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SEA TEMPERATURE IN THE HAWAIIAN ISLAND AREA

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Introduction

Since the time for preparation of this report was limited to three days it is not meant to be complete or final. However, the results obtained in the preliminary work should indicate with reasonable accuracy the results which may later be obtained upon a more thorough investigation.

Distribution of Bathythermograms

On page 5 is shown the distribution by one degree quadrangles of latitude and longitude of bathythermograph observations made in the Hawaiian Island area. On pages 6 to 17 are shown the distributions for various months of the year. All observations were made between January 1941 and November 1947.

Availability of Data

The bathythermograms which were prepared from the above observations are filed at Scripps Institution by position (1° quadrangles of latitude and longitude) and also by individual cruises. Additional copies of these bathythermograms may be prepared for selected cruises at a cost of about \$0.20 per bathythermogram. The cost is greatly reduced when a larger number of copies is desired for particular observations.

Temperature Sections

For certain studies it is often useful to know what temperature data are available from which temperature sections may be constructed at selected times. The paths followed by some ships making bathythermograph observations have been plotted on pages 18 to 20 together with the cruise numbers which have been assigned. Thus, when it is desired to construct a temperature section along any one of these paths, bathythermograms may be readily obtained from the cruise files. The figures do not represent the total number of sections which are available in the Hawaiian Island area. It is estimated that about 2/3 of these sections remain to be plotted.

Diurnal Temperature Variation

A study carried out in 1941 gives an example of the diurnal variation of temperature at the various depths in August. The amount of this variation is shown in Table 1, page 2, and in the Figure on page 21. Table 2, which gives the diurnal variation near San Diego, is included for comparison with the Hawaiian Island area.

Diurnal Variation of Temperature*

TABLE 1

Diurnal variation of temperature to the east of the Hawaiian Islands, Lat. 21° - 32° N, Aug. 9 - 29, 1941, shown by average deviations from temperature at 120 feet. Thickness of wind-stirred layer 120 feet or more, average temperature 75° F. (USS PYRO).

Depth Feet	Hours						Average
	0	4	8	12	16	20	
0	.58	.27	.08	.53	.99	.75	0.53
30	.42	.29	.08	.22	.59	.56	0.36
60	.30	.25	.07	.11	.33	.38	0.24
90	.21	.05	.04	.04	.14	.24	0.12
120	.00	.00	.00	.00	.00	.00	0.00

TABLE 2

Diurnal variation of temperature to the southwest of San Diego, Lat. $31^{\circ} 20'$ - $32^{\circ} 10'$ N, Long. $117^{\circ} 30'$ - $118^{\circ} 30'$ W, Sept. 16 and 17, 1941, shown by average deviations from temperature at 60 feet. Thickness of wind-stirred layer 60 to 80 feet, average temperature 65° F. (B.V. SCRIPPS).

Depth Feet	Hours						Average
	0	4	8	12	16	20	
0	.10	-.01	.20	.43	.45	.34	0.27
30	.11	.02	.07	.05	.25	.30	0.13
60	.00	.00	.00	.00	.00	.00	0.00

* From Report September, 1941, OSRD, University of California, San Diego.

Annual Variation of Temperature

An indication of the annual variation of temperature may be obtained from Table 3 and from the figure on page 22. The area selected for study is one where there were data available for successive months. The sea temperature was averaged at the surface and at each hundred feet of depth to 400'. In most months there were at least five observations, but in January, March, May and September the temperatures were based on only one observation. The average depth of the nearly isothermal layer was computed and found to be greatest in the months December, January and February when it averaged about 350 feet and least in May and June when it averaged about 100 feet.

TABLE 3

AVERAGE TEMPERATURES AT SELECTED DEPTHS °F
20-25°N, 155-160°W

Depth Ft.	January		February		March		April		May		June	
	Avg. Temp.	No. Obs.	Avg. Temp.	No. Obs.	Avg. Temp.	No. Obs.	Avg. Temp.	No. Obs.	Avg. Temp.	No. Obs.	Avg. Temp.	No. Obs.
0	77.0	(1)	76.1	(6)	75.0	(1)	75.2	(6)	76.8	(1)	77.7	(6)
100	76.3	(1)	75.9	(5)	75.0	(1)	75.1	(6)	75.0	(1)	77.4	(6)
200	75.9	(1)	75.8	(5)	--	(0)	74.5	(6)	74.9	(1)	75.4	(4)
300	75.1	(1)	75.5	(4)	--	(0)	74.5	(6)	74.8	(1)	74.7	(3)
400	--	(0)	73.1	(4)	--	(0)	73.3	(3)	--	(0)	--	(0)

Depth Ft.	July		August		September		October		November		December	
	Avg. Temp.	No. Obs.	Avg. Temp.	No. Obs.	Avg. Temp.	No. Obs.	Avg. Temp.	No. Obs.	Avg. Temp.	No. Obs.	Avg. Temp.	No. Obs.
0	77.3	(5)	76.6	(6)	78.0	(1)	77.5	(6)	72.6	(6)	69.6	(6)
100	77.0	(5)	76.4	(6)	78.0	(1)	77.4	(6)	71.9	(5)	69.5	(6)
200	75.1	(5)	74.8	(6)	75.3	(1)	75.5	(6)	71.8	(5)	68.1	(5)
300	72.2	(3)	72.4	(5)	72.9	(1)	71.4	(5)	68.9	(3)	68.0	(5)
400	--	(0)	69.0	(2)	72.0	(1)	70.0	(4)	66.6	(1)	66.2	(5)

Typical Bathythermograms

A series of typical bathythermograms for successive months was selected from an area northeast of the Islands and another series from an area southwest of them. These are included in the envelopes attached to the back of the book. Also included are sample bathythermograms from other areas near Honolulu and from other years.

Vapor Pressure Difference

The vapor pressure difference between sea surface and a height above it has been computed for different months in the area 20-25°N, 155-160°W. The results are:

TABLE IV

SEA-AIR VAPOR PRESSURE DIFFERENCE ($e_s - e_a$)

Month	Vapor Pressure Difference	No. of Obs.
May	7.9 mb	2
June	5.0	5
July	3.0	8
August	5.9	22
September	5.7	9
December	6.1	2

Sea Surface Isotherms

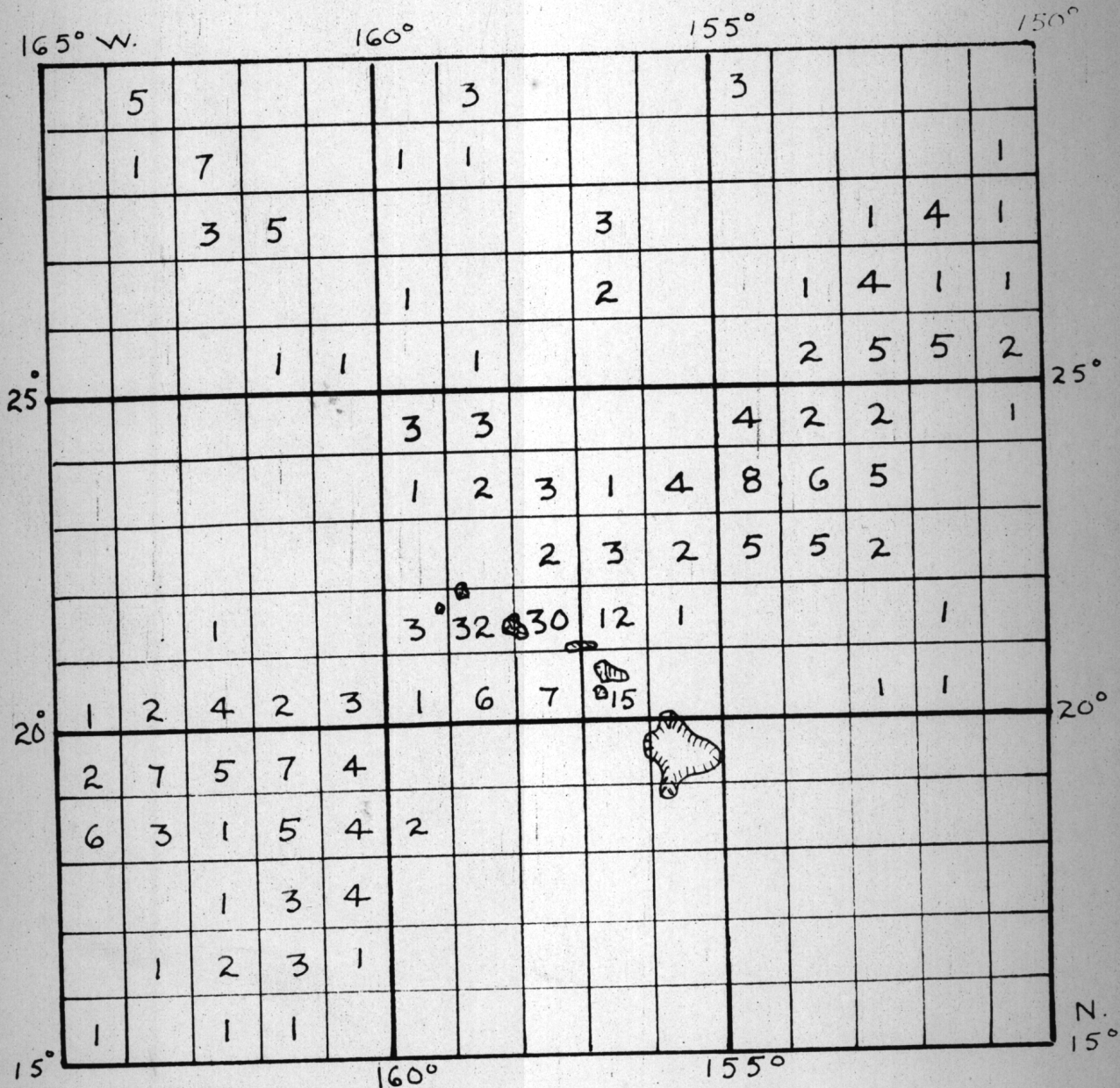
To give some indication of the detailed features of the sea surface isotherms in the Hawaiian area bucket and injection temperatures from bathythermograph observations were averaged by one degree quadrangles of latitude and longitude from 20-25°N, 155-160°W. These averages, together with the number of observations and isotherms based on the average temperatures, are entered in the Figures on pages 23 and 24 for the months March and September. These months were selected since, in the Climatic Atlas of the Oceans, they were the months having the lowest and the highest sea surface temperatures respectively.

Location of Stations Where Serial Temperature and Salinity Observations were Made

In the Figure on page 25 are shown some of the various approximate locations in the Hawaiian Island area where serial observations of temperature and salinity have been made. The data are generally available and may be obtained by referring to the source indicated by the legend of the Figure.

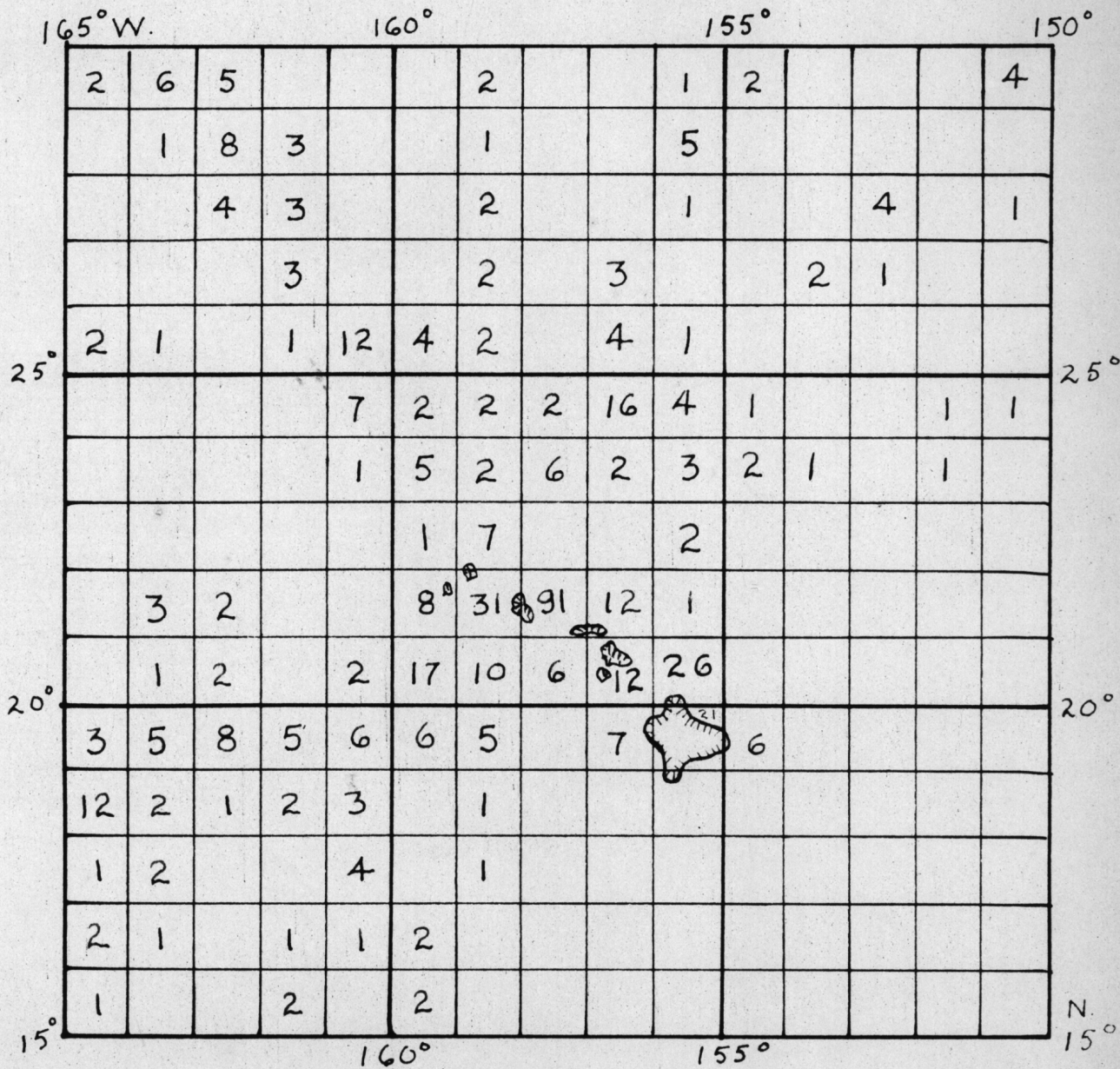
	165° W.				160°					155°				150°	
	24	67	35			1	44	2	1	13	23	3		4	16
		24	80	12	1	4	38	3	1	23	14		4	8	4
	5	3	55	49		4	33	3	11	13	3	4	17	6	4
	3	1	11	58	47	8	49	1	12	6	7	18	9	12	12
25°	32	17	2	18	79	10	45	5	19	8	18	16	14	21	18
	3	18	22	11	84	43	36	14	31	16	22	26	34	22	27
	1	5	7	38	46	77	33	18	13	32	55	41	33	17	5
	14	5	1	1	5	35	59	14	29	26	28	15	4	4	2
	6	18	19	10	10	25 ⁸	323 ⁸	455 ⁸	45	5	3	1	5	3	1
	6	12	26	17	35	53	91	54	52	29			2	1	1
20°	32	42	54	70	69	56	51	16	10	22	7			3	1
	74	34	35	58	42	27	16	2	2	3		1	1		
	33	9	21	15	16	20	14	1	1	1					
	11	8	9	12	6	11	8	1			3				
15°	7	2	4	5	8	10	7	2	2	2	1		1	2	
					160°					155°					N. 15°

DISTRIBUTION OF BATHYTHERMOGRAPH OBSERVATIONS
 PROCESSED PRIOR TO NOVEMBER 1947



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JANUARY



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FEBRUARY