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OREGON STATE UNIVERSITY

Inshore Sea Surface Temperature and Salinity Conditions at Agate Beach, Yaquina Bay and Whale Cove, Oregon, in 1970. A Technical Report to the Office of Naval Research.

By
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Alan B. Thum
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Office of Naval Research
Contract N00014-67-A-0369-0001
Project NR 104 936

Data Report No. 45 Reference 70-44
November 1970

DEPARTMENT OF OCEANOGRAPHY
SCHOOL OF SCIENCE

OREGON STATE UNIVERSITY
Corvallis, Oregon 97331

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J. W. Hedgpeth, Principal Investigator
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John V. Byrne, Chairman
Department of Oceanography

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Location of Stations and Instrumentation

Daily Temperature and Salinity observations made in relation to the ecological program (Marine Ecological Studies, NR 104 936) have been made since 1967 at Agate Beach, Oregon. In 1968 an analog recorder was installed at the O.S.U. Marine Science Center floating dock to continuously record sea surface temperature and near surface air temperature, providing more detailed data to supplement the Agate Beach station. The data resulting from these observations and recordings from 1967 through 1969 have been reported in O.S.U. Department of Oceanography Data Reports Nos. 34 and 39. Similar data and observations made using recently installed equipment are given in this report which covers the period January through October, 1970.

A calibrated bucket thermometer, read to the nearest 0.10°C, was used to measure the temperature of the surf at Agate Beach (44°40.3' N, 124°04.5' W), and the salinity of a water sample taken at the same time was determined to 0.01 o/oo by conductance. Daily sampling and measurements were made at Agate Beach between 1500 and 1700 hrs. PDT.

A Rustrak analog strip chart temperature recorder and thermistor probes were used to continuously record the water temperature at 10 cm. depth and at 50 cm. above water level at the Marine Science Center floating dock, approximately one mile from the mouth of Yaquina Bay. The temperatures recorded at the time of the four daily tidal extremes predicted for the location were read from the recordings to the nearest 0.5°C.

In 1969 a system for recording temperature from various intertidal levels was devised and tested by installation on pilings of the laboratory dock. During 1970 this system was modified and permanently installed at rocky intertidal site on Whale Cove, Oregon (44°47.3' N, 124°06.0' W), where it has been in continuous operation since August, 1970. This system, which monitors true air temperature at the substrate surface is relatively simple, sturdy, and reliable. It permits us to examine the intertidal temperature regime under both submerged and exposed conditions, an undertaking never before accomplished. The construction of the system is described below.

Yellow Springs Instrument Company precision thermistors (resistance 3000 ohms at 25°C) were soldered to medium duty multistranded two-lead Cornish Coroprene service cord and housed in machined brass pressure protected thermistor cases (Figure 1). The thermistor is kept in position within the case by a cylindrical plastic insert. The housing is filled with Dow Corning diffusion pump fluid, a silicone oil, to ensure good thermal contact between thermistor and case, and sealed with an "O" ring and threaded nut fitted around the cord.

The thermistors are placed within shields attached along a length of polyvinylchloride pipe (PVC) 3.8 cm (1-1/2 inches) internal diameter, which provides protection for the cords and the desired tidal elevation for

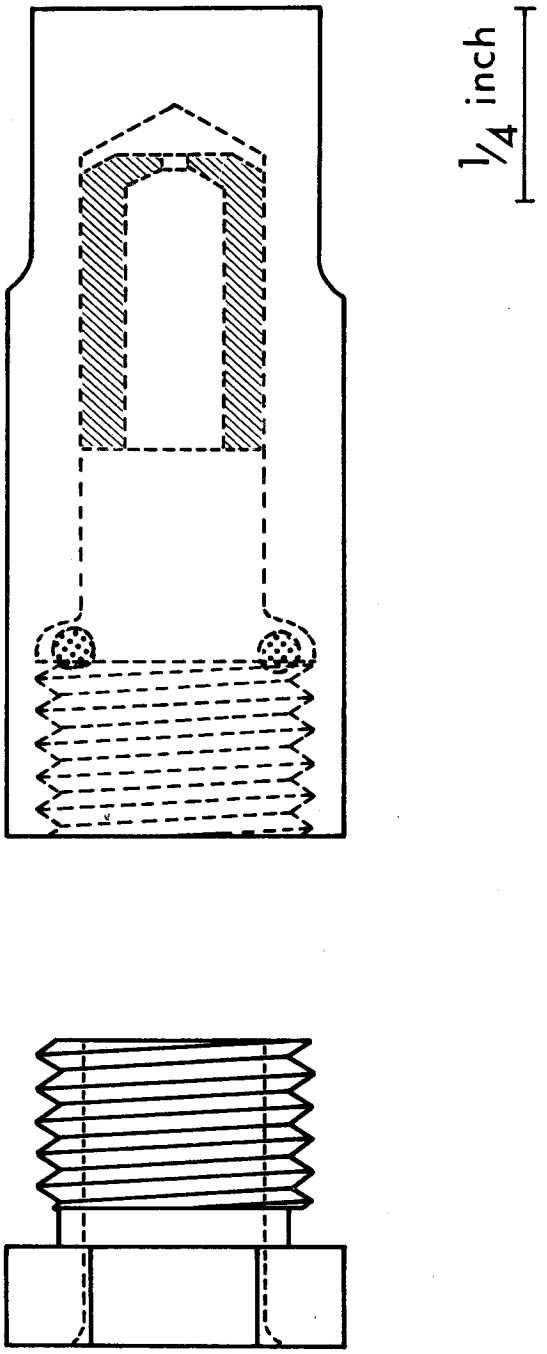

Figure 1. Pressure protected thermistor case with enclosed plastic insert (cross-hatched) and "O" ring (stippled).

the thermistors. At selected tidal levels, the thermistor support pipe is segmented by T junctions, into which 15 cm lengths of PVC pipe are inserted horizontally. These pieces function as both a housing and a shield for each thermistor case (Figure 2). Three series of 1.1 cm (7/16 inch) diameter holes were drilled along the bottom of each shield to permit free air circulation. The thermistor case is fixed in a central position within the shield by a 6.4 cm length of 1.52 cm (6/10 inch) I.D. PVC pipe by means of external support vanes of plexiglass that form a tripod fit within the thermistor shield. The thermistor is held snugly within the tripod brace by flexible plastic tubing. This places the thermistor case approximately three inches from the mouth of the shield. The removable shields were painted white on the outside and black on the inside with several coats of Valspar Poly-Aqua Epoxy Marine Finish to achieve maximal external and minimal internal reflection of light.

Thermistor signals are compared to that in a Wheatstone Bridge (Figure 3). The bridge design allows for maintenance of maximum scale sensitivity of the recorder by incorporating a "winter" (0 - 20°C) and a "summer" (8 - 35°C) temperature range.

The thermistor signal is recorded on an Esterline-Angus Multi-channel Recorder with a ten inch scale span, a 24 channel capacity, and an eight inch per hour chart speed. Appropriate wiring allowed utilization of all channels by the eight thermistors, with each thermistor read at six minute intervals, but under other circumstances many more

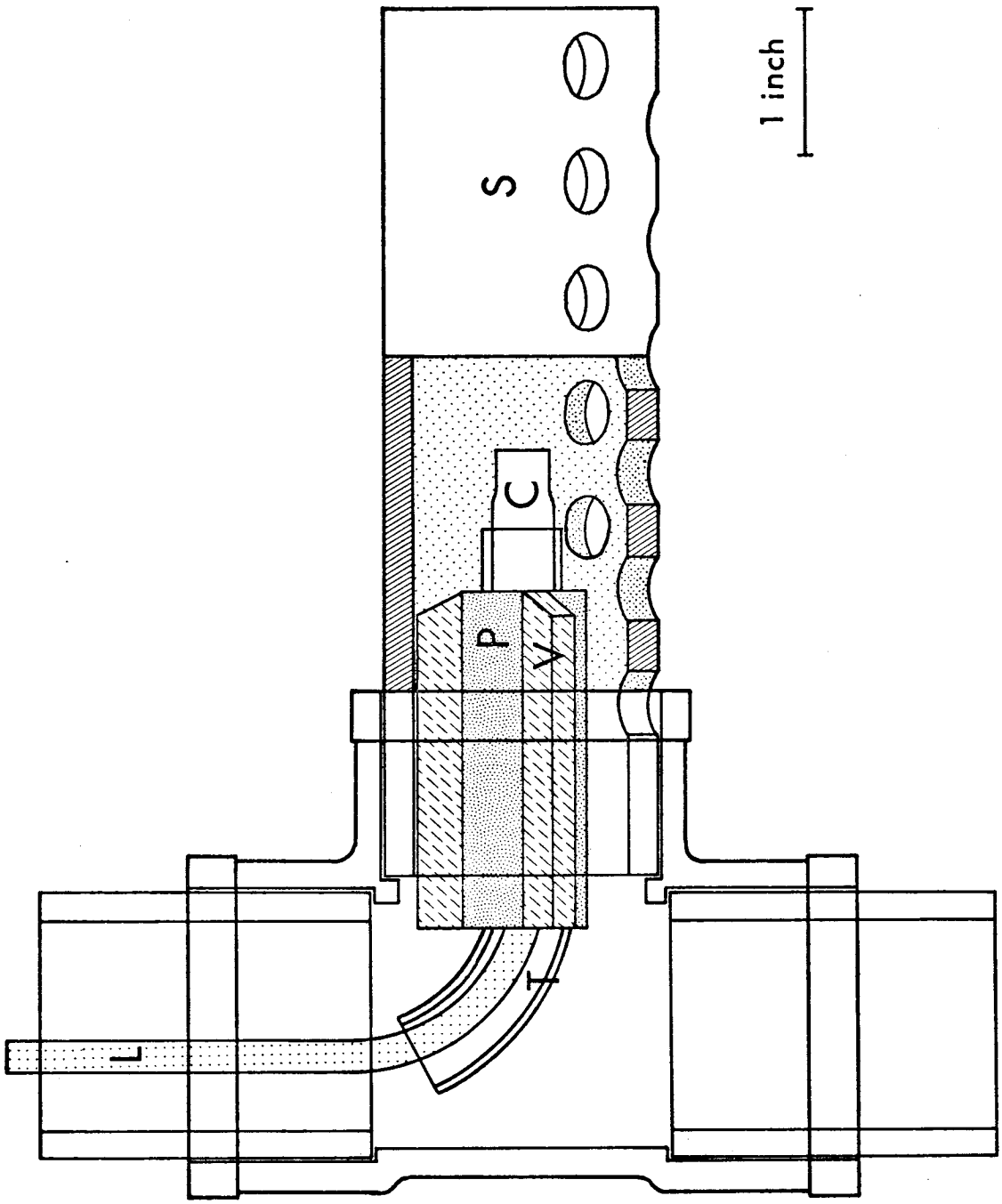

Figure 2. Portion of thermistor chain pipe showing thermistor case (C), tripod support pipe (P), vanes (V), plastic tubing (T), thermistor lead (L), and shield (S).

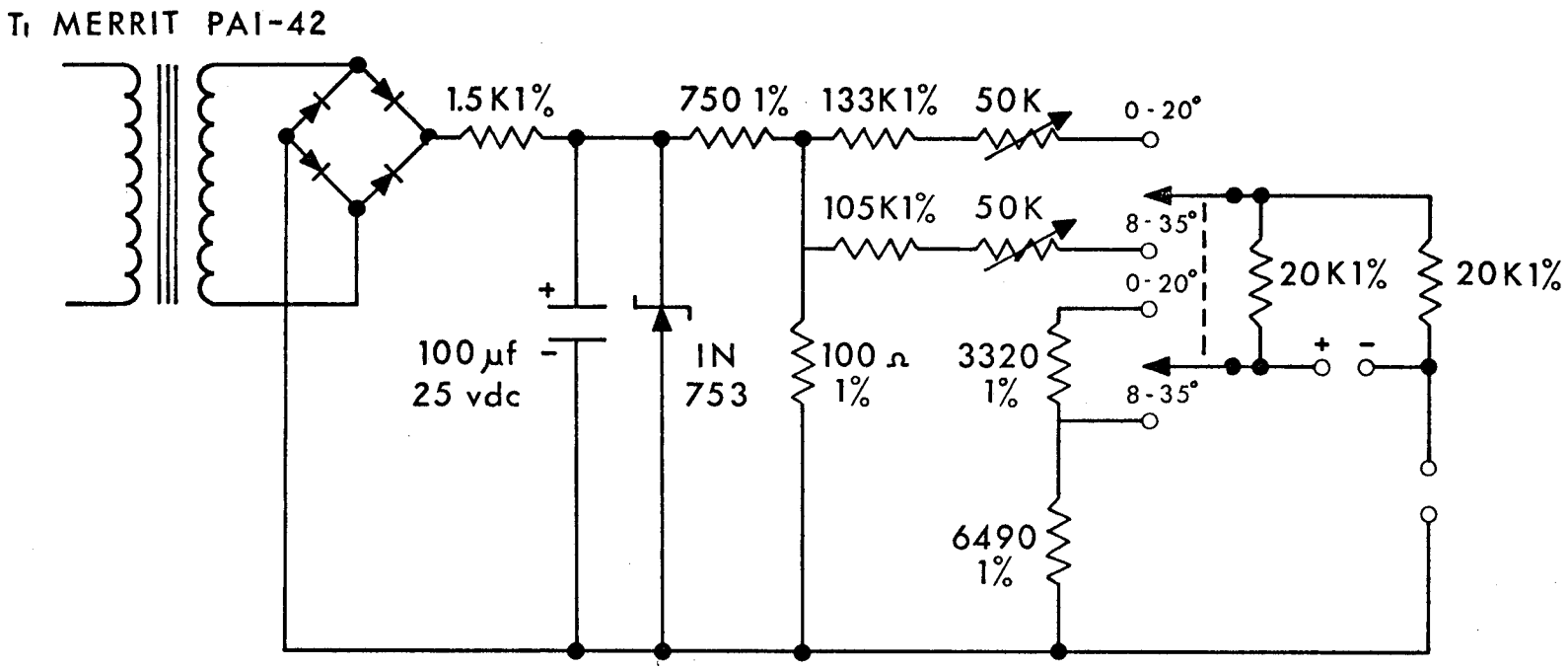

Figure 3. Wheatstone bridge circuit with dual temperature range of 0-20 and 8-35°C. All resistor values in ohms.

thermistors could be read by keeping more or all channels separate. This procedure produces a highly redundant record. However, this type of near-continuous recording is necessary so that data at continuously changing critical periods during tidal exposure is available for selection and detailed analysis. The analog record produced requires manual "reading" of the temperature values. A digital punch tape system and machine tape reading would greatly speed analysis.

The thermistor chain installation is located on a north-facing rock slope near the mouth of Whale Cove, a small embayment opening broadly to the sea. The cove is on the north side of a rocky point and the surrounding high rocky shore line descends steeply to inshore water depths of from 5 to 8 fathoms. The intertidal basaltic rock face to which the thermistor chain is attached slopes at approximately 70°, with slight mid and low tide level wave cut benches. The PVC thermistor support pipe and thermistor housings are tightly fixed to the rock by steel straps attached to lag bolts set into holes bored into the rock. Levels on the rock face were determined with reference to a nearby bench mark by regular surveying methods, and the thermistor housings were placed at levels selected from tide gauge and tidal exposure curve data. Above the intertidal zone, the PVC pipe is attached to a piece of flexible polyethylene pipe, also strapped to the rock, which protects the thermistor leads across the remaining supratidal rock face to the top of the bluff. There, the

leads are connected to a multilead weatherproof cable which runs, buried in soil, to a waterproof instrument housing. The instrument housing is provided with 110V AC line current for the recorder and is kept illuminated and dry inside by a low wattage electric bulb.

Before field installation, the thermistor chain and recorder were assembled in the laboratory and after a 30 minute warm-up period, were calibrated. The thermistors were immersed in a stirred water bath, and the temperature readings on the recorder were compared to that on a YSI telethermometer with its thermistor probe immersed in the same bath. The telethermometer and probe had been previously calibrated in a similar way with a certified standard thermometer. All thermistors of the chain produced readings similar enough to be considered identical to 0.1°C. The recorder has an accuracy of $\pm$0.25% of its 10 inch span, producing a temperature accuracy of better than 0.1°C. When the calibration bath temperature was changed at 1 to 3°C intervals from 1 to 30°C, the recorder deflection was linear. A table of temperature values for 1/10 inch increments of deflection was prepared and this table is used to reduce the recordings to temperature values. After the recorder and thermistor chain were installed in the field, the same telethermometer was used to check the recordings of the probes, which were found not to have changed.

DISCUSSION OF RESULTS

The temperature data from the Agate Beach station (Tables 1 and 2)

Table 1. Daily inshore sea surface temperature and salinity observations at Agate Beach, Oregon, made from January 1 through October 31, 1970.

1970 Date		T.°C.	S o/oo	1970 Date		T.°C.	S o/oo
Jan.	1	9.9	30.875	Feb.	1	10.2	27.087
	2	9.6	30.567		2	10.4	28.261
	3	9.8	30.006		3	10.4	28.836
	4	8.5	31.586		4	10.6	28.451
	5	7.8	31.636		5	10.0	26.259
	6	7.4	30.498		6	10.2	26.084
	7	8.6	31.844		7	11.3	29.290
	8	8.4	30.867		8	11.2	29.650
	9	9.2	30.775		9	10.7	28.079
	10	8.9	26.091		10	11.4	28.507
	11	9.2	32.266		11	11.6	30.046
	12	9.6	31.412		12	11.4	29.609
	13	9.2	31.130		13	11.5	28.446
	14	9.6	28.701		14	10.9	29.628
	15	9.8	31.249		15	11.0	29.350
	16	9.2	26.960		16	11.4	20.742
	17	9.3	28.076		17	11.2	27.599
	18	9.9	21.771		18	11.2	28.541
	19	10.5	16.465		19	11.6	29.460
	20	10.6	27.236		20	11.4	30.333
	21	11.2	27.711		21	11.1	30.528
	22	10.9	22.802		22	11.8	29.148
	23	10.6	27.009		23	12.2	24.781
	24	10.5	27.368		24	11.8	30.606
	25	10.4	25.039		25	11.6	29.969
	26	10.7	25.715		26	11.8	30.443
	27	10.0	27.495		27	11.6	31.044
	28	10.4	28.423		28	11.0	31.590
	29	10.6	28.443				
	30	11.3	26.214				
	31	10.7	25.308				

1970 Date		T.°C.	S o/oo
Mar.	1	11.2	30.763
	2	10.6	30.942
	3	10.8	31.067
	4	10.7	23.520
	5	11.3	26.490
	6	11.6	30.340
	7	11.9	29.105
	8	12.2	30.495
	9	11.8	30.715
	10	11.2	27.598
	11	11.0	28.586
	12	10.7	-
	13	11.3	32.448
	14	11.2	31.525
	15	10.8	17.987
	16	10.7	31.207
	17	11.0	30.734
	18	10.8	31.043
	19	11.6	31.160
	20	11.5	31.504
	21	10.9	32.134
	22	10.7	31.943
	23	11.3	32.294
	24	11.0	32.089
	25	11.7	32.542
	26	11.3	30.771
	27	11.4	33.019
	28	11.2	30.065
	29	11.6	32.446
	30	10.7	32.968
	31	10.8	32.083

1970 Date		T.°C.	S o/oo
Apr.	1	11.6	31.443
	2	11.8	29.526
	7	9.8	31.556
	8	10.3	31.988
	9	11.4	30.683
	10	10.9	33.095
	11	11.6	30.462
	12	10.1	31.504
	13	11.3	33.511
	14	10.3	33.342
	15	12.6	32.631
	16	11.7	32.601
	17	12.6	33.157
	18	9.2	32.005
	19	8.9	32.913
	20	10.6	33.114
	21	11.3	33.186
	22	10.4	32.244
	23	9.7	32.047
	24	9.9	31.696
	25	10.2	31.503
	26	11.3	31.728
	27	11.9	31.383
	28	14.5	28.025
	29	12.0	16.800
	30	13.4	28.007

1970 Date		T.°C.	S o/oo
May	1	13.7	32.198
	2	13.5	32.322
	3	14.8	31.943
	4	12.4	32.439
	5	13.4	31.932
	6	12.3	33.009
	7	12.4	31.627
	8	10.3	32.134
	9	11.4	31.655
	10	10.5	31.482
	11	11.2	31.306
	12	12.4	28.686
	13	12.4	29.740
	14	16.3	29.747
	15	15.3	30.213
	16	13.5	32.110
	17	13.0	33.352
	18	14.4	30.870
	19	12.9	32.921
	20	13.5	30.648
	21	12.0	32.476
	22	12.4	32.169
	23	14.5	33.231
	24	13.3	33.307
	25	16.4	33.792
	26	15.8	33.630
	27	15.4	32.683
	28	13.4	32.810
	29	14.6	33.873
	30	16.4	33.643
	31	18.3	32.017

1970 Date		T.°C.	S o/oo
June	1	16.4	33.140
	2	16.4	33.255
	3	16.7	-
	4	17.4	30.058
	5	15.4	30.011
	6	14.3	33.584
	7	13.0	33.424
	8	14.2	33.101
	9	15.3	32.946
	10	13.4	32.825
	11	15.6	32.145
	12	18.3	32.474
	13	15.2	33.359
	14	11.3	30.836
	15	13.4	-
	16	16.3	33.374
	17	16.4	33.111
	18	14.3	33.507
	19	13.3	33.517
	20	15.2	33.788
	21	10.5	32.907
	22	9.0	33.634
	23	10.7	33.870
	24	8.4	33.789
	25	9.4	33.940
	26	8.4	33.869
	27	11.4	33.784
	28	14.6	32.981
	29	10.7	33.702
	30	11.3	33.466

1970 Date		T.°C.	S o/oo
July	1	13.7	33.324
	2	16.3	33.044
	3	12.2	33.586
	4	14.3	33.506
	5	15.4	33.872
	6	11.9	33.831
	7	-	33.867
	8	-	33.862
	9	-	33.562
	10	-	33.863
	11	-	33.911
	12	-	33.720
	13	-	33.955
	14	-	33.949
	15	12.3	33.759
	16	10.2	33.424
	17	11.4	33.391
	18	13.6	33.712
	19	12.4	33.790
	20	14.4	33.709
	21	16.4	33.763
	22	17.4	33.702
	23	13.4	33.812
	24	14.3	29.786
	25	16.4	33.709
	26	12.2	33.722
	27	13.4	33.431
	28	12.4	33.008
	29	16.3	32.180
	30	14.8	33.689
	31	10.6	33.661

1970 Date		T.°C.	S o/oo
Aug.	1	-	-
	2	11.7	33.777
	3	9.1	33.797
	4	11.3	33.706
	5	12.2	33.728
	6	12.0	33.720
	7	13.5	33.595
	8	13.9	33.545
	9	11.6	33.684
	10	11.0	33.820
	11	-	-
	12	9.6	33.855
	13	10.6	33.850
	14	10.3	33.823
	15	11.0	33.849
	16	10.5	33.756
	17	10.6	33.541
	18	9.3	33.662
	19	8.9	33.773
	20	9.1	33.748
	21	8.3	33.825
	22	9.3	33.845
	23	9.5	33.701
	24	11.3	33.691
	25	12.3	33.717
	26	13.0	33.629
	27	12.3	33.731
	28	12.3	33.673
	29	10.3	33.620
	30	9.3	33.377
	31	10.0	33.474

1970 Date		T.°C.	S o/oo
Sept.	1	-	-
	2	12.3	33.643
	3	12.8	33.169
	4	13.2	33.217
	5	12.0	33.253
	6	12.3	33.044
	7	12.3	33.190
	8	12.9	32.063
	9	12.3	33.524
	10	-	-
	11	12.7	33.464
	12	10.1	33.832
	13	9.6	33.818
	14	11.0	33.328
	15	10.9	33.584
	16	10.9	33.584
	17	10.3	33.523
	18	10.8	33.456
	19	10.9	33.301
	20	12.3	33.111
	21	12.5	33.101
	22	10.8	33.348
	23	12.3	33.641
	24	13.2	33.379
	25	12.0	33.534
	26	12.6	33.655
	27	11.6	33.613
	28	11.1	33.468
	29	11.0	33.203
	30	11.8	33.195

1970 Date		T.°C.	S o/oo
Oct.	1	12.6	33.025
	2	11.7	33.329
	3	10.2	33.454
	4	10.4	33.493
	5	11.3	33.390
	6	-	-
	7	12.3	33.434
	8	12.6	33.419
	9	10.9	31.749
	10	12.1	33.440
	11	11.7	33.483
	12	9.8	33.545
	13	-	-
	14	9.6	33.686
	15	9.5	33.646
	16	9.2	33.466
	17	-	-
	18	11.0	33.216
	19	-	-
	20	10.5	32.887
	21	10.7	32.713
	22	10.6	32.358
	23	-	-
	24	11.1	32.771
	25	10.9	32.712
	26	11.4	32.872
	27	11.2	32.918
	28	11.1	32.903
	29	11.4	32.827
	30	10.8	32.830
	31	12.3	32.812

Table 2. Summary of sea surface temperature conditions at Agate Beach, Oregon, in 1970. Daily measurements combined for 15 day period for statistical analysis. For each month, period 1 is days 1-15, and period 2 is days 16-30(31). Highest, lowest, sample size (N), mean, mean +2x standard error, and mean -2x standard error are given for each period. All temperatures are mid afternoon.

Month	Period	High	Low	N	Mean	Mean +2 SE	Mean -2 SE
Jan. 1970	1	9.9	7.4	15	9.03	9.42	8.64
	2	11.3	9.2	16	10.42	10.71	10.13
Feb.	1	11.6	10.0	15	10.85	11.13	10.58
	2	12.2	11.0	13	11.52	11.70	11.33
Mar.	1	12.2	10.6	15	11.22	11.47	10.97
	2	11.7	10.7	16	11.14	11.32	10.96
Apr.	1	12.6	9.2	14	11.09	11.63	10.54
	2	14.5	8.9	12	11.18	12.10	10.25
May	1	16.3	10.3	15	12.82	13.70	11.94
	2	18.3	12.0	16	14.36	15.21	13.51
June	1	18.3	11.3	15	15.09	16.04	14.13
	2	16.4	8.4	15	11.99	13.44	10.55
July	1	16.3	11.9	7	13.73	15.02	12.44
	2	17.4	10.2	16	13.73	14.81	12.64
Aug.	1	13.9	9.1	13	11.37	12.13	10.61
	2	13.0	8.3	16	10.39	11.12	9.67
Sept.	1	13.2	9.6	13	11.88	12.50	11.25
	2	13.2	10.3	15	11.61	12.05	11.17
Oct.	1	12.6	9.5	13	11.13	11.76	10.50
	2	12.3	9.2	13	10.94	11.32	10.55

continues to demonstrate the variable and unpredictable nature of central Oregon inshore surface temperatures. While all of the observations made to date at this station fall within the 12°C range of from 6.0°C to 18.3°C, the timing of even the extremes is variable as the following tabulation shows. (See also Fig. 4).

	Lowest	Lowest 15 day $\bar{X}$	Highest	Highest 15 day $\bar{X}$
1968	8.1 (Jan.)	8.80 (Jan.)	17.0 (Aug.)	15.85 (Aug.)
1969	6.0 (Jan.)	8.45 (Jan.)	17.1 (July)	14.27 (June)
1970	9.9 (Jan.)	9.03 (Jan.)	18.3 (June)	15.09 (June)

The January period continues to be one of stable low temperatures, but due to the variable nature of coastal upwelling here, other seasonal events are much more variable. As in 1968, seasonal warming in 1970 was interrupted by upwelling in the March-April period with temperatures averaging near 11°C. A second drop in mean temperature occurred in both years in June, but temperatures showed much greater summer period variation in 1970, with both lows of around 9° and highs around 18° recorded, exceeding the summer extremes observed in 1968 and 1969. By contrast, in 1969 only one period (July-August) of low upwelling associated temperature was observed. Salinity observations (Table 3) for 1970 do not differ significantly from the observations of the two previous years.

Only a portion of the extensive data recorded at Whale Cove has been reduced at this time. Table 4 lists the temperatures recorded

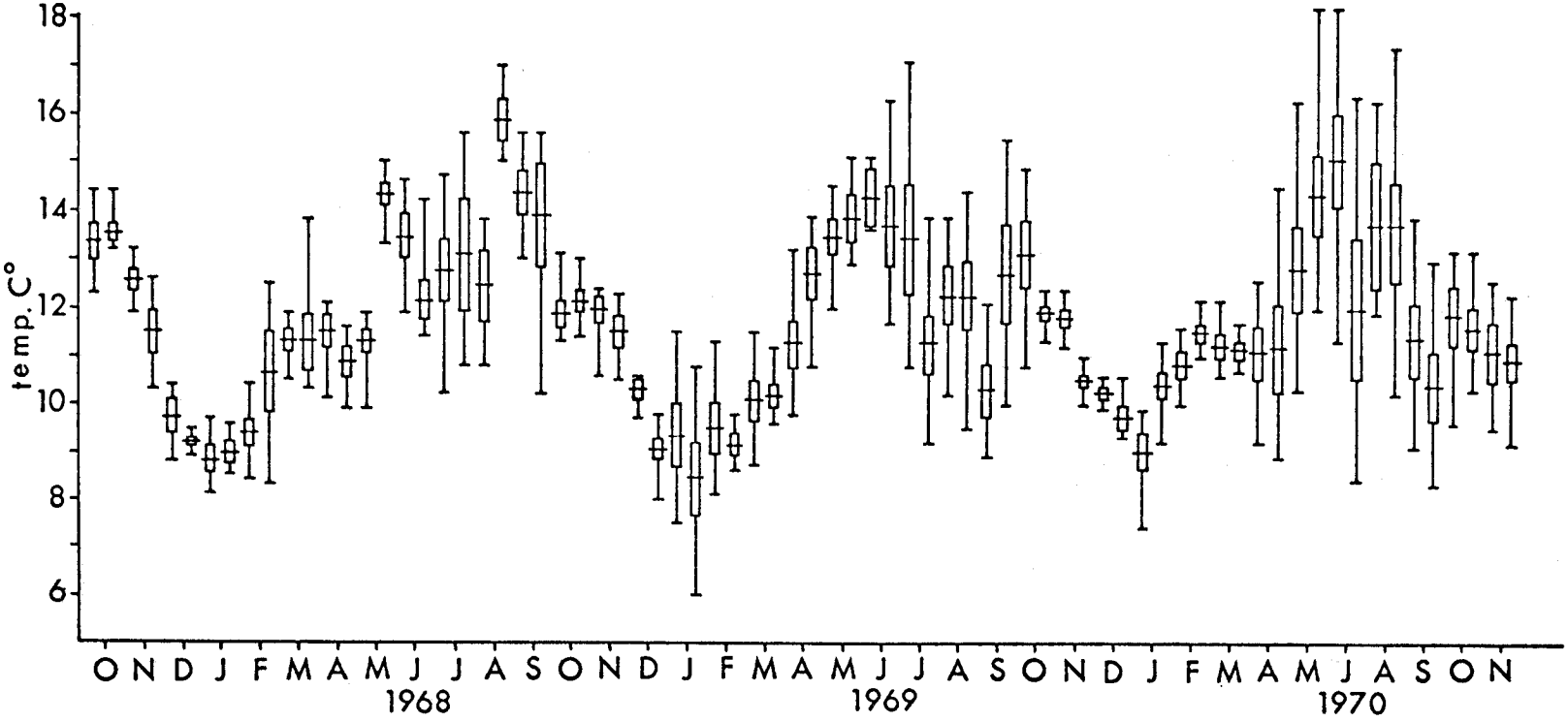

Figure 4. Inshore sea surface temperatures at Agate Beach, Oregon, from October, 1967 through October, 1970. The range, mean, and ±2x standard error are shown for 15 day periods.

Table 3. Summary of sea surface salinity conditions at Agate Beach, Oregon, in 1970. Daily measurements combined for 15 day periods for statistical analysis. For each month, period 1 is days 1-15, and period 2 is days 16-30(31). Highest, lowest, sample size (N) mean, mean +2x standard error, and mean -2x standard error are given for each period. All salinities are mid afternoon.

Month	Period	High	Low	N	Mean	Mean +2 SE	Mean -2 SE
Jan. 1970	1	32.27	26.09	15	30.63	31.42	29.85
	2	28.44	21.77	15	26.37	27.39	25.36
Feb.	1	30.05	26.08	15	28.51	29.13	27.88
	2	31.59	20.74	13	28.83	30.50	27.16
Mar.	1	31.53	17.99	14	28.68	30.75	26.62
	2	33.02	30.07	16	31.75	32.18	31.32
Apr.	1	33.51	29.53	14	31.96	32.60	31.33
	2	33.19	28.01	12	30.22	32.86	27.59
May	1	33.01	28.69	15	31.36	31.99	30.74
	2	33.87	30.65	16	32.72	33.21	32.23
June	1	33.58	30.04	13	32.40	33.10	31.69
	2	33.94	32.91	15	33.55	33.72	33.38
July	1	33.96	33.04	15	33.71	33.84	33.57
	2	33.81	29.79	16	33.28	33.79	32.77
Aug.	1	33.86	33.55	13	33.75	33.80	33.70
	2	33.85	33.38	16	33.67	33.73	33.61
Sept.	1	33.83	32.06	13	33.32	33.57	33.07
	2	33.66	33.10	15	33.41	33.51	33.31
Oct.	1	33.69	31.75	13	33.31	33.59	33.04
	2	33.47	32.36	13	32.87	33.01	32.72

Table 4. Temperature measurements taken by thermistor chain from eight intertidal levels on the rocky shore at Whale Cove, Oregon, coincident with the four semidiurnal tidal extremes. Temperature in °C, tide levels in feet.

WHALE COVE

1970			PROBE LEVEL							
Day	Tide Level	P.S.T.	-2.0	MLLW 0.0	+1.6	+3.0	MSL +4.5	+6	MHW +7.6	MHHW +8.4
Aug. 20	HH	1542	-	-	-	-	-	-	-	-
	LL	0918	-	-	-	-	-	-	-	-
	LH	0312	-	-	-	-	-	-	-	-
	HL	2200	8.2	8.1	10.1	10.25	10.45	10.45	10.45	10.45
21	HH	1618	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
	LL	2254	7.7	7.7	9.2	9.6	9.6	9.6	9.6	9.6
	LH	0406	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
	HL	1000	8.1	8.1	8.1	8.1	10.1	10.65	10.8	11.4
22	HH	1706	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95
	LL	2354	7.95	7.95	10.0	10.2	10.4	10.4	10.4	10.4
	LH	0506	7.35	7.35	7.35	7.35	7.35	7.35	7.35	7.35
	HL	1042	7.7	7.7	7.7	7.7	10.8	10.6	10.8	11.55
23	HH	1754	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
	LL	-	-	-	-	-	-	-	-	-
	LH	0618	7.95	7.7	7.95	7.95	7.95	7.95	7.95	7.95
	HL	1130	8.15	8.15	8.3	8.3	8.3	9.2	10.0	10.4
24	HH	1848	9.0	8.85	9.0	9.0	9.0	9.0	9.0	9.0
	LL	0101	8.3	8.3	9.0	10.2	10.4	10.4	10.4	10.2
	LH	0742	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.65
	HL	1224	8.65	8.65	8.85	8.85	8.85	9.0	9.45	9.6
25	HH	1954	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
	LL	0212	8.85	8.85	10.8	11.3	11.3	11.1	11.3	11.3
	LH	0912	9.0	8.85	9.0	9.0	9.0	9.0	9.0	9.2
	HL	1336	9.45	9.45	9.45	9.45	9.45	9.6	10.6	11.1
26	HH	2106	9.2	9.2	9.2	9.2	9.2	9.45	9.45	9.45
	LL	0324	9.2	9.2	7.2	7.7	7.0	7.0	7.0	7.0
	LH	1030	9.45	9.45	9.45	9.45	9.45	9.45	9.45	9.0
	HL	1500	9.8	9.6	9.8	9.8	9.8	10.2	11.1	11.3
27	HH	2206	9.2	9.2	9.45	9.45	9.45	9.45	9.2	9.2
	LL	0424	9.0	9.0	10.6	10.8	10.8	10.8	10.8	10.8
	LH	1124	9.2	9.2	9.2	9.2	9.2	9.2	9.45	9.8
	HL	1612	9.6	9.6	9.6	9.6	9.6	10.4	10.6	10.8
28	HH	2300	9.8	9.6	9.8	9.8	9.8	9.8	9.8	9.8
	LL	0518	9.2	9.2	10.0	10.0	10.0	10.0	10.0	10.0
	LH	1206	10.2	10.0	10.2	10.2	10.2	10.2	10.2	10.2
	HL	1706	10.4	10.4	10.4	10.4	10.4	11.3	12.0	12.0
29	HH	2348	9.0	8.85	9.0	9.0	9.0	9.0	9.0	9.0
	LL	0554	9.45	9.45	8.65	8.85	8.85	8.85	9.0	9.0
	LH	1230	10.0	10.0	10.2	10.2	10.2	10.2	10.2	10.4
	HL	1748	9.8	9.6	9.8	9.8	11.75	12.4	12.7	12.7
30	HH	-	-	-	-	-	-	-	-	-
	LL	0630	8.5	8.5	9.0	9.45	9.45	9.6	9.6	9.6
	LH	1300	8.65	8.5	8.65	8.65	8.65	8.65	8.65	8.65
	HL	1830	8.3	8.3	8.3	8.3	9.8	10.6	10.6	10.6
31	HH	0024	8.65	8.65	8.65	8.65	8.85	8.85	8.85	8.85
	LL	0700	8.65	8.65	11.1	11.3	11.3	11.55	11.55	11.55
	LH	1324	9.0	8.85	9.0	9.0	9.0	9.0	9.0	9.0
	HL	1906	9.2	9.0	9.2	9.2	9.45	10.0	10.4	10.4

WHALE COVE

1970

Day	Tide Level	P.S.T.	PROBE LEVEL -2.0	MLLW 0.0	+1.6	+3.0	MSL +4.5	+6	MHW +7.6	MHHW +8.4
Sept. 1	HH	0106	9.0	8.85	9.0	9.0	9.0	9.0	9.0	9.0
	LL	0730	9.2	9.0	11.1	11.3	11.3	11.3	11.55	11.55
	LH	1354	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
	HL	1942	9.6	9.6	9.6	11.1	11.75	11.75	11.75	11.75
2	HH	0142	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	LL	0754	9.2	9.0	-	-	-	-	-	-
	LH	1418	10.0	9.8	10.0	10.0	10.0	10.0	10.0	10.0
	HL	2018	10.2	10.2	10.2	11.1	11.1	11.1	11.1	11.1
3	HH	1442	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
	LL	0824	9.8	9.8	9.8	11.75	12.2	12.2	12.2	12.2
	LH	0218	10.2	10.2	10.4	10.4	10.4	10.4	10.4	10.4
	HL	2054	10.0	10.0	10.0	10.6	11.1	11.1	11.1	11.1
4	HH	1506	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
	LL	2130	10.6	10.4	10.6	10.6	10.2	10.0	10.2	10.2
	LH	0300	10.2	10.0	10.2	10.2	10.2	10.2	10.2	10.2
	HL	0854	10.4	10.2	10.4	10.4	10.4	11.1	11.75	12.0
5	HH	1536	10.6	10.6	10.6	10.6	10.6	10.8	10.8	10.8
	LL	2112	10.8	10.6	11.55	11.75	11.75	11.75	11.75	11.75
	LH	0342	10.4	10.4	10.6	10.6	10.6	10.6	10.6	10.6
	HL	0924	10.0	10.0	10.2	10.2	10.2	11.1	11.75	12.0
6	HH	1606	11.55	11.55	11.55	11.55	11.55	11.55	11.55	11.55
	LL	2300	11.3	11.3	11.55	11.55	12.4	13.0	13.0	13.0
	LH	0430	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8
	HL	0948	11.3	11.1	11.3	11.3	11.3	11.75	12.0	12.4
7	HH	1636	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75
	LL	-	-	-	-	-	-	-	-	-
	LH	0530	11.3	11.3	11.55	11.55	11.55	11.55	11.55	11.55
	HL	1030	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75
8	HH	1736	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2
	LL	0001	11.55	11.55	11.55	10.6	9.8	9.8	9.8	9.8
	LH	0642	11.55	11.3	11.55	11.55	11.55	11.55	11.55	11.55
	HL	1118	11.75	11.55	11.75	11.75	11.75	11.75	11.75	11.75
9	HH	1854	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4
	LL	0112	11.3	11.3	8.85	8.85	8.85	8.5	8.5	8.5
	LH	0812	9.8	9.6	9.8	9.8	9.8	9.8	9.8	9.8
	HL	1236	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
10	HH	2012	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
	LL	0224	9.2	9.2	7.0	7.35	6.45	6.65	6.8	6.8
	LH	0930	8.65	8.65	8.65	8.65	8.65	8.65	8.65	8.65
	HL	1406	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
11	HH	2130	8.15	7.95	8.15	8.15	8.15	8.15	8.15	8.15
	LL	0336	8.15	8.15	8.85	9.6	9.45	9.2	9.2	9.0
	LH	1030	7.95	7.95	8.15	8.15	8.15	8.15	8.15	8.15
	HL	1524	8.5	8.5	8.65	8.65	8.65	8.85	8.85	9.0
12	HH	2236	7.55	7.55	7.55	7.55	7.55	7.55	7.55	7.55
	LL	0430	7.7	7.2	4.1	4.42	4.1	3.9	4.1	4.1
	LH	1112	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
	HL	1630	7.95	7.95	7.95	7.95	8.3	8.85	9.2	9.2

WHALE COVE

1970

Day	Tide Level	P.S.T.	PROBE LEVEL -2.0 MLLW	0.0 MLLW	+1.6	+3.0	+4.5 MSL	+6	+7.6 MHW	+8.4 MHHW
Sept.13	HH	2330	7.55	7.55	7.55	7.55	7.55	7.55	7.55	7.55
	LL	0524	7.35	4.8	3.4	4.25	3.55	3.4	3.55	3.2
	LH	1154	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
	HL	1730	8.3	8.15	8.3	8.65	8.5	8.5	8.65	8.5
14	HH	-	-	-	-	-	-	-	-	-
	LL	0606	7.55	5.9	5.2	5.2	5.2	5.2	5.2	5.2
	LH	1230	8.3	8.15	8.3	8.3	8.3	8.3	8.3	8.5
	HL	1818	8.5	8.5	10.0	10.6	10.6	10.4	10.4	10.4
15	HH	0024	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
	LL	0648	8.15	7.0	5.70	5.70	5.55	5.55	5.55	5.55
	LH	1306	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
	HL	1906	8.65	8.65	10.0	10.4	10.4	10.4	10.4	10.2
16	HH	1342	8.65	8.65	8.85	8.85	8.85	8.85	8.85	8.85
	LL	2000	9.2	9.2	7.7	8.15	7.95	7.95	8.15	8.15
	LH	0118	8.5	8.3	8.5	8.3	8.3	8.3	8.3	8.3
	HL	0730	8.5	8.3	8.15	10.4	9.2	9.0	9.45	9.45
17	HH	1418	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	LL	2048	9.45	9.6	12.4	13.0	13.3	13.3	13.3	13.3
	LH	0212	8.65	8.65	8.65	8.65	8.65	8.85	8.85	8.85
	HL	0806	8.85	8.65	10.2	14.0	14.25	14.25	14.25	14.25
18	HH	1500	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
	LL	2136	9.6	9.6	9.6	10.4	10.4	10.4	10.4	10.4
	LH	0306	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	HL	0848	9.2	9.2	9.2	9.8	12.0	12.2	12.2	12.2
19	HH	1536	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
	LL	2244	9.6	9.6	9.6	10.8	11.1	11.1	11.1	11.1
	LH	0400	9.45	9.45	9.45	9.45	9.45	9.45	9.45	9.45
	HL	0924	10.0	9.8	10.0	10.0	10.0	10.2	10.2	10.4
20	HH	1618	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
	LL	2318	9.8	9.8	9.0	9.0	8.85	8.85	9.0	9.0
	LH	0454	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
	HL	1012	9.8	9.6	9.8	9.8	9.8	9.8	10.0	10.0
21	HH	1712	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6
	LL	-	-	-	-	-	-	-	-	-
	LH	0600	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
	HL	1100	10.2	10.2	10.2	10.2	10.2	10.2	10.4	10.4
22	HH	1812	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
	LL	0024	10.0	10.0	7.95	8.3	7.95	7.95	8.15	7.95
	LH	0724	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
	HL	1206	9.8	9.6	9.8	9.8	9.8	9.8	9.8	10.0
23	HH	1924	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
	LL	0130	10.2	10.2	9.6	9.2	8.85	8.65	8.65	8.65
	LH	0848	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
	HL	1324	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
24	HH	2042	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
	LL	0242	9.8	9.8	9.45	7.95	7.7	7.7	7.7	7.7
	LH	0954	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
	HL	1448	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
25	HH	2148	9.45	9.45	9.45	9.45	9.45	9.45	9.45	9.45
	LL	0348	9.2	9.2	5.4	5.4	5.0	4.8	4.8	4.8
	LH	1048	9.2	9.0	9.2	9.0	9.2	9.2	9.2	9.2
	HL	1554	10.0	10.0	10.0	10.0	11.1	13.0	13.75	13.5

WHALE COVE

1970

Day		Tide Level	P.S.T.	PROBE LEVEL -2.0	MLLW 0.0	+1.6	+3.0	MSL +4.5	+6	MHW +7.6	MHHW +8.4
Oct.	1	HH	1330	9.2	9.2	9.45	9.45	9.2	9.2	9.45	9.45
		LL	1954	9.0	8.85	8.85	9.2	9.0	9.0	9.2	9.2
		LH	0130	-	-	-	-	-	-	-	-
		HL	0718	-	-	-	-	-	-	-	-
	2	HH	1354	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
		LL	2030	9.2	9.2	8.5	8.85	8.65	8.65	8.85	8.85
		LH	0206	8.85	8.65	8.85	8.85	8.85	8.85	8.85	8.85
		HL	0748	8.5	8.5	8.5	8.5	7.7	7.7	7.95	7.7
	3	HH	1418	9.45	9.45	9.45	9.45	9.45	9.45	9.45	9.45
		LL	2106	9.2	9.2	10.2	10.4	10.4	10.4	10.4	10.2
		LH	0248	9.0	9.0	9.0	9.0	9.0	9.2	9.2	9.2
		HL	0818	9.0	9.0	9.0	9.0	9.6	9.6	10.2	10.6
	4	HH	1448	9.45	9.45	9.45	9.45	9.45	9.45	9.45	9.45
		LL	2148	9.2	9.2	10.4	10.8	10.8	10.6	10.8	10.8
		LH	0336	8.5	8.3	8.5	8.5	8.5	8.5	8.5	8.5
		HL	0848	9.2	9.0	9.45	9.2	9.2	9.45	9.8	10.0
	5	HH	1524	9.8	9.6	9.8	9.6	9.8	9.8	9.8	9.6
		LL	2236	9.45	9.2	8.5	8.5	8.5	8.5	8.5	8.5
		LH	0424	9.45	9.2	9.45	9.45	9.45	9.45	9.45	9.45
		HL	0924	9.2	9.2	9.45	9.45	9.45	9.45	9.6	9.8
	6	HH	1606	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
		LL	2336	9.6	9.45	6.1	6.1	5.9	5.55	5.55	5.55
		LH	0524	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
		HL	1012	9.2	9.0	9.2	9.2	9.2	9.2	9.2	9.2
	7	HH	1712	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
		LL	-	-	-	-	-	-	-	-	-
		LH	0636	9.2	9.2	9.45	9.2	9.2	9.2	9.2	9.2
		HL	1112	9.2	9.2	9.45	9.2	9.2	9.2	9.0	9.0
	8	HH	1836								
		LL	0048	9.8	9.8	9.6	9.6	11.55	11.55	11.55	11.55
		LH	0754	9.6	9.6	9.8	9.6	9.6	9.6	9.6	9.8
		HL	1242	10.0	10.0	10.0	10.0	10.2	10.8	11.3	11.75

from the eight intertidal levels at the times of the four tidal extremes during parts of August, September, and October 1970. This data is insufficient to characterize the annual pattern of inshore temperature at Whale Cove, but permitted comparison with the Agate Beach data from the same period. For this purpose, the temperature was taken from the Whale Cove recordings from the probe at -2 ft. for the time of the day that the temperature was measured at Agate Beach on the same days. A regression analysis (Fig. 5) was performed, and although a positive correlation was demonstrated, it is very poor ($r^2 = 0.506$). Agate Beach temperatures are in general about one to three degrees Centigrade above those at Whale Cove. While the distance between these two shore stations is only 10 miles, local hydrographic differences as well as differences of topography make it impossible to substitute Whale Cove sea temperature data for Agate Beach data in making biological correlations in work done at Yaquina Head, the intertidal ecological study site nearest Agate Beach.

The recordings of temperature at low tide for the various levels will be used to develop a predictive model for heating and annual heat budgets of intertidal organisms, work which is incomplete at this time.

The temperature measurements made in Yaquina Bay are given in Table 5. These estuarine temperatures show a greater range than those at Agate Beach because of the greater effects of seasonal heating and cooling on the shallow waters of the Bay and also because of the influence of river water temperature on the Bay, particularly in winter.

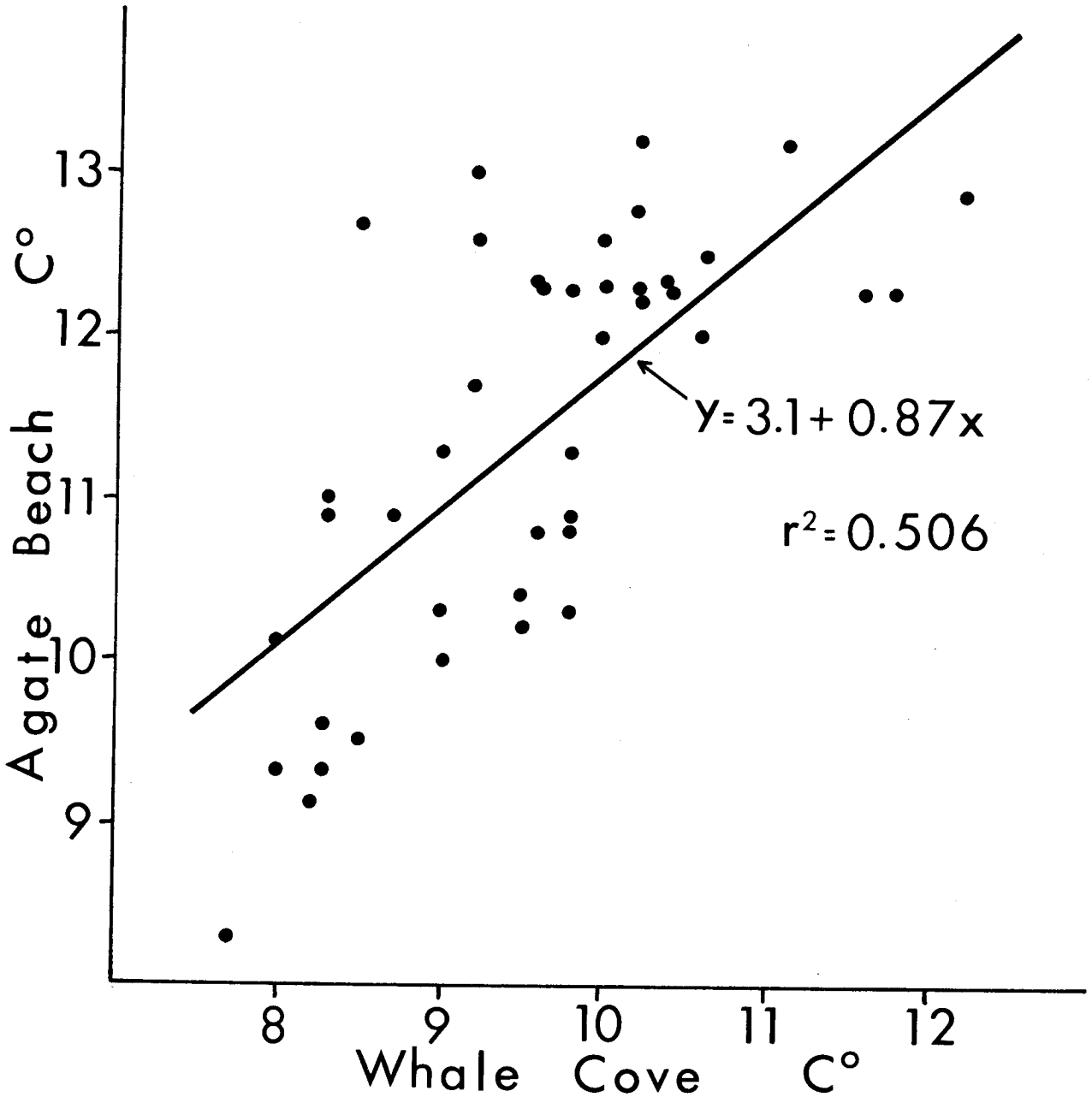

Figure 5. Comparison of Agate Beach and Whale Cove inshore sea temperatures. The calculated regression line is indicated.

Table 5. Daily temperature measurements at 10 cm depth and at 50 cm above water level, made coincident with the four semidiurnal tidal extremes at the Marine Science Center floating dock in Yaquina Bay.

* Indicates day with 3 tides only;

\- indicates no data.

Temperature given in °C to nearest 0.5°C.

1970	Water Temperature °C				Air Temperature °C			
Tide State	HH	LL	LH	HL	HH	LL	LH	HL
Feb. 1	8.0	10.0	7.5	8.5	10.0	13.0	8.0	11.0
2	6.5	11.5	10.0	7.0	6.5	14.5	13.0	7.0
3	7.0	9.0	5.0	8.0	8.0	13.5	4.5	9.5
4	6.5	9.5	-	5.0	6.0	7.5	-	3.0
5	9.5	9.5	9.5	8.5	7.5	13.0	5.5	6.0
6	10.5	10.0	10.0	10.0	14.5	14.0	10.0	10.0
7	11.0	10.0	10.0	9.5	13.5	12.5	10.0	11.0
8	11.0	10.0	10.0	9.5	15.5	12.5	11.5	9.5
9	10.0	10.5	11.0	9.5	11.0	12.0	15.0	9.0
10	10.5	10.0	11.5	10.5	10.5	10.5	23.0	10.0
11	10.5	10.0	11.0	11.0	10.0	10.5	15.5	11.5
12	10.5	10.5	11.0	10.5	10.5	13.0	13.5	11.5
13	10.5	10.5	10.5	9.5	8.5	13.5	9.0	6.5
14	9.0	10.0	10.5	-	5.5	14.0	12.5	-
15	10.0	10.5	11.0	10.0	11.5	13.5	13.5	13.5
16	10.5	10.0	10.5	10.5	9.5	9.5	11.0	12.5
17	10.0	10.0	9.5	10.0	12.0	14.0	10.0	10.5
18	8.5	10.0	-	9.0	7.0	13.0	-	7.0
19	9.5	10.0	9.5	8.5	10.5	11.0	7.5	7.5
20	9.5	10.0	9.5	8.0	11.5	12.0	9.5	8.0
21	10.5	10.0	10.0	8.5	17.5	10.5	8.5	7.5
22	11.0	10.0	10.0	9.5	20.0	9.0	7.0	8.0
23	10.0	10.5	11.0	9.0	6.5	11.5	13.0	6.0
24	10.0	10.5	11.0	9.0	10.5	12.5	15.5	10.5
25	10.0	10.0	11.5	11.0	9.5	10.5	18.0	9.5
26	10.5	10.0	11.5	11.0	8.5	11.5	14.5	9.0
27	10.0	10.0	11.0	11.0	6.5	9.5	13.0	11.0
28	10.5	10.0	9.5	9.0	8.0	7.0	6.0	4.5

1970	Water Temperature °C				Air Temperature °C			
Tide State	HH	LL	LH	HL	HH	LL	LH	HL
Mar. 1	9.5	9.5	10.0	-	3.0	15.0	7.0	-
2	9.0	10.5	10.0	9.0	6.5	14.0	10.0	6.5
3	9.5	10.5	10.0	9.5	6.5	12.5	6.5	10.0
4	9.5	11.0	10.0	9.0	8.5	12.5	8.0	7.0
5	10.0	11.0	10.5	9.5	9.5	14.5	13.0	7.0
6	10.5	10.5	-	10.5	12.5	12.5	-	9.5
7	11.0	11.0	10.5	10.5	12.0	12.5	12.5	9.5
8	-	-	10.5	10.0	-	-	7.5	5.5
9	-	-	-	-	-	-	-	-
10	-	-	11.0	10.5	-	-	17.5	9.0
11	10.5	10.0	11.5	11.0	7.0	8.5	18.0	10.0
12	11.0	10.5	11.5	11.0	9.0	11.5	17.5	10.5
13	10.5	11.0	11.0	11.0	9.5	16.5	17.5	13.5
14	11.0	11.0	11.5	11.5	10.0	12.0	13.5	13.0
15	11.5	11.0	11.5	11.0	13.5	14.0	11.5	9.0
16	10.5	11.0	11.0	-	9.0	15.5	12.5	-
17	10.5	12.0	10.5	11.0	8.5	16.0	8.5	13.0
18	10.0	12.0	10.5	10.0	7.0	13.5	6.5	6.5
19	9.5	12.0	11.5	9.5	7.5	14.0	8.0	4.5
20	10.5	12.5	11.0	10.0	11.5	14.5	7.5	7.5
21	11.5	12.0	11.0	9.5	16.5	14.5	8.0	5.0
22	11.5	12.0	-	11.0	12.0	10.5	-	8.5
23	10.5	11.5	11.5	10.5	8.0	9.5	12.0	5.0
24	10.5	10.5	12.0	11.5	7.0	5.5	17.5	13.0
25	10.5	11.5	12.0	12.5	7.5	10.0	11.0	9.5
26	10.0	12.0	11.5	-	5.0	13.0	9.0	-
27	10.5	12.5	12.0	11.0	8.5	12.5	9.5	9.5
28	10.0	13.0	12.0	10.5	6.0	14.5	10.5	6.5
29	11.0	13.0	12.0	11.5	9.5	14.0	10.5	10.0
30	11.0	12.5	10.5	11.5	11.0	10.5	9.5	11.0
31	9.0	13.0	10.5	10.0	6.0	12.5	9.5	7.0

1970	Water Temperature °C				Air Temperature °C			
Tide State	HH	LL	LH	HL	HH	LL	LH	HL
Apr. 1	10.5	13.0	9.5	10.0	10.0	15.0	7.0	5.5
2	10.5	11.0	10.0	12.0	9.5	9.0	11.0	13.5
3	-	10.0	10.5	12.0	-	7.0	12.0	11.5
4	9.5	10.0	10.0	12.0	5.5	4.0	12.5	11.0
5	9.5	11.0	10.5	11.0	7.0	7.5	15.0	13.0
6	10.0	11.0	10.5	11.5	13.0	12.0	16.5	14.0
7	10.5	11.0	11.0	10.5	13.5	10.0	13.5	10.0
8	9.5	11.0	10.5	10.0	7.5	13.5	13.0	8.0
9	10.0	11.0	11.0	-	9.0	16.0	17.0	-
10	11.5	11.0	10.5	11.0	11.5	11.5	10.5	11.5
11	11.5	12.0	10.5	11.0	11.5	13.5	8.0	9.5
12	11.0	13.0	9.5	10.5	8.5	17.5	5.0	7.0
13	10.5	12.0	9.5	11.0	8.0	9.5	4.0	5.0
14	9.5	10.0	9.0	12.0	8.5	7.0	7.0	11.0
15	11.0	10.0	9.5	13.5	9.0	6.0	6.0	19.5
16	10.0	11.0	10.5	13.5	8.0	7.0	8.5	14.0
17	-	10.5	11.0	13.5	-	5.5	22.5	14.5
18	10.0	10.5	11.0	12.5	8.5	6.0	13.5	16.5
19	9.5	11.0	9.0	10.5	11.0	11.5	12.5	10.0
20	8.5	10.0	9.0	10.5	9.5	7.5	16.0	12.5
21	8.5	10.0	10.0	11.0	6.0	6.0	12.0	7.5
22	9.0	11.0	10.5	10.5	4.0	18.0	17.5	9.0
23	9.5	12.0	11.5	10.5	8.0	20.0	14.0	10.0
24	11.0	11.5	10.0	-	12.0	15.5	11.0	-
25	10.0	11.0	10.0	10.0	11.0	14.0	10.0	11.5
26	10.0	11.0	9.5	10.0	5.0	11.5	9.0	9.5
27	10.5	11.0	8.5	9.5	5.5	15.5	4.0	4.0
28	9.5	12.0	9.0	10.0	11.0	19.0	5.0	3.0
29	10.0	10.0	11.0	12.5	10.5	9.0	12.5	17.5
30	10.5	11.0	11.0	11.5	11.5	7.5	11.5	13.0

1970		Water Temperature °C				Air Temperature °C			
Tide State		HH	LL	LH	HL	HH	LL	LH	HL
May	1	-	11.0	12.0	13.0	-	11.5	22.0	15.0
	2	11.0	10.5	12.0	13.0	8.5	8.0	12.0	13.0
	3	10.5	12.5	13.0	13.5	9.5	16.0	13.0	14.0
	4	10.5	13.0	14.0	11.5	8.5	25.0+	20.0	12.5
	5	10.5	12.5	10.5	12.0	12.5	13.5	14.5	14.5
	6	10.5	12.5	11.0	12.0	9.5	11.5	11.5	10.5
	7	10.0	13.0	11.0	11.5	7.5	17.5	15.0	8.5
	8	9.5	13.0	9.5	-	7.5	18.0	13.5	-
	9	10.0	12.0	10.0	10.5	13.5	14.5	12.5	12.5
	10	10.5	12.0	10.0	10.5	12.5	16.0	7.5	8.0
	11	11.0	12.0	10.5	10.5	12.5	17.5	8.0	7.5
	12	11.5	10.0	12.0	12.5	11.5	7.0	19.5	18.0
	13	12.0	11.0	13.5	14.5	12.0	6.0	20.0	16.5
	14	12.5	14.0	15.0	16.0	12.5	25.0+	22.0	19.0
	15	-	15.0	15.5	16.0	-	22.5	16.5	17.5
	16	12.5	14.0	14.5	16.0	12.5	15.0	23.0	17.0
	17	12.5	14.0	13.0	14.5	11.5	14.0	12.5	12.5
	18	12.0	14.0	11.5	13.5	8.0	12.0	12.5	12.5
	19	11.0	14.5	11.5	13.0	10.0	16.5	18.0	18.5
	20	10.5	14.0	12.0	13.0	10.5	19.0	13.0	14.5
	21	10.5	15.0	12.0	14.5	7.5	25.0	21.0	18.0
	22	10.0	13.5	11.5	12.5	10.0	16.0	15.0	12.5
	23	10.0	14.5	11.0	-	7.0	15.0	12.5	-
	24	10.0	15.0	10.0	10.5	8.0	16.5	14.0	8.5
	25	10.0	14.5	9.5	13.5	9.0	19.0	11.0	11.5
	26	10.0	15.0	9.0	11.5	10.5	14.5	10.5	10.5
	27	9.5	15.0	10.0	-	10.0	19.5	10.5	-
	28	10.0	15.0	9.5	11.5	13.5	20.0	8.5	8.0
	29	10.0	13.5	10.0	12.0	11.0	18.5	14.5	13.0
	30	11.5	12.5	11.5	13.5	11.5	10.0	14.5	14.5
	31	10.5	13.0	12.5	17.0	18.0	11.5	20.0	25.0+

1970		Water Temperature °C				Air Temperature °C			
Tide State		HH	LL	LH	HL	HH	LL	LH	HL
June	1	11.0	14.5	10.0	14.0	12.0	24.5	25.0+	25.0+
	2	12.0	14.5	13.0	16.0	14.5	18.5	25.0	23.5
	3	-	15.0	13.0	15.0	-	16.5	22.0	13.5
	4	13.0	15.5	11.0	14.0	13.0	14.5	13.0	14.5
	5	10.0	16.5	11.0	15.5	9.0	25.0+	14.0	16.5
	6	9.0	15.0	11.0	14.0	14.5	18.5	19.0	18.0
	7	10.5	15.5	11.5	13.5	11.0	21.5	15.0	12.5
	8	10.5	14.5	10.5	12.0	10.0	19.5	13.5	11.0
	9	10.5	13.5	11.5	13.5	11.5	17.0	16.0	12.5
	10	12.0	15.5	13.0	-	10.0	19.5	14.0	-
	11	13.5	16.5	13.0	14.5	13.0	23.5	11.0	11.0
	12	12.5	16.0	13.5	14.5	13.0	16.0	13.0	12.0
	13	11.0	16.0	13.5	14.5	15.5	23.0	14.5	13.0
	14	11.5	14.5	12.5	14.5	16.5	17.5	13.5	21.5
	15	12.5	14.0	12.5	14.5	12.0	16.0	15.0	18.5
	16	12.0	14.0	13.0	14.5	10.5	12.0	14.5	15.5
	17	11.0	14.5	13.0	15.0	11.5	14.5	19.0	18.0
	18	-	15.5	14.0	15.5	-	16.0	17.0	16.5
	19	11.0	16.5	13.0	15.0	10.5	19.5	18.0	17.0
	20	10.0	17.0	11.0	14.5	10.5	25.0	17.5	20.0
	21	9.5	16.0	10.5	13.5	10.5	16.5	13.5	14.5
	22	9.5	16.0	10.5	11.5	10.0	17.5	13.5	10.5
	23	9.0	15.0	10.5	12.0	10.0	15.5	13.0	12.5
	24	9.0	15.0	10.0	12.0	10.5	15.5	13.5	10.0
	25	10.0	14.5	8.5	-	13.0	20.0	11.5	-
	26	9.0	13.0	9.0	12.5	11.5	17.0	10.5	11.0
	27	9.5	12.5	9.5	12.5	11.5	11.0	15.0	17.5
	28	10.5	13.0	10.5	13.5	10.5	11.0	20.0	19.0
	29	11.0	14.0	10.5	12.5	12.0	11.5	16.0	15.0
	30	12.0	13.5	12.0	12.5	13.0	12.0	19.5	17.5

1970	Water Temperature °C				Air Temperature °C			
Tide State	HH	LL	LH	HL	HH	LL	LH	HL
July 1	12.5	14.0	12.5	14.0	12.5	16.5	15.5	21.5
2	13.0	15.5	13.5	15.0	14.5	25.0+	18.0	16.5
3	13.5	16.0	12.0	14.0	23.5	22.0	13.0	17.0
4	12.0	13.5	11.5	16.5	13.5	13.5	14.5	22.0
5	11.0	12.0	11.5	16.5	14.0	12.0	11.0	18.0
6	11.0	12.5	9.5	16.0	15.5	12.5	11.0	24.5
7	11.0	-	11.0	16.0	14.5	-	17.5	12.5
8	10.5	12.5	11.0	15.5	14.5	12.5	12.5	15.5
9	10.5	12.0	10.0	15.0	13.0	11.0	9.5	17.5
10	10.5	12.0	10.0	14.5	15.5	10.5	11.0	15.0
11	10.5	13.0	11.0	14.5	12.0	10.5	11.5	14.5
12	10.5	14.0	12.0	14.0	12.0	11.5	13.5	15.0
13	10.5	14.5	13.0	14.0	11.0	12.5	12.5	15.0
14	10.5	15.0	12.5	15.0	10.5	9.5	24.0	20.0
15	9.0	15.0	9.0	11.5	11.5	9.5	17.0	15.0
16	10.0	14.5	10.5	12.5	11.0	12.5	19.5	17.5
17	10.5	14.5	12.0	13.0	10.5	13.5	16.5	16.0
18	-	15.5	11.5	12.5	-	17.5	11.5	17.0
19	10.0	16.0	11.5	13.0	12.0	24.5	20.0	14.0
20	10.0	15.5	11.0	12.0	12.5	14.5	16.0	13.5
21	9.5	15.0	11.0	12.0	12.0	16.0	17.0	13.0
22	9.5	14.5	10.5	12.0	9.5	19.5	14.5	11.0
23	10.5	13.5	9.0	12.0	16.0	22.5	9.0	13.0
24	10.0	13.5	9.5	-	17.0	21.0	11.5	-
25	9.0	12.5	9.5	12.0	18.0	10.5	11.5	19.0
26	10.0	13.0	10.0	11.5	16.5	13.5	18.0	21.0
27	10.5	13.0	11.0	13.5	11.5	15.0	20.5	24.5
28	11.0	14.0	12.0	14.0	11.0	13.5	25.0	24.5
29	11.5	14.0	13.0	14.0	10.5	12.0	24.5	19.0
30	10.5	14.5	12.5	13.5	10.5	12.0	18.0	18.0
31	-	15.0	12.0	13.5	-	12.0	18.5	15.0

1970	Water Temperature °C				Air Temperature °C			
Tide State	HH	LL	LH	HL	HH	LL	LH	HL
Aug. 1	10.5	15.5	10.5	12.0	12.5	14.5	22.0	16.0
2	10.0	15.0	11.0	12.0	11.5	14.5	18.5	16.0
3	9.5	14.5	10.5	11.5	9.5	16.0	18.0	14.0
4	9.5	13.5	10.0	12.0	13.0	15.5	22.0	14.0
5	9.5	14.5	11.5	12.5	12.0	25.0+	23.0	18.5
6	11.5	13.5	11.5	13.5	23.5	15.5	12.5	16.0
7	12.5	13.5	12.0	13.5	22.5	12.0	12.5	22.5
8	13.0	15.0	12.0	15.0	16.5	14.0	12.0	25.0+
9	13.5	-	13.0	15.5	18.5	-	12.0	25.0+
10	13.0	15.5	13.5	16.5	17.0	12.5	14.0	25.0+
11	11.0	15.5	12.5	15.5	13.0	13.0	16.0	17.0
12	10.0	16.0	12.5	14.5	15.5	13.5	15.0	18.0
13	10.5	16.0	12.0	12.5	12.0	14.0	17.5	18.0
14	9.5	15.5	11.5	13.0	10.0	11.0	15.5	14.0
15	9.5	15.0	10.5	12.0	12.5	12.0	14.5	14.5
16	-	15.0	10.5	12.0	-	14.5	14.5	14.0
17	9.5	14.0	11.0	12.0	11.0	14.5	14.5	13.5
18	9.5	14.0	10.5	12.0	10.0	15.0	15.0	13.0
19	9.5	12.5	10.0	12.0	11.0	12.5	14.5	13.0
20	10.5	12.0	8.0	12.5	16.0	17.0	11.5	14.0
21	10.5	12.5	9.5	12.0	12.5	13.0	11.5	17.5
22	9.5	12.0	9.0	11.0	15.0	14.5	10.5	17.0
23	10.0	-	9.5	10.5	18.5	-	12.0	18.0
24	10.5	12.0	10.5	11.5	17.0	14.5	12.0	21.0
25	11.5	13.0	11.5	12.5	11.5	13.5	13.5	22.5
26	11.5	13.5	12.0	13.0	13.0	11.0	16.5	16.0
27	11.0	14.5	12.5	13.0	11.0	13.5	22.0	18.0
28	11.0	14.0	12.0	13.0	11.0	12.0	25.0	14.0
29	10.5	14.0	12.5	13.5	11.0	15.0	18.0	14.5
30	-	14.0	10.0	12.0	-	20.0	17.5	15.5
31	10.0	13.5	11.0	12.5	12.0	16.5	19.5	14.0

However, the temperatures recorded at the daily higher high tide correspond closely to the temperature measured the same day on the coast 8 miles away at Agate Beach, even though the measurements were not made at the same time of day.

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13. ABSTRACT

Daily temperature and salinity conditions measured in the surf at Agate Beach, Oregon, are given and summarized by 15 day periods, with the range, mean and standard deviation of each period indicated. Conditions in 1970 are briefly compared to those observed in 1968 and 1969, and temperature measurements at this station summarized for 15 day periods is figured for the period 1967-1970. Water and near surface air temperatures at a station 3 miles inside Yaquina Bay measured at the daily four tidal extremes are tabulated. A system for continuously recording temperature from a thermistor chain installed in the intertidal is described. The design and construction of thermistor pressure cases, thermistor shielding, and a dual range Wheatstone Bridge are described and figured. Data recorded from intertidal thermistor chain installed at Whale Cove, Oregon, at the four daily tidal extremes are given. These data are compared to those from Agate Beach, 10 miles away, and it is concluded that there is poor correlation between the two locations due to hydrographic and topographic differences.

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Design of thermistor case, shielding.						