	27.719 .058 74	27.758 .044 74	27.779 .032 74	27.832 .015 55
DEC											
AVE N	27.068 .141 47	27.085 .124 47	27.107 .098 47	27.146 .081 47	27.225 .089 47	27.500 .067 47	27.656 .041 46	27.727 .020 45	27.757 .016 44	27.777 .015 44	27.819 .017 23

MONTHLY BOTTLE DATA STATISTICS FOR OWS - DELTA

<u>PARAMETER :</u>	<u>THETA</u>											
<u>DEPTH</u>	0	25	50	75	100	200	400	600	800	1000	1500	
JAN												
AVE SDEV N	14.857 .730 46	14.812 .775 45	14.786 .754 45	14.795 .755 45	14.781 .798 45	14.276 .892 44	12.525 1.037 43	9.249 1.207 43	6.480 .812 40	5.231 .474 38	4.023 .200 17	
FEB												
AVE SDEV N	14.488 .247 54	14.475 .279 55	14.459 .328 56	14.462 .339 56	14.456 .343 56	14.338 .461 56	13.417 1.204 56	10.736 1.738 56	7.290 1.027 56	5.333 .445 54	4.086 .126 41	
MAR												
AVE SDEV N	14.248 .796 61	14.215 .805 60	14.184 .811 60	14.137 .793 60	14.094 .790 60	13.836 .778 59	12.524 1.187 57	9.373 1.198 55	6.618 .965 53	5.291 .819 51	4.020 .303 22	
APR												
AVE SDEV N	13.955 .920 92	13.896 .899 92	13.844 .846 93	13.809 .695 93	13.755 .669 93	13.426 .685 93	11.620 1.187 92	7.998 .974 92	5.731 .386 91	4.794 .219 87	3.841 .099 68	
MAY												
AVE SDEV N	14.859 .754 103	14.612 .645 105	14.386 .657 105	14.251 .584 105	14.128 .505 105	13.678 .458 105	11.892 .919 102	8.464 .978 101	6.080 .794 100	4.995 .583 98	3.883 .131 63	
JUN												
AVE SDEV N	.16.195 1.006 98	15.688 .790 96	14.875 .832 99	14.623 .773 99	14.377 .796 99	13.743 .652 99	11.941 1.658 97	8.840 1.492 94	6.383 .926 89	5.140 .655 88	3.913 .120 57	
JUL												
AVE SDEV N	18.588 2.289 123	17.722 1.594 122	15.978 1.360 123	15.288 1.021 123	14.937 .906 123	14.021 .920 123	12.120 1.354 123	8.778 1.335 122	6.313 .859 120	5.169 .505 118	3.958 .337 82	
AUG												
AVE SDEV N	19.378 1.573 103	18.532 1.537 107	16.335 1.402 107	15.557 1.235 107	15.074 1.185 107	14.069 1.122 107	12.079 1.319 107	8.700 1.309 107	6.308 .864 107	5.114 .446 105	3.927 .153 76	
SEP												
AVE SDEV N	20.225 2.004 94	19.869 1.877 96	17.759 1.504 96	16.592 1.207 96	15.977 1.113 96	14.396 .703 96	12.023 .846 96	8.552 1.134 96	6.141 .781 95	4.953 .344 94	3.913 .126 59	
OCT												
AVE SDEV N	17.805 1.086 125	17.826 1.163 124	17.571 1.065 126	16.430 1.257 126	15.425 1.386 125	13.980 1.038 124	11.609 1.104 124	8.323 1.233 124	6.242 .961 122	5.195 .725 118	3.877 .158 85	
NOV												
AVE SDEV N	16.534 .883 96	16.618 1.179 52	16.388 1.039 52	16.065 1.023 52	15.350 1.181 52	13.846 1.010 51	11.189 1.245 51	7.886 1.286 51	5.942 .832 50	4.998 .559 49	3.874 .134 28	
DEC												
AVE SDEV N	.15.405 1.240 70	15.536 1.169 66	15.544 1.130 66	15.453 1.051 66	15.321 1.053 66	14.354 .825 66	12.324 1.085 66	9.122 1.401 66	6.488 .926 62	5.189 .516 61	3.910 .147 36	

MONTHLY BOTTLE DATA STATISTICS FOR OWS - DELTA

<u>PARAMETER</u>	<u>SALINITY</u>											
<u>DEPTH</u>	0	25	50	75	100	200	400	600	800	1000	1500	
JAN												
AVE SDEV N	35.836 .194 46	35.832 .194 45	35.829 .193 45	35.848 .174 45	35.873 .161 45	35.884 .153 44	35.644 .167 43	35.220 .148 43	35.041 .078 40	35.012 .042 38	34.966 .020 17	
FEB												
AVE SDEV N	35.949 .062 54	35.953 .061 55	35.955 .062 56	35.959 .063 56	35.961 .063 56	35.946 .088 56	35.792 .209 56	35.412 .212 56	35.069 .053 56	34.996 .040 54	34.989 .034 41	
MAR												
AVE SDEV N	35.902 .132 61	35.900 .134 60	35.900 .128 60	35.899 .124 60	35.895 .122 60	35.865 .120 59	35.671 .183 57	35.243 .212 55	35.059 .134 53	35.016 .100 51	34.955 .038 22	
APR												
AVE SDEV N	35.834 .262 92	35.852 .215 92	35.857 .182 93	35.862 .131 93	35.858 .123 93	35.807 .127 93	35.500 .186 92	35.077 .105 92	34.985 .042 91	34.979 .028 87	34.946 .018 68	
MAY												
AVE SDEV N	35.908 .120 103	35.914 .124 105	35.908 .119 105	35.905 .105 105	35.900 .094 105	35.845 .092 105	35.557 .160 102	35.169 .164 101	35.039 .102 100	35.007 .065 98	34.954 .026 63	
JUN												
AVE SDEV N	35.706 .301 98	35.805 .242 96	35.873 .228 99	35.891 .229 99	35.879 .227 99	35.819 .198 99	35.562 .274 97	35.186 .154 94	35.030 .068 89	35.000 .046 88	34.955 .018 57	
JUL												
AVE SDEV N	35.420 .627 123	35.780 .281 122	35.948 .266 123	35.977 .211 123	35.968 .181 123	35.862 .177 123	35.582 .211 123	35.182 .141 122	35.050 .079 120	35.024 .048 118	34.960 .018 82	
AUG												
AVE SDEV N	35.395 .348 103	35.610 .286 107	35.967 .266 107	36.023 .229 107	36.000 .224 107	35.886 .192 107	35.571 .191 107	35.169 .141 107	35.058 .074 107	35.020 .046 105	34.961 .020 76	
SEP												
AVE SDEV N	35.340 .412 94	35.499 .345 96	35.983 .250 96	36.105 .191 96	36.114 .192 96	35.895 .116 96	35.546 .143 96	35.140 .127 96	35.022 .062 95	34.998 .034 94	34.955 .019 59	
OCT												
AVE SDEV N	35.444 .374 125	35.518 .283 124	35.662 .263 126	35.922 .264 126	35.969 .262 125	35.826 .203 124	35.488 .177 124	35.137 .122 124	35.060 .083 122	35.038 .061 118	34.962 .023 85	
NOV												
AVE SDEV N	35.738 .220 96	35.668 .206 52	35.696 .232 52	35.839 .256 52	35.946 .234 52	35.822 .152 51	35.437 .192 51	35.099 .146 51	35.041 .077 50	35.014 .051 49	34.957 .029 28	
DEC												
AVE SDEV N	35.667 .330 70	35.717 .262 66	35.794 .171 66	35.847 .152 66	35.895 .162 66	35.892 .161 66	35.611 .176 66	35.208 .170 66	35.043 .084 62	35.011 .064 61	34.951 .035 36	

MONTHLY BOTTLE DATA STATISTICS FOR OWS - DELTA

<u>PARAMETER</u>	<u>SIG-THETA</u>											
DEPTH	0	25	50	75	100	200	400	600	800	1000	1500	
JAN												
AVE	26.662	26.668	26.672	26.685	26.707	26.824	26.997	27.253	27.534	27.674	27.777	
SDEV	.182	.190	.182	.169	.150	.092	.094	.099	.073	.043	.020	
N	46	45	45	45	45	44	43	43	40	38	17	
FEB												
AVE	26.832	26.837	26.843	26.845	26.848	26.861	26.930	27.144	27.444	27.650	27.789	
SDEV	.041	.031	.035	.036	.036	.040	.084	.142	.113	.050	.021	
N	54	55	56	56	56	56	56	56	56	54	41	
MAR												
AVE	26.845	26.850	26.856	26.865	26.871	26.901	27.010	27.244	27.518	27.658	27.762	
SDEV	.080	.079	.082	.080	.080	.082	.082	.116	.153	.091	.074	
N	61	60	60	60	60	59	57	55	53	51	22	
APR												
AVE	26.853	26.880	26.896	26.908	26.916	26.945	27.058	27.344	27.593	27.702	27.780	
SDEV	.110	.084	.071	.067	.065	.057	.077	.083	.046	.025	.009	
N	92	92	93	93	93	93	92	92	91	87	66	
MAY												
AVE	26.717	26.776	26.821	26.848	26.870	26.923	27.053	27.343	27.583	27.696	27.782	
SDEV	.171	.111	.090	.079	.069	.053	.069	.097	.069	.052	.015	
N	103	105	105	105	105	105	102	101	100	98	63	
JUN												
AVE	26.258	26.451	26.685	26.754	26.798	26.886	27.033	27.285	27.532	27.670	27.779	
SDEV	.320	.238	.155	.142	.140	.125	.125	.188	.167	.137	.015	
N	98	96	99	99	99	99	97	94	89	88	57	
JUL												
AVE	25.441	25.941	26.488	26.671	26.745	26.860	27.024	27.300	27.563	27.691	27.779	
SDEV	.474	.441	.269	.125	.090	.069	.087	.112	.079	.048	.014	
N	123	122	123	123	123	123	123	122	120	118	82	
AUG												
AVE	25.233	25.612	26.420	26.644	26.736	26.867	27.024	27.304	27.571	27.696	27.783	
SDEV	.411	.429	.322	.191	.132	.095	.103	.113	.087	.046	.013	
N	103	107	107	107	107	107	107	107	105	105	76	
SEP												
AVE	24.962	25.178	26.090	26.468	26.620	26.808	27.021	27.306	27.566	27.698	27.780	
SDEV	.438	.408	.311	.194	.126	.078	.065	.100	.081	.033	.012	
N	94	96	96	96	96	96	96	96	95	94	59	
OCT												
AVE	25.672	25.722	25.894	26.361	26.627	26.833	27.040	27.325	27.567	27.687	27.788	
SDEV	.365	.317	.251	.286	.206	.154	.128	.154	.141	.107	.026	
N	125	124	126	126	125	124	124	124	122	118	85	
NOV												
AVE	26.205	26.128	26.204	26.389	26.631	26.865	27.086	27.372	27.603	27.701	27.786	
SDEV	.297	.354	.299	.255	.181	.108	.096	.121	.093	.059	.024	
N	96	52	52	52	52	51	51	51	50	49	28	
DEC												
AVE	26.406	26.415	26.473	26.535	26.601	26.813	27.011	27.265	27.535	27.680	27.777	
SDEV	.356	.321	.270	.227	.186	.082	.086	.106	.075	.035	.020	
N	70	66	66	66	66	66	66	66	62	61	36	

MONTHLY BOTTLE DATA STATISTICS FOR OWS - ECHO

<u>PARAMETER :</u>	THETA											
DEPTH	0	25	50	75	100	200	400	600	800	1000	1500	
JAN												
AVE SDEV N	18.531 .523 88	18.451 .550 71	18.437 .542 72	18.380 .528 72	18.286 .523 71	17.597 .448 71	16.011 .915 70	12.814 1.041 69	9.089 .969 68	6.558 .622 65	4.403 .225 48	
FEB												
AVE SDEV N	17.932 .559 70	17.871 .563 71	17.826 .555 72	17.768 .537 72	17.733 .516 71	17.367 .531 66	15.771 1.057 65	12.593 1.564 64	9.116 1.657 63	6.631 1.022 57	4.342 .348 35	
MAR												
AVE SDEV N	17.520 .478 128	17.422 .492 123	17.347 .485 123	17.274 .476 123	17.221 .470 123	16.931 .487 120	15.476 1.397 117	12.375 1.962 114	8.831 1.815 112	6.409 1.177 110	4.370 .560 67	
APR												
AVE SDEV N	17.785 .619 229	17.540 .520 210	17.337 .438 210	17.207 .382 210	17.125 .343 211	16.933 .302 208	15.820 .670 207	13.055 .983 206	9.123 1.112 203	6.396 .632 200	4.285 .162 165	
MAY												
AVE SDEV N	19.114 .829 266	18.402 .669 266	17.754 .460 266	17.439 .353 266	17.292 .315 266	16.943 .303 262	15.750 .744 259	13.094 .933 250	9.252 .970 245	6.524 .599 241	4.338 .160 193	
JUN												
AVE SDEV N	21.511 1.367 230	19.838 1.023 230	17.998 .875 230	17.315 .692 230	17.048 .635 230	16.342 .785 230	14.539 1.467 230	11.603 1.902 229	8.462 1.416 222	6.232 .714 220	4.177 .203 185	
JUL												
AVE SDEV N	24.529 .966 129	22.241 1.177 127	19.335 1.098 127	18.102 .926 126	17.606 .794 126	16.786 .761 124	14.851 1.280 122	11.685 1.566 119	8.368 1.253 115	6.362 .848 103	4.320 .365 63	
AUG												
AVE SDEV N	25.725 .979 126	23.972 1.446 126	20.472 1.275 126	18.729 1.094 126	17.970 .982 126	16.994 .875 126	15.350 1.254 126	12.441 1.433 124	8.970 1.162 124	6.562 .829 119	4.369 .233 68	
SEP												
AVE SDEV N	25.165 1.047 114	24.465 .919 114	21.582 1.364 115	19.464 1.295 115	18.545 1.040 115	17.423 .550 114	16.037 .834 114	13.285 1.038 113	9.619 1.167 113	6.627 .753 116	4.316 .196 87	
OCT												
AVE SDEV N	23.028 1.090 133	22.963 1.141 124	22.164 1.259 124	19.561 .988 124	18.298 .799 123	16.953 .902 123	15.067 1.594 118	11.676 1.809 118	7.899 1.401 116	5.779 .640 117	4.088 .152 82	
NOV												
AVE SDEV N	20.770 .614 103	20.713 .639 99	20.462 .855 99	19.696 1.251 99	18.527 1.187 99	16.918 .795 99	14.909 1.406 99	11.630 1.629 98	8.126 1.058 97	5.984 .552 95	4.153 .149 64	
DEC												
AVE SDEV N	19.789 .837 71	19.636 .789 60	19.597 .779 60	19.431 .776 61	18.864 .840 61	17.217 .747 61	15.062 1.181 59	11.799 1.462 57	8.384 1.006 53	6.253 .424 46	4.313 .251 25	

MONTHLY BOTTLE DATA STATISTICS FOR OWS - ECHO

<u>PARAMETER</u>	<u>SALINITY</u>											
<u>DEPTH</u>	0	25	50	75	100	200	400	600	800	1000	1500	
JAN												
AVE SDEV N	36.401 .051 88	36.416 .050 71	36.416 .049 72	36.415 .047 72	36.419 .048 71	36.430 .060 71	36.195 .148 70	35.685 .152 69	35.258 .099 68	35.128 .057 65	35.029 .031 48	
FEB												
AVE SDEV N	36.406 .072 70	36.407 .070 71	36.406 .069 72	36.406 .065 72	36.404 .062 71	36.384 .073 66	36.161 .176 65	35.672 .220 64	35.299 .169 63	35.147 .095 57	35.025 .044 35	
MAR												
AVE SDEV N	36.391 .070 128	36.388 .067 123	36.386 .062 123	36.383 .063 123	36.381 .062 123	36.360 .075 120	36.135 .257 117	35.650 .304 114	35.256 .183 112	35.119 .113 110	35.026 .055 67	
APR												
AVE SDEV N	36.396 .058 229	36.403 .047 210	36.406 .041 210	36.403 .036 210	36.401 .035 211	36.385 .050 208	36.186 .148 207	35.706 .164 206	35.236 .124 203	35.108 .075 200	35.029 .031 165	
MAY												
AVE SDEV N	36.408 .091 266	36.404 .056 266	36.407 .053 266	36.408 .045 266	36.405 .046 266	36.377 .062 262	36.169 .143 259	35.722 .145 250	35.247 .101 245	35.112 .074 241	35.024 .027 193	
JUN												
AVE SDEV N	36.424 .154 230	36.384 .118 230	36.365 .107 230	36.367 .093 230	36.355 .090 230	36.262 .128 230	35.975 .255 230	35.548 .265 229	35.261 .106 222	35.141 .052 220	35.021 .028 185	
JUL												
AVE SDEV N	36.430 .170 129	36.426 .155 127	36.425 .112 127	36.412 .091 126	36.405 .085 126	36.323 .104 124	36.012 .218 122	35.557 .209 119	35.242 .118 115	35.147 .072 103	35.024 .037 63	
AUG												
AVE SDEV N	36.311 .221 126	36.357 .151 126	36.418 .098 126	36.428 .087 126	36.423 .082 126	36.349 .110 126	36.094 .212 126	35.660 .182 124	35.291 .094 124	35.141 .074 119	35.032 .026 68	
SEP												
AVE SDEV N	36.117 .274 114	36.170 .266 114	36.345 .173 115	36.436 .104 115	36.463 .075 115	36.428 .075 114	36.212 .162 114	35.763 .158 113	35.324 .123 113	35.131 .074 116	35.019 .023 87	
OCT												
AVE SDEV N	36.134 .204 133	36.179 .163 124	36.280 .136 124	36.376 .169 124	36.406 .148 123	36.347 .166 123	36.047 .277 118	35.538 .236 118	35.174 .108 116	35.081 .041 117	35.003 .025 82	
NOV												
AVE SDEV N	36.319 .095 103	36.323 .095 99	36.328 .086 99	36.362 .088 99	36.420 .099 99	36.349 .141 99	36.031 .255 99	35.541 .209 98	35.213 .085 97	35.119 .077 95	35.024 .050 64	
DEC												
AVE SDEV N	36.335 .065 71	36.342 .071 60	36.347 .073 60	36.366 .074 61	36.393 .071 61	36.377 .097 61	36.045 .186 59	35.559 .190 57	35.219 .080 53	35.117 .053 46	35.015 .023 25	

MONTHLY BOTTLE DATA STATISTICS FOR OWS - ECHO

<u>PARAMETER</u> : SIG-THETA	DEPTH	0	25	50	75	100	200	400	600	800	1000	1500
	JAN											
AVE	26.227	26.258	26.262	26.276	26.302	26.482	26.676	26.967	27.312	27.596	27.786	
SDEV	.130	.128	.126	.123	.118	.084	.097	.090	.097	.060	.025	.025
N	88	71	72	72	71	71	70	69	68	65	48	48
	FEB											
AVE	26.381	26.397	26.407	26.421	26.429	26.502	26.701	26.992	27.324	27.591	27.787	
SDEV	.113	.116	.116	.113	.111	.091	.103	.136	.154	.096	.024	.024
N	70	71	72	72	71	66	65	64	63	57	35	35
	MAR											
AVE	26.471	26.492	26.509	26.524	26.535	26.586	26.739	27.005	27.330	27.593	27.781	
SDEV	.107	.108	.108	.104	.101	.080	.116	.173	.170	.115	.052	.052
N	128	123	123	123	123	120	117	114	112	110	67	67
	APR											
AVE	26.410	26.475	26.527	26.557	26.575	26.609	26.715	26.940	27.292	27.602	27.799	
SDEV	.151	.123	.101	.090	.082	.064	.080	.103	.108	.066	.026	.026
N	229	210	210	210	211	208	207	206	203	200	165	165
	MAY											
AVE	26.082	26.260	26.425	26.504	26.538	26.601	26.718	26.944	27.280	27.588	27.790	
SDEV	.223	.169	.112	.082	.071	.053	.065	.084	.097	.065	.017	.017
N	266	266	266	266	266	262	259	250	245	241	193	193
	JUN											
AVE	25.447	25.871	26.330	26.501	26.558	26.652	26.830	27.088	27.413	27.649	27.804	
SDEV	.363	.247	.172	.230	.115	.096	.093	.131	.166	.158	.080	.018
N	230	230	230	230	230	230	230	229	222	220	185	185
	JUL											
AVE	24.581	25.243	26.033	26.339	26.458	26.593	26.790	27.078	27.409	27.632	27.788	
SDEV	.276	.317	.257	.127	.216	.185	.147	.129	.141	.115	.087	.032
N	129	127	127	127	126	126	124	119	115	103	63	63
	AUG											
AVE	24.125	24.684	25.722	26.191	26.379	26.560	26.740	27.012	27.345	27.597	27.790	
SDEV	.335	.445	.356	.126	.304	.278	.235	.187	.181	.161	.022	.022
N	126	126	126	126	126	126	124	124	124	119	68	68
	SEP											
AVE	24.150	24.401	25.364	26.007	26.267	26.521	26.681	26.931	27.269	27.585	27.788	
SDEV	.311	.305	.154	.115	.377	.288	.178	.120	.101	.081	.021	.021
N	114	114	115	115	115	114	114	113	113	116	87	87
	OCT											
AVE	24.800	24.852	25.154	25.938	26.287	26.572	26.767	27.062	27.424	27.661	27.799	
SDEV	.395	.381	.399	.124	.252	.133	.123	.136	.156	.141	.077	.025
N	133	124	124	124	124	123	123	118	118	116	82	82
	NOV											
AVE	25.577	25.595	25.665	25.891	26.237	26.582	26.793	27.077	27.429	27.666	27.809	
SDEV	.154	.156	.227	.99	.332	.292	.095	.120	.152	.122	.061	.037
N	103	99	99	99	99	99	99	98	97	95	64	64
	DEC											
AVE	25.850	25.896	25.910	25.968	26.133	26.532	26.771	27.059	27.390	27.627	27.782	
SDEV	.227	.210	.203	.60	.198	.210	.119	.125	.137	.118	.063	.025
N	71	60	60	61	61	61	61	59	57	53	46	25