

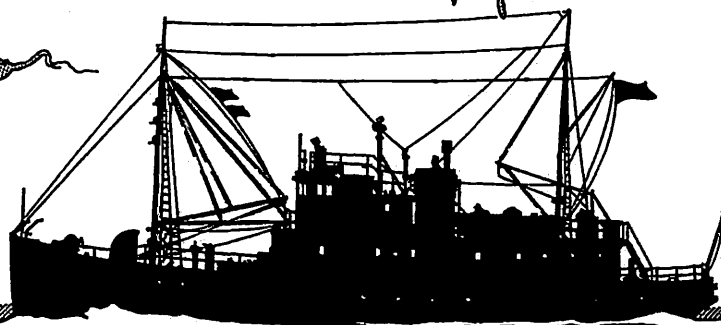
# DEPARTMENT OF OCEANOGRAPHY UNIVERSITY OF WASHINGTON

Special Report No. 15

OCEANOGRAPHIC SURVEY OF CARR INLET  
PART XIII - FEBRUARY 1955

Puget Sound Naval Shipyard  
Contract No. N251s-6261A  
Negotiation 417/54

Reference 55-6  
February 1955



SEATTLE 5, WASHINGTON

UNIVERSITY OF WASHINGTON DEPARTMENT OF OCEANOGRAPHY  
(Formerly Oceanographic Laboratories)  
Seattle, Washington

OCEANOGRAPHIC SURVEY OF CARR INLET  
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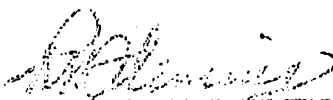
by

Stanford A. Barnes and Eugene F. Collias

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Richard H. Blodgett  
Executive Officer

## ABSTRACT

This report presents the temperature and salinity data from Carr Inlet as measured during February 1955 and is the thirteenth of a series of monthly reports for this area. Fifteen stations at which observations were made at various levels from the surface to the bottom were occupied in the Inlet or off its entrance. The average temperature was about  $8.1^{\circ}\text{C}$  and the average salinity  $28.9\text{ ‰}$ , a decrease of  $0.5^{\circ}\text{C}$  and  $0.2\text{ ‰}$  respectively since January. The temperature was closely the same as found in February 1954 but the salinity was  $0.5\text{ ‰}$  higher, a consequence of the lesser precipitation and runoff during the present winter. Both temperature and salinity increased slightly and quite uniformly with depth throughout the acoustic range area. A surface lens of relatively cool less saline water persisted near the head of the Inlet. The work discussed herein is being integrated with that carried out under Office of Naval Research Contracts N8onr-520/III, Project NR 083-012 and Nonr-477(01), Project NR 083-072.

OCEANOGRAPHIC SURVEY OF CARR INLET  
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INTRODUCTION

This is the thirteenth of a series of monthly reports on the temperature, salinity and density conditions in the waters of Carr Inlet, Puget Sound and is based on observations made by the Department of Oceanography during January 1955. The work outlined in this report completes the annual series of monthly observations began on 15 February 1954. The oceanographic background of the area and the field methods used were discussed in Part I - February 1954 (Reference 54-21). March through January were presented in Parts II through XII respectively (References 54-22, 54-25, 54-26, 54-28, 54-30, 54-31, 54-32, 55-1, 55-2, 55-3 and 55-5).

OBSERVATIONS

The field survey for which results are presented herein was conducted from 1525 to 2346 on 9 February 1955. Figure 1 shows the station locations. Stations 85-4 through 85-10 were occupied on a large flood tide and stations 85-11 through 85-18 were occupied on a large ebb tide. The observed station data, exclusive of values for dissolved oxygen and soluble phosphate, are listed on pages 5 through 8.

The vertical distribution of temperature, salinity and density along the channel are shown in Figures 2, 3 and 4. Figures 5, 6 and 7 show the vertical distribution of temperature, salinity and density for two transverse sections across the channel. The temperature on the sections is expressed in degrees Centigrade ( $^{\circ}\text{C}$ ), the salinity in parts

per thousand ( $^{\circ}/\text{‰}$ ) and the density as sigma-t ( $\sigma_t$ ).

## DISCUSSION

The monthly survey reported herein was the thirteenth and last of an annual series made in Carr Inlet starting with February 1954. As the year-to-year variation in the winter season will normally not exceed about two weeks the series of 13 surveys which began and ended in successive Februaries can be expected to effectively close the annual cycle. Year-to-year differences can be more readily separated from anomalous seasonal effects than would have been possible had the series been concluded in January.

The average temperature of Carr Inlet during the February 1955 survey was  $8.1^{\circ}\text{C}$ , about the same as in February 1954. The decrease off Green Point since January 1955 amounted to  $0.5^{\circ}\text{C}$  and was about twice the decrease which occurred between January and February 1954. One-third of this decrease occurred in the first week of February during a period of colder air temperatures over Puget Sound. The temperature pattern was similar to January with colder water on the surface than at depth. In the range area the temperature increased about  $0.2^{\circ}\text{C}$  from surface to bottom. A northerly wind which prevailed during the sampling period forced a cloud of colder, fresher water out of the head of the Inlet towards Green Point, but it did not penetrate the range area. In February 1954, a southerly wind held a similar pocket in the head of the Inlet off Wauna. Although this lens of surface water is almost invariably present it is unlikely that it will contribute to erratic conditions in the range area.

The average salinity in February 1955 was 28.9 ‰ as compared to 29.1 ‰ in January, and about 0.5 ‰ higher than in February 1954. This difference is attributed to less precipitation and runoff during the month of January 1955 when only 2.07 inches of rain fell in Seattle as compared to 8.36 inches in January 1954. The decrease of 0.1 ‰ in average salinity during January 1955 was only 7% of the decrease which occurred between January and February 1954. The heavy rainfall on 5-8 February 1955 did not cause a noticeable decrease in salinity in the Acoustic Range between observations made on 1 February and 9 February. Except for the difference in location of the surface lens near the head of the Inlet in response to the prevailing winds the patterns for the two years were closely the same. The consistent patterns despite rather appreciable changes in absolute values afford a promising basis for predicting water structure for desired periods.

The average density of the water was about 0.4 sigma-t units higher in 1955 than in 1954. As with temperature and salinity the density distribution the two years were similar except for surface effects.

Sound velocities were indicated as quite uniform over the entire Acoustic Range, increasing slightly from surface to the bottom.

## DATA (Explanation of Headings)

The time at which the messenger was dropped on the first cast is listed for the Pacific Standard Time (+8) zone. Positions are given to the nearest 0.1 minute. Depth in fathoms was obtained with aid of a Navy EDO echo sounder. Weather is reported in the Navy bathythermograph weather code given in H. O. Publication No. 606-c, except in cases where the only weather phenomenon reported is the state of the sky. For the state of the sky the following symbols were used: b., clear sky; b.c., blue sky with detached clouds; c., sky mainly cloudy; o., sky overcast. Wind speed is reported in knots. Dry and wet bulb temperatures are reported in degrees Fahrenheit ( $^{\circ}\text{F}$ ). The dry bulb reading is listed first, followed by a virgule (/) and then the wet bulb reading.

All data are actual observed values. The maximum depth of sampling was governed by the depth of water. The presentation of these data in this form constitutes neither final evaluation nor publication. Subsequent, more rigorous analyses of these data may disclose errors which are not apparent at this time.

STA 85-4    47° 11.5'N    WEATHER b.c. 9 Feb. 55    122° 36.8'W    WIND NEH 12 1525 (+8)    DEPTH 76 fms    50/43° F TOLIVA SHOAL			
Depth	Temp	Sal	Density
m	°C	‰	σ <sub>t</sub>
0	8.17	28.71	22.36
5	8.15	28.73	22.37
10	8.16	28.78	22.41
20	8.10	28.85	22.47
30	8.26	28.89	22.50
50	8.17	28.95	22.53
75	8.14	28.95	22.55
100	8.11	28.97	22.56
125	8.15	29.05	22.62

STA 85-5    47° 15.6'N    WEATHER b.c. 9 Feb. 55    122° 42.0'W    WIND NNW 8 1629 (+8)    DEPTH 50 fms    43/36° F SOUTH HEAD II			
Depth	Temp	Sal	Density
m	°C	‰	σ <sub>t</sub>
0	8.07	28.87	22.49
2	8.05	28.87	22.50
5	8.03	28.87	22.50
10	8.02	28.88	22.50
20	8.12	28.88	22.49
30	8.04	28.89	22.51
40	8.16	28.93	22.51
60	8.28	28.97	22.54
85	8.27	29.05	22.60

STA 85-6    47° 13.9'N    WEATHER b.c. 9 Feb. 55    122° 42.8'W    WIND N 10 1659 (+8)    DEPTH 10 fms    54/42° F SOUTH HEAD IV			
Depth	Temp	Sal	Density
m	°C	‰	σ <sub>t</sub>
0	8.07	28.85	22.47
5	8.02	28.85	22.48
10	8.00	28.86	22.49
15	7.90	28.88	22.50

STA 85-7    47° 14.8'N    WEATHER b.c. 9 Feb. 55    122° 42.8'W    WIND N 10 1723 (+8)    DEPTH 12 fms    44/38° F SOUTH HEAD III			
Depth	Temp	Sal	Density
m	°C	‰	σ <sub>t</sub>
0	8.04	28.86	22.49
5	8.02	28.86	22.49
10	7.99	28.86	22.49
15	7.96	28.86	22.49
20	8.10	28.86	22.48



STA 85-8    47° 16.8'N    WEATHER b.c. 9 Feb 55    122° 39.4'W    WIND N 3 1756 (+8)    DEPTH 15 fms    46/42° F WARREN			
Depth	Temp	Sal	Density
m	°C	‰	σ <sub>t</sub>
0	8.15	28.93	22.52
5	8.10	28.93	22.53
10	8.10	28.93	22.53
15	8.07	28.93	22.53
20	8.24	28.91	22.50

STA 85-9    47° 16.4'N    WEATHER b.c. 9 Feb 55    122° 41.1'W    WIND N 4 1821 (+8)    DEPTH - fms    42/36° F SOUTH HEAD I			
Depth	Temp	Sal	Density
m	°C	‰	σ <sub>t</sub>
0	8.12	28.84	22.46
5	8.09	28.89	22.50
10	8.09	28.89	22.50
20	8.01	28.89	22.51
30	8.24	28.89	22.48
40	8.14	28.92	22.52
60	8.15	28.96	22.55
80	8.20	28.97	22.55

STA 85-10    47° 18.8'N    WEATHER b.c. 9 Feb 55    122° 42.3'W    WIND NNE 3 1857 (+8)    DEPTH - fms    40/35° F CUTTS IS., SW of			
Depth	Temp	Sal	Density
m	°C	‰	σ <sub>t</sub>
0	7.82	28.62	22.33
2	7.77	28.64	22.34
5	7.90	28.71	22.39
10	7.94	28.80	22.46
20	8.07	28.80	22.43
30	8.28	28.96	22.53
40	8.22	28.98	22.55
50	8.26	28.98	22.54
60	8.23	29.05	22.61

STA 85-11    47° 21.4'N    WEATHER b.c. 9 Feb 55    122° 40.2'W    WIND NNE 2 1938 (+8)    DEPTH 17 fms    39/35° F BLOOM, East of			
Depth	Temp	Sal	Density
m	°C	‰	σ <sub>t</sub>
0	7.37	27.85	21.78
2	7.48	28.02	21.90
5	7.90	28.68	22.36
10	7.88	28.73	22.40
15	8.23	28.80	22.41
20	8.19	28.87	22.47
25	8.23	28.92	22.51

STA 85-12 47° 22.5'N WEATHER b. 9 Feb 55 122° 38.2'W WIND NNE 6 2000 (+8) DEPTH 9 fms 37/34° F WAUNA			
Depth	Temp	Sal	Density
m	°C	‰	σ <sub>t</sub>
0	7.89	28.52	22.24
2	7.88	28.48	22.20
4	8.01	28.62	22.30
6	8.04	28.66	22.33
10	8.04	28.76	22.41

STA 85-13 47° 20.2'N WEATHER b. 9 Feb 55 122° 41.7'W WIND NNE 5 2033 (+8) DEPTH 28 fms 37/34° F GLEN COVE, East of			
Depth	Temp	Sal	Density
m	°C	‰	σ <sub>t</sub>
0	7.54	28.14	21.99
2	7.58	28.15	21.99
5	7.80	28.47	22.21
10	7.86	28.69	22.37
20	8.24	28.84	22.44
30	8.32	28.96	22.53
40	8.28	29.00	22.56
50	8.30	29.05	22.60

STA 85-14 47° 16.9'N WEATHER b. 9 Feb 55 122° 42.3'W WIND NNE ? 2112 (+8) DEPTH 55 fms 38/35° F GREEN POINT			
Depth	Temp	Sal	Density
m	°C	‰	σ <sub>t</sub>
0	8.04	28.86	22.49
2	8.00	28.89	22.51
5	8.00	28.89	22.51
10	7.97	28.86	22.49
20	8.14	28.87	22.49
30	8.14	28.87	22.49
40	8.16	28.87	22.47
50	8.20	28.95	22.53
70	8.23	29.05	22.61
90	8.24	29.05	22.61

STA 85-15 47° 13.6'N WEATHER b. 9 Feb 55 122° 39.6'W WIND NNE 8 2152 (+8) DEPTH 30 fms 39/35° F STILL HARBOR III			
Depth	Temp	Sal	Density
m	°C	‰	σ <sub>t</sub>
0	8.06	28.87	22.49
5	8.04	28.87	22.50
10	8.02	28.87	22.50
20	8.02	28.87	22.50
30	8.20	28.87	22.47
40	8.23	28.96	22.54
50	8.22	28.96	22.54

STA 85-16 47° 14.4'N WEATHER b. 9 Feb 55 122° 38.4'W WIND NE 4 2213 (+8) DEPTH 67 fms 38/34° F STILL HARBOR I			
Depth	Temp	Sal	Density
m	°C	‰	$\sigma_t$
0	8.06	28.87	22.49
5	8.02	28.87	22.50
10	8.03	28.96	22.57
20	8.10	28.91	22.52
30	8.28	28.95	22.52
50	8.18	28.95	22.53
75	8.16	28.95	22.53
100	8.28	29.00	22.56
125	8.16	29.05	22.61

STA 85-17 47° 14.2'N WEATHER b. 9 Feb 55 122° 39.3'W WIND ENE 10 2302 (+8) DEPTH 65 fms 38/35° F STILL HARBOR II			
Depth	Temp	Sal	Density
m	°C	‰	$\sigma_t$
0	8.06	28.90	22.51
2	8.04	28.89	22.51
5	8.02	28.89	22.51
10	8.04	28.89	22.51
20	8.18	28.89	22.48
30	8.12	28.90	22.51
50	8.12	28.92	22.52
75	8.28	29.01	22.57
100	8.22	29.05	22.61
120	8.23	29.07	22.63

STA 85-18 47° 12.6'N WEATHER b. 9 Feb 55 122° 37.3'W WIND NNE 13 2346 (+8) DEPTH 89 fms 38/35° F GIBSON FT., SW of			
Depth	Temp	Sal	Density
m	°C	‰	$\sigma_t$
0	8.06	28.90	22.51
2	8.02	28.90	22.52
5	8.04	28.91	22.53
10	8.06	28.87	22.49
20	8.24	28.94	22.52
30	8.15	28.96	22.55
50	8.14	28.99	22.57
75	8.16	29.00	22.57
100	8.14	29.01	22.60
130	8.16	29.06	22.62
160	8.18	29.09	22.64

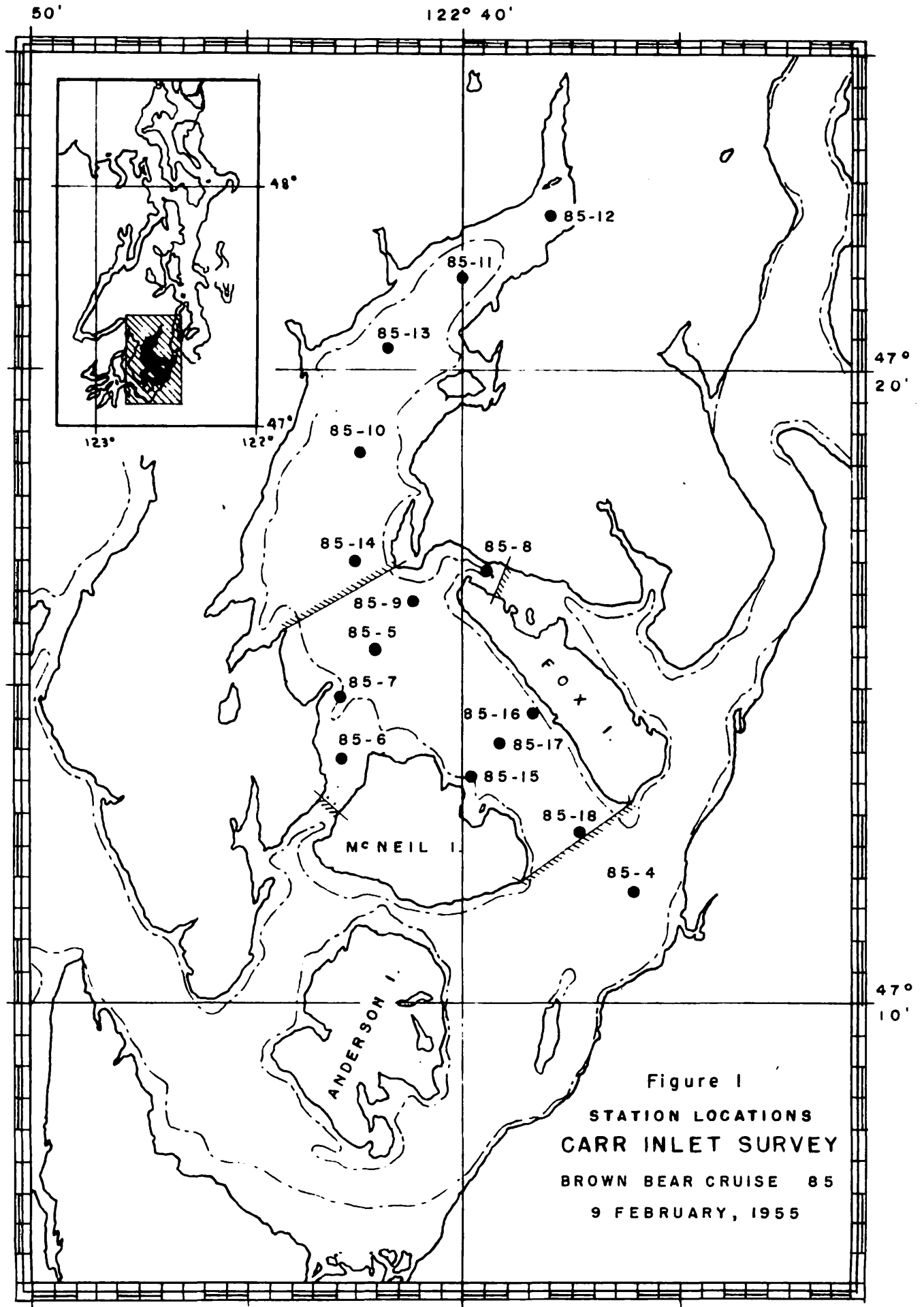


Figure 1  
 STATION LOCATIONS  
 CARR INLET SURVEY  
 BROWN BEAR CRUISE 85  
 9 FEBRUARY, 1955

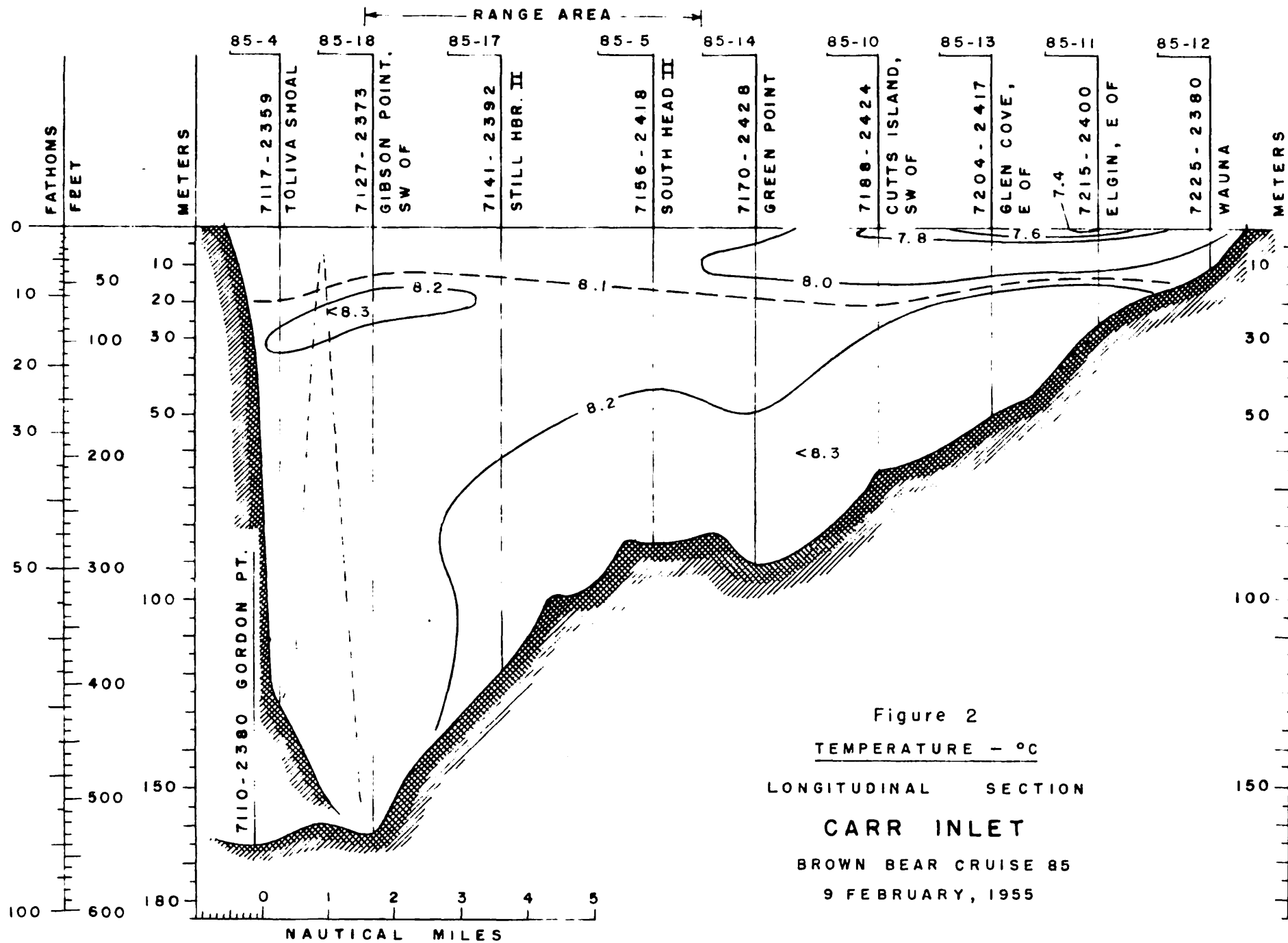


Figure 2  
 TEMPERATURE - °C  
 LONGITUDINAL SECTION  
 CARR INLET  
 BROWN BEAR CRUISE 85  
 9 FEBRUARY, 1955

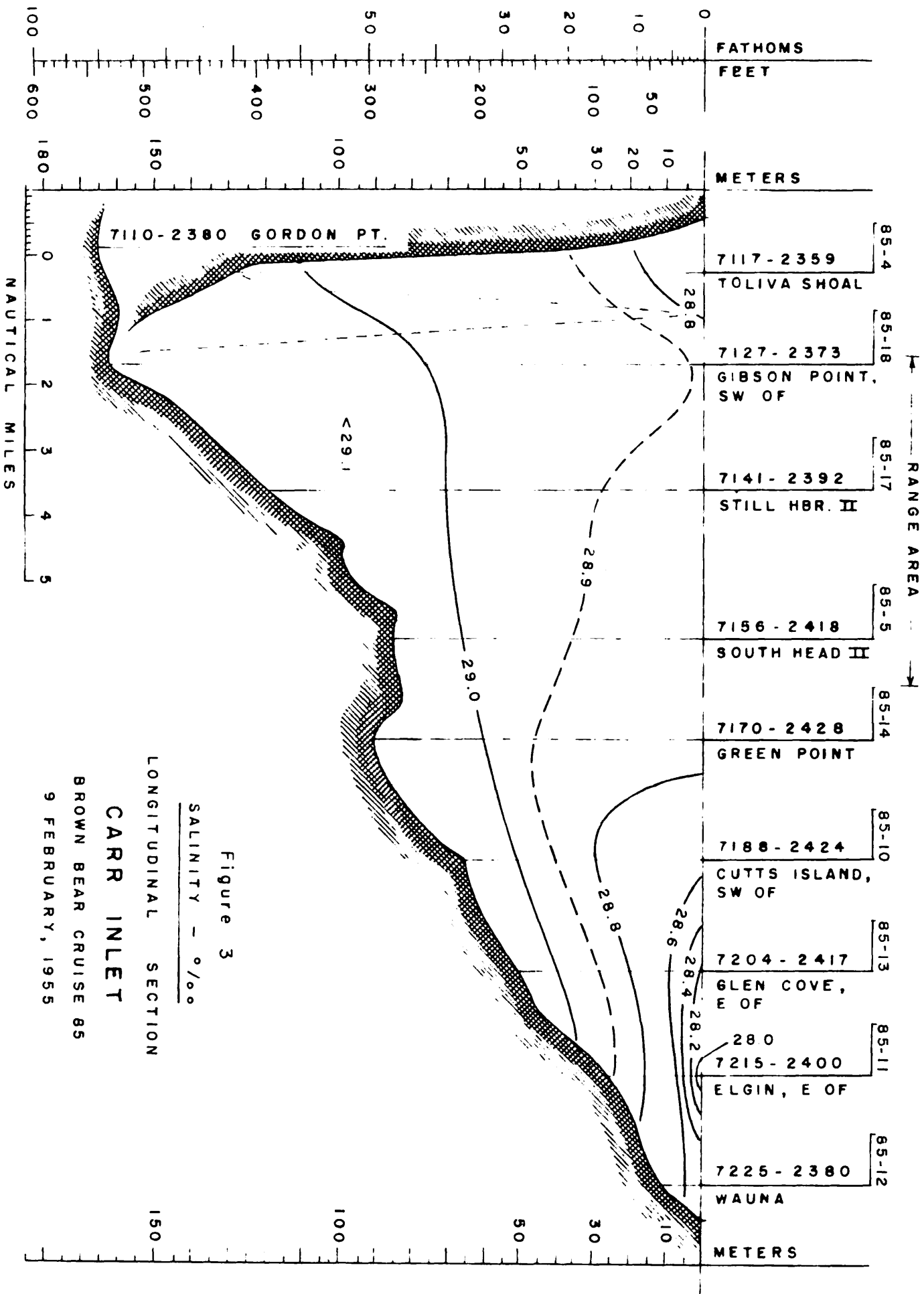


Figure 3  
 LONGITUDINAL SECTION  
 CARR INLET  
 BROWN BEAR CRUISE 85  
 9 FEBRUARY, 1955

SALINITY - ‰

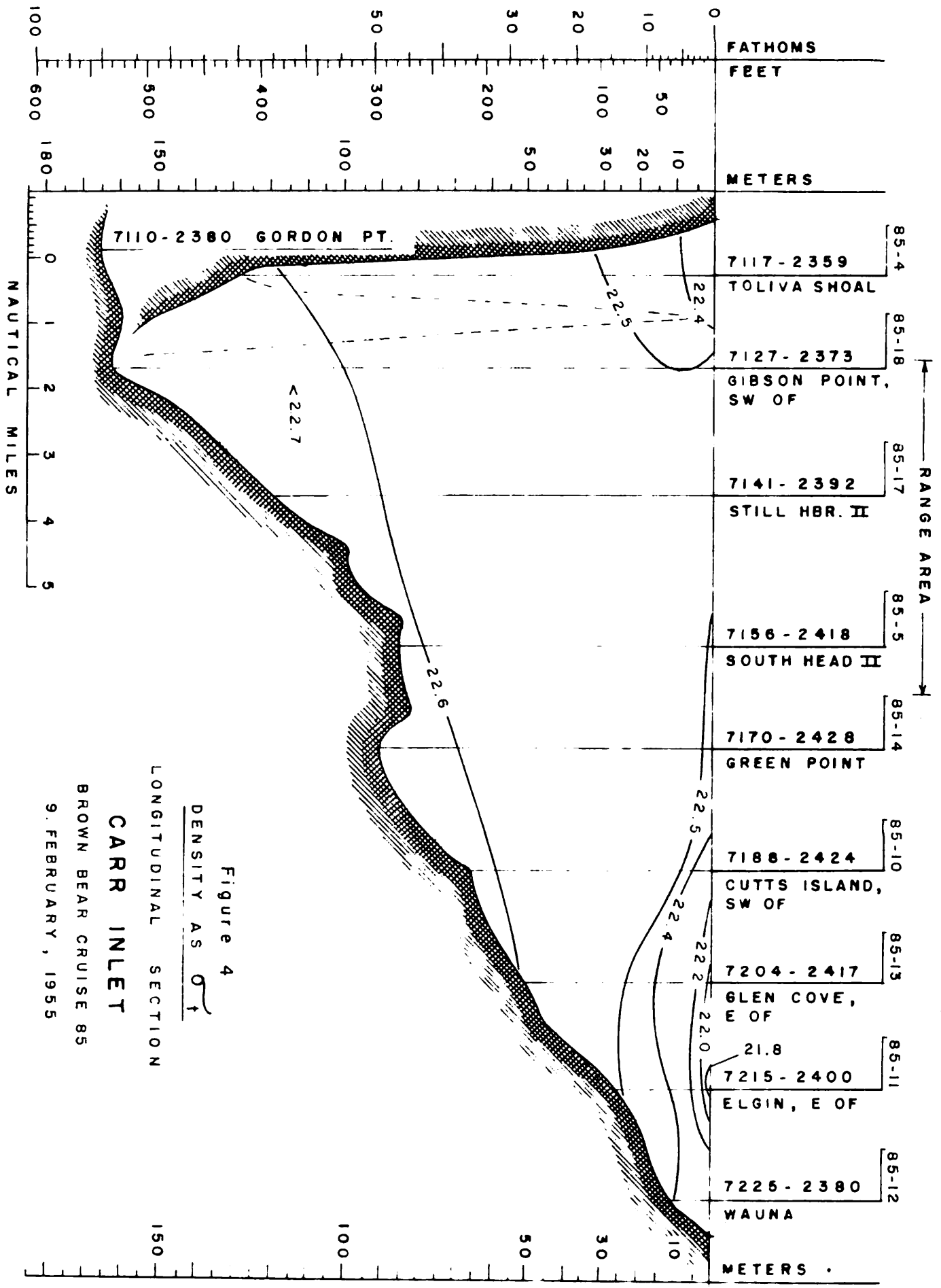


Figure 4  
 DENSITY AS OF  
 LONGITUDINAL SECTION  
 CARR INLET  
 BROWN BEAR CRUISE 85  
 9. FEBRUARY, 1955

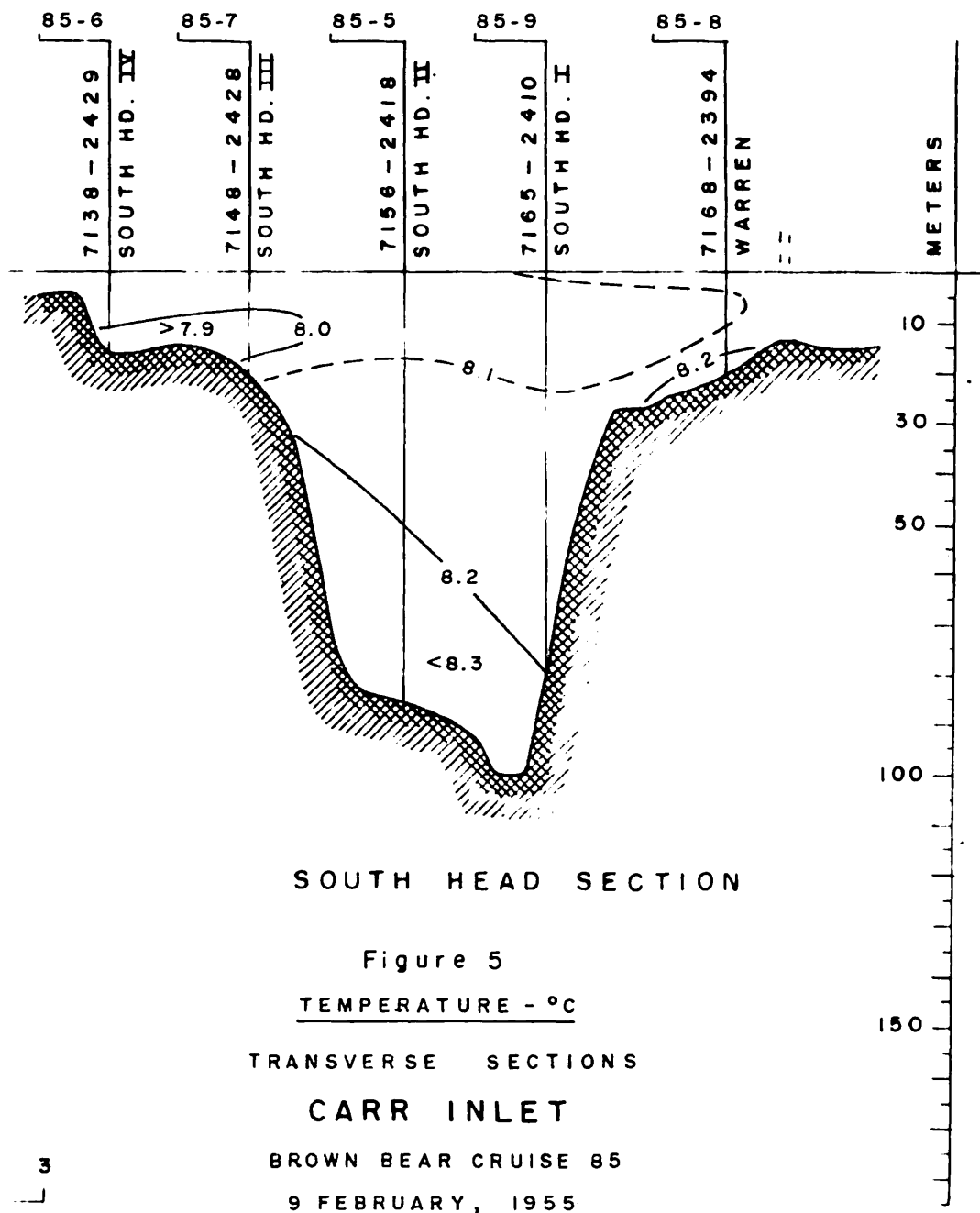
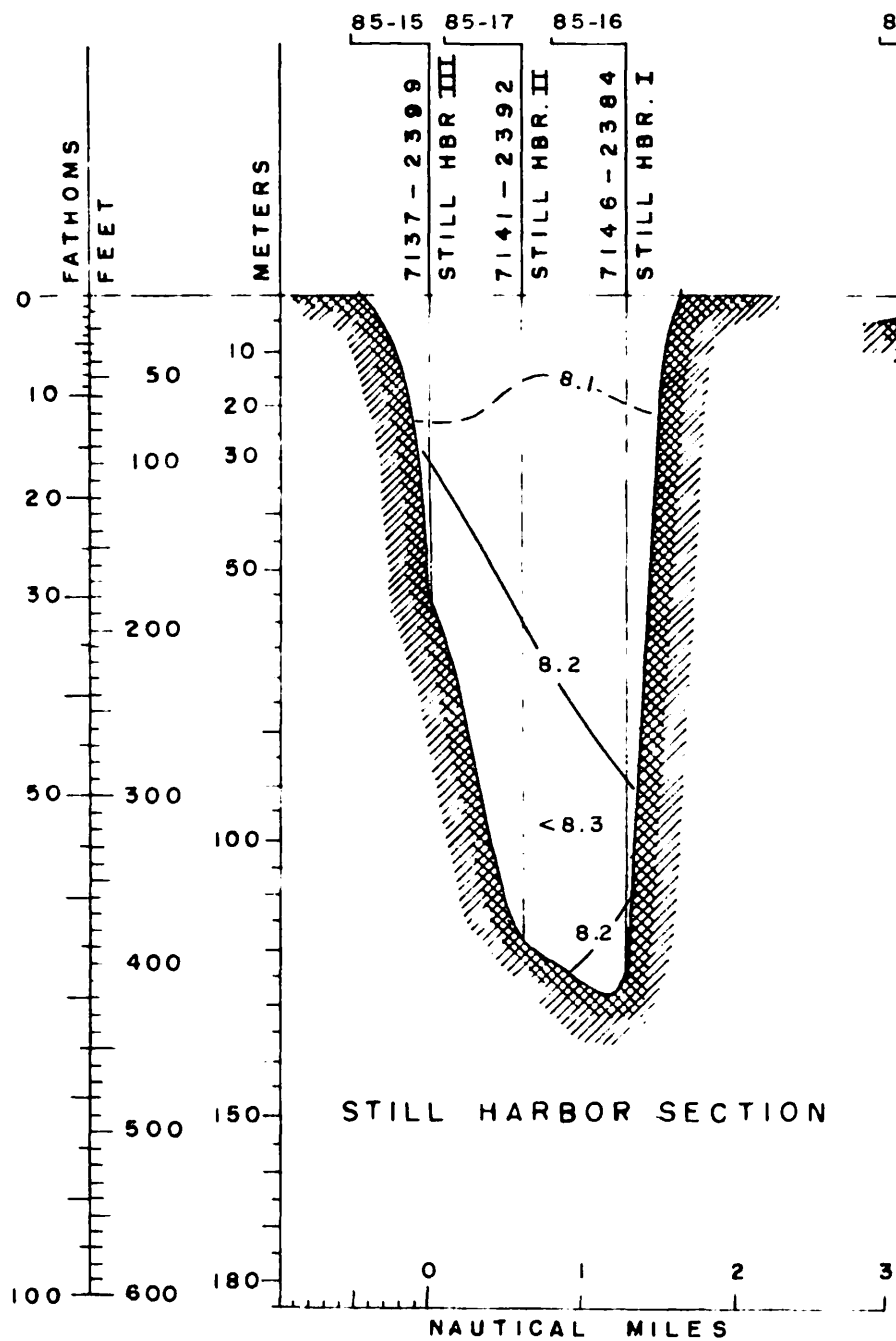
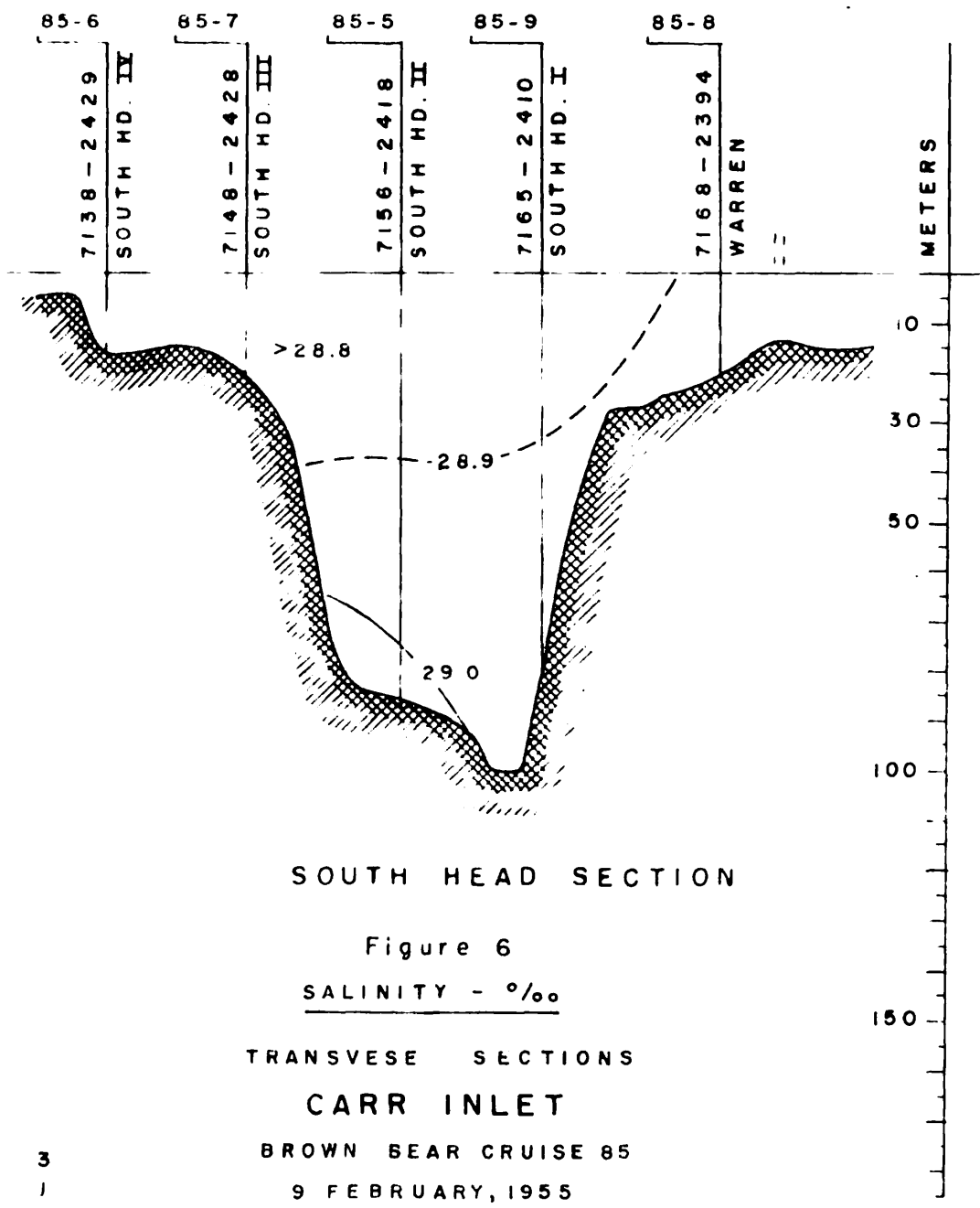
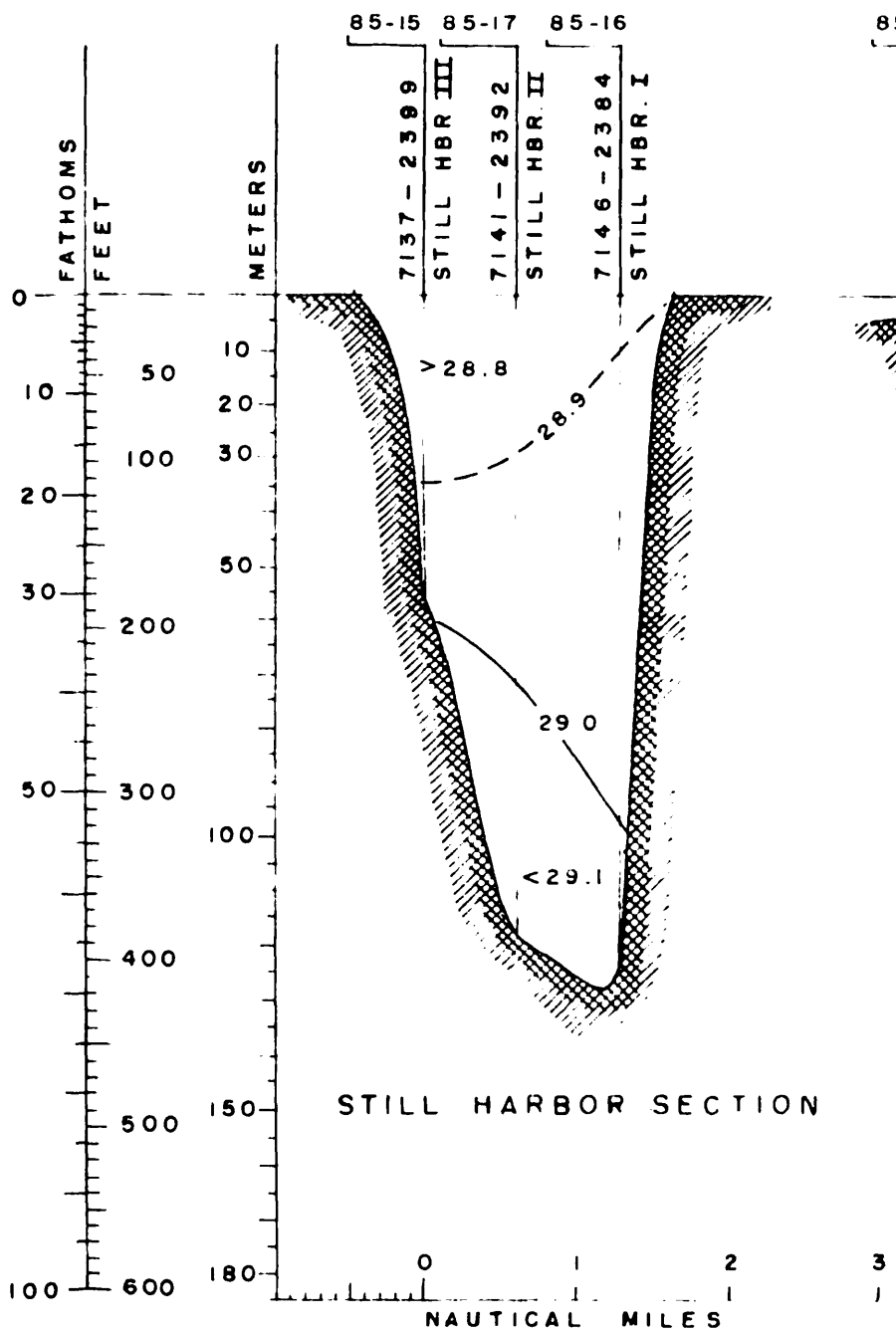


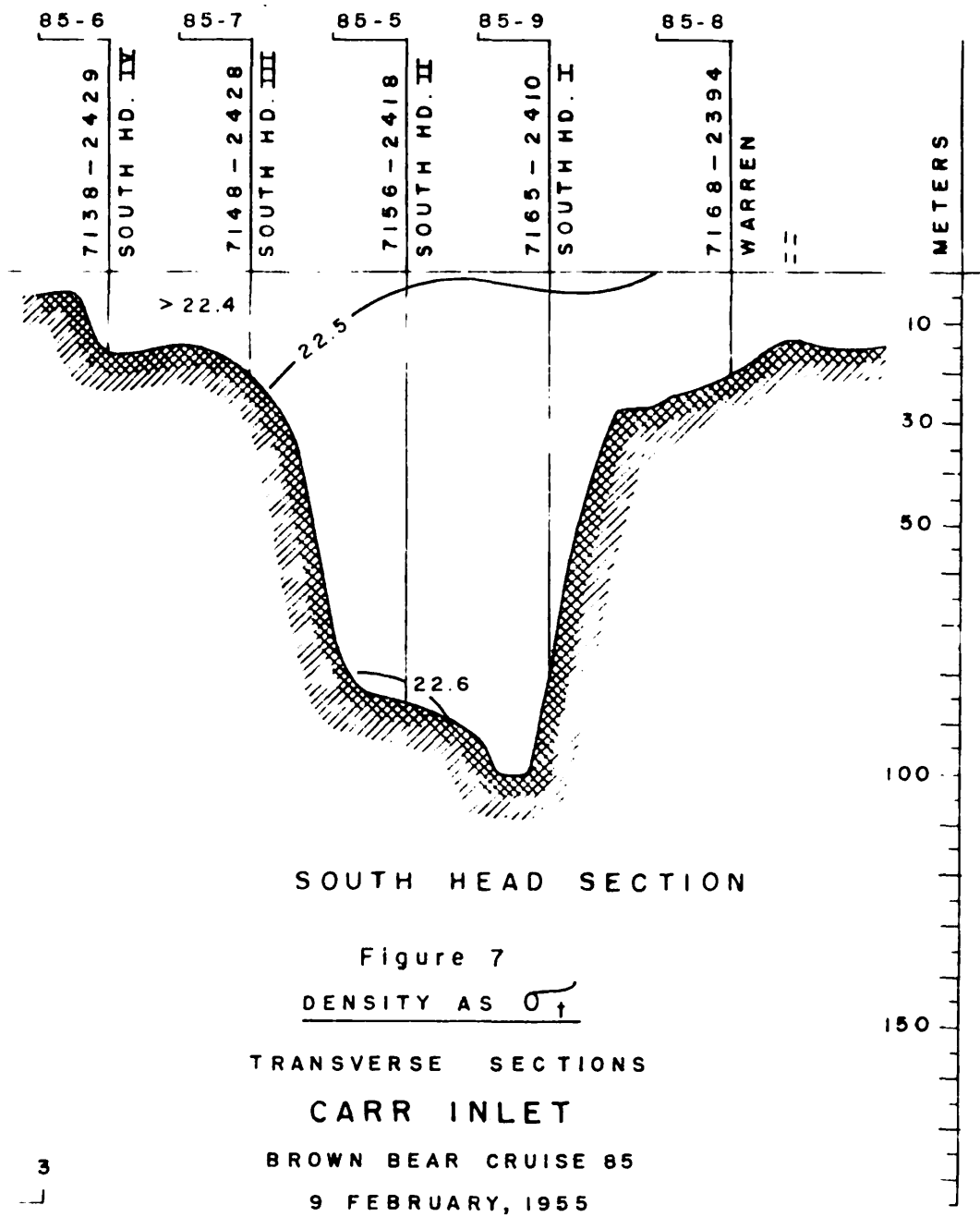
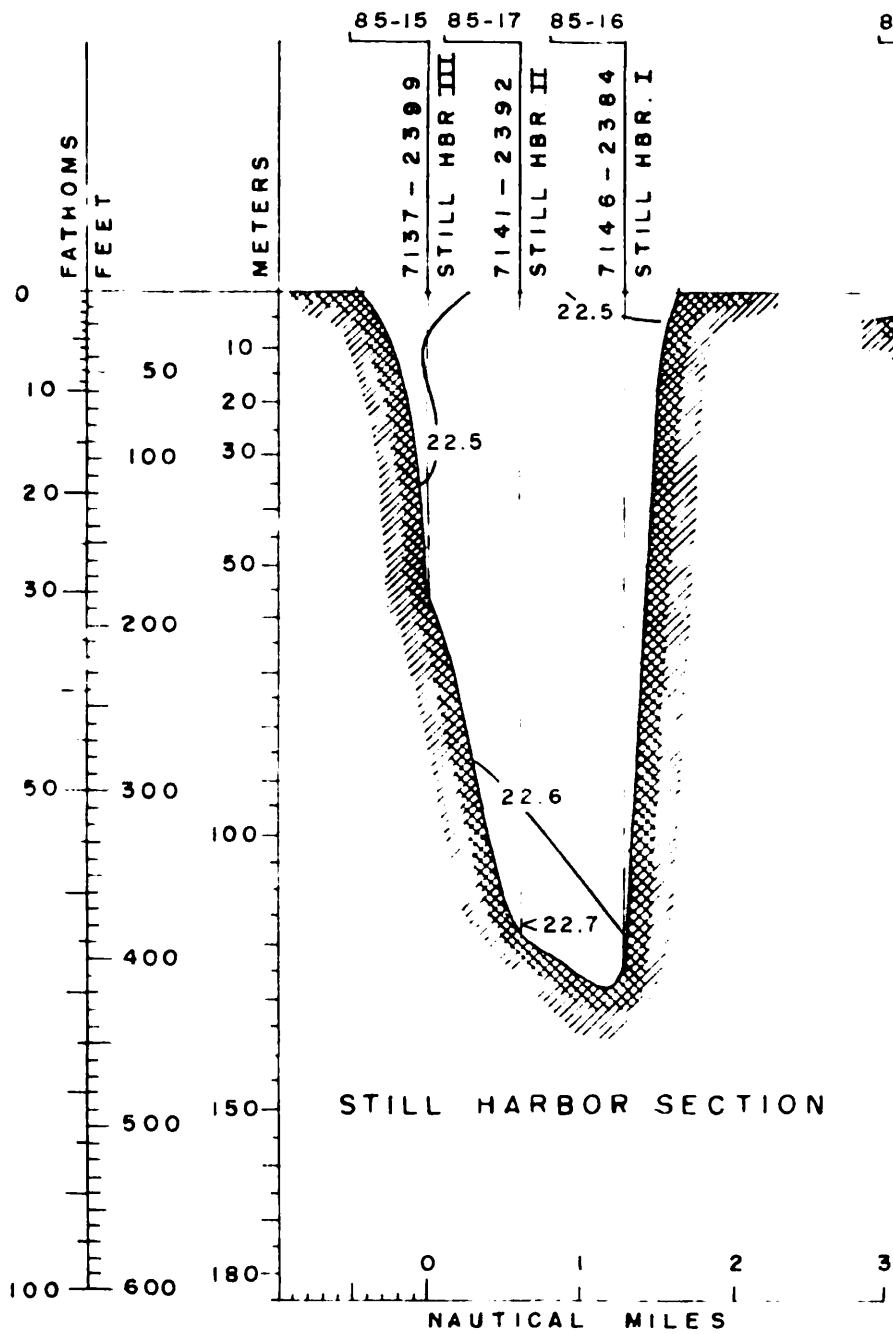
Figure 5  
TEMPERATURE - °C  
 TRANSVERSE SECTIONS  
**CARR INLET**  
 BROWN BEAR CRUISE 85  
 9 FEBRUARY, 1955





**SOUTH HEAD SECTION**

Figure 6  
 SALINITY - ‰  
 TRANSVERSE SECTIONS  
 CARR INLET  
 BROWN BEAR CRUISE 85  
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