444

NORTHEAST PACIFIC ALBACORE OCEANOGRAPHY SURVEY, 1961

by R. W. Owen, Jr.

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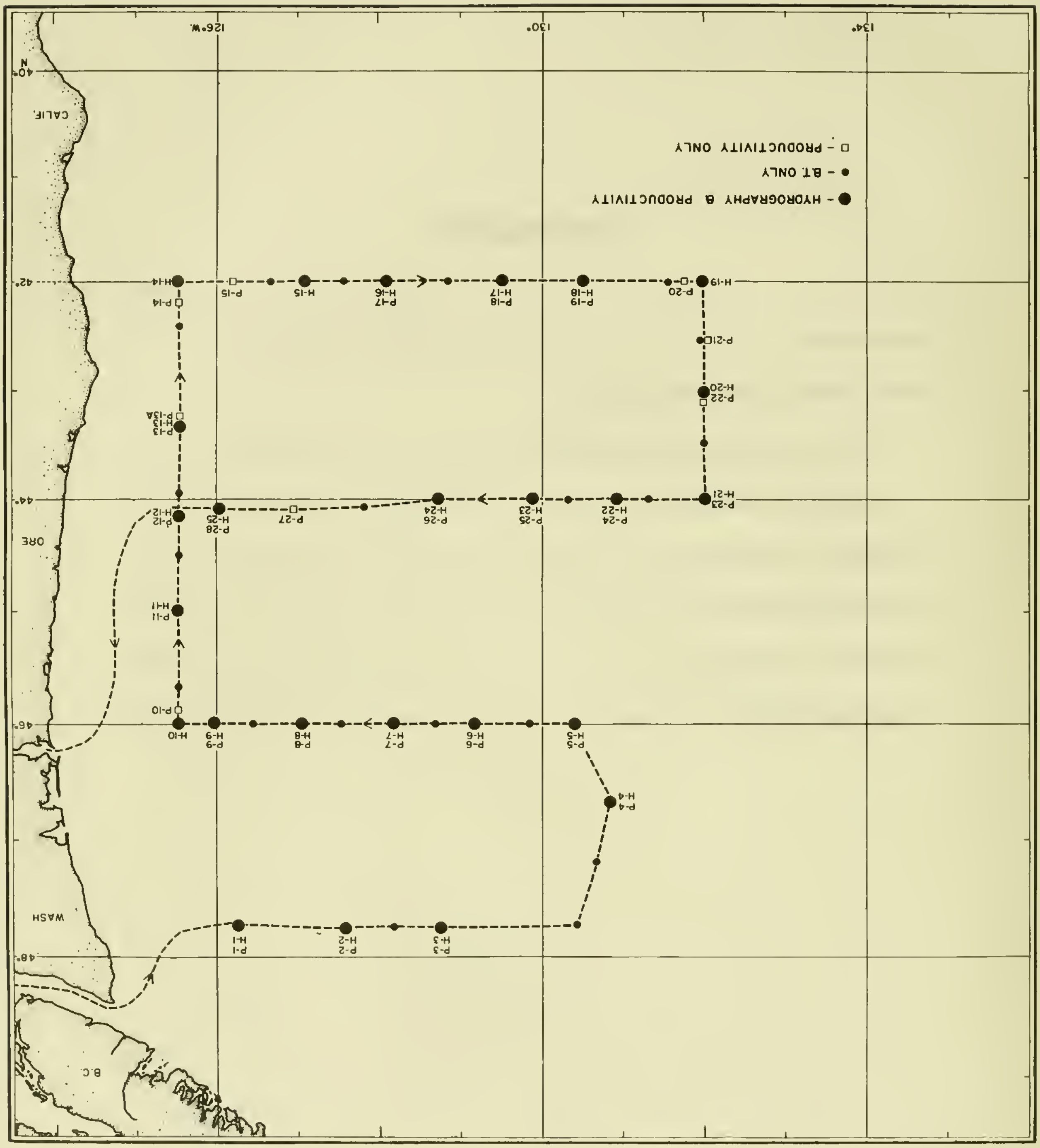

Figure 1.--Cruise track and station positions on *John N. Cobb* Cruise 51, July 1961. "H" designates hydrographic stations, "P" designates productivity stations.

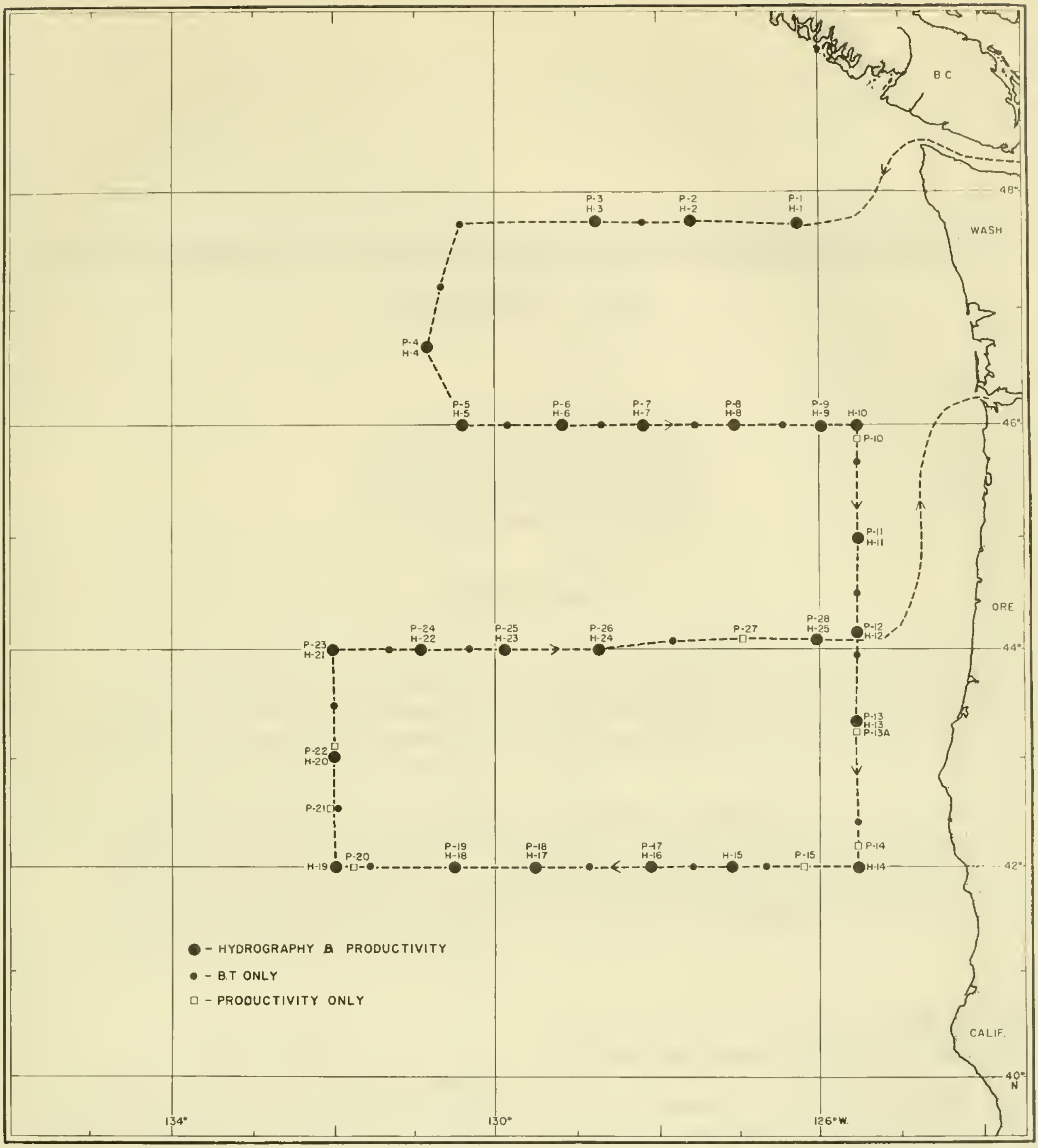

Figure 1.--Cruise track and station positions on *John N. Cobb* Cruise 51, July 1961. "H" designates hydrographic stations, "P" designates productivity stations.

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ABSTRACT

Oceanographic and biological data obtained on the first of a series of albacore oceanography cruises are presented in this report, together with a statement of the methods employed. The cruises are a cooperative venture between the Bureau of Commercial Fisheries Biological Laboratory, San Diego, Calif., and the Exploratory Fishing and Gear Research Base, Seattle, Wash.

The first cruise was made during July 1961 between latitudes 42° N. to 48° N. and longitudes 125° 30' W. to 132° W. Measured were salinity, temperature, and oxygen concentration from 0 to 600 meters, zooplankton standing crop from 0 to 140 meters, surface phytoplankton pigments and productivity, and incoming solar radiation. Other activities included trolling and gill netting for albacore, logging weather observations, and collecting with nightlights.

INTRODUCTION

The present work is a report on the first of a series of annual oceanography cruises planned for the region off the coasts of Washington and Oregon at the time of year when albacore, *Thunnus alalunga* (Bonnaterre), usually are available. The survey was a cooperative venture of the Bureau of Commercial Fisheries Biological Laboratory, San Diego, Calif., with the Bureau's Exploratory Fishing and Gear Research Base, Seattle, Wash. The vessel used was M/V *John N. Cobb*, operated by the latter group. The principal objective of the cruise was to provide data for investigating relationships between availability of albacore and mensurable features of the environment.

In Washington-Oregon coastal waters, marked fluctuations in the annual commercial catch of albacore have characterized this fishery since its inception in 1937, and apparently are related to variable features of the oceanic environment (Alverson, 1961; Johnson, 1962). Exploratory fishing for albacore was conducted in this area from 1949 to 1952 and in 1956 as part of the North Pacific Exploratory Fishing Program of the Bureau of Commercial Fisheries (Powell and Hildebrand, 1950; Powell, Alverson, and Livingstone, 1952;

Schaefers, 1952 and 1953; Powell, 1957). The Fish Commission of Oregon made independent exploratory fishing and tagging cruises in 1959, 1960, and 1961.[1]

Albacore trolling has been conducted on several oceanographic surveys off the Washington-Oregon coast. In 1955 and 1956 oceanographic and biological data were collected from the British Columbia, Washington, Oregon, and northern California coastline out to about longitude 145° W. (Holmberg[2]; Love, 1957). In the fall of 1956, vessels of the Bureau of Commercial Fisheries Pacific Oceanic Fishery Investigations collected data from longitude 150° W. to the American Pacific coast between latitudes 31° N. and 46° N. (Callaway, 1957). The Northeastern Pacific Albacore Survey (NEPAS) operated in 1957 between latitudes 35° N. and 47° N. (Callaway and McGary, 1959; Graham, 1959). In 1958 the area off Washington and Oregon was surveyed as part of the International Geophysical Year (Fleming and staff, 1959).

On Exploratory Cruise 51 the M/V *John N. Cobb* departed Seattle on July 10, 1961, and proceeded to the cruise track (fig. 1). The first hydrographic station was occupied on July 11 and the last on July 26, 1961. During the cruise, the *Cobb* drifted at night. The vessel docked in Astoria, Oreg., on July 27.

OBSERVATIONS AND FIELD PROCEDURES

Physical and Chemical Methods

Hydrographic stations usually were occupied at noon and shortly after dark at intervals of about 48 nautical miles (fig. 1, table 1). Casts of 18 Nansen bottles each were made at 23 stations to depths of about 600 meters, and casts of 9 bottles each were made at 2 stations to about 120 meters depth. Results of physical and chemical measurements are presented in figures 2-10 and in tables 2-4.

Nansen bottle spacings were determined by characteristics of bathythermograph (BT) traces obtained at each station and by anticipated wire angles. Because the hydrographic wire was of small diameter (1/8 inch), two casts were made at each station: a shallow cast to sample from 0 to 125 meters and a deep cast to sample from 125 to 600 meters. Paired protected reversing thermometers were attached to each bottle, and most bottles sampling below 100 meters were equipped with unprotected reversing thermometers. Samples were drawn for salinity and oxygen analysis. Oxygen determinations were made aboard the *Cobb*, and salinity determinations were made at the Department of Oceanography, University of Washington.

Bathythermograph casts to 900 feet were made at each hydrographic station and at points about halfway between stations (fig. 1, table 3). The vessel was stopped for all BT casts. Observations were made in accordance with U.S. Navy Hydrographic Office Publication No. 606-c (1956).

Drift bottles were released at 19 stations (tables 1 and 2). These were provided by Hans T. Klein, Data Collection and Processing Group, Scripps Institution of Oceanography. No recoveries had been received as of March 1962.

Continuous recording of incident solar radiation was made throughout the cruise. The sensor used was a gimbal-mounted pyranometer using Parsons' Black as the "black body." A strip-chart recorder provided the trace (table 4).

Biological Methods

Surface measurements of primary production using the C^{14} method were made at 21 stations. These were often coincident with hydrographic station locations but are labelled independently of hydrographic stations due to occasional differences in time and location (fig. 11, tables 1 and 5). The method employed is a modification of those described by Steemann Nielsen (1952), Strickland (1960), and Strickland and Parsons (1960). Water samples were obtained with a plastic bucket from the

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[1] Robert J. Ayers. 1959, 1960, 1961. Unpublished reports of the Fish Commission of Oregon.

[2] Edwin K. Holmberg. 1956. Unpublished report of the Fish Commission of Oregon.

sea surface at sunrise and local noon. Water was placed in clear ("light") and opaque ("dark") 125-ml. glass-stoppered Pyrex bottles. Each sample was inoculated with 1 ml. of C^{14} solution (1.7 microcuries/ml.) and trailed from sunrise to local apparent noon or from local apparent noon to sunset. After incubation, samples were immediately filtered through 25-mm. membrane filters (0.30-micron (μ) $\pm$.02-μ pore size - manufacturer's rating). The filters were rinsed with 2 ml. of 0.05 N HCl and placed in a vacuum dessicator for counting ashore.

Surface chlorophyll samples were obtained at 28 stations (fig. 12, tables 1 and 6). Three surface water samples of 2.0-3.0 liters each were taken at the same time that water was taken for primary production measurement. These were filtered immediately through 47-mm. membrane filters (0.45-μ $\pm$.02-μ pore size). Small amounts of magnesium carbonate were added during filtration. The filters were dessicated and frozen for shore analysis of chlorophyll a.

Oblique zooplankton hauls were made at 10 noon stations, coincident with hydrographic and productivity stations (tables 7 and 8). Samples were collected with a 1-meter net identical to those used on cruises of the California Cooperative Oceanic Fisheries Investigations (e.g., Thrailkill, 1956) and of the Pacific Oceanic Fisheries Investigations (King and Demond, 1953). Calibration of the water-flow meter was done before and after the cruise. The meter was affixed to a towing frame and hauled back and forth through a 50-ft. water course at 13 speeds from 1.3 to 3.6 ft./sec. Revolutions/sec. recorded at each speed, averaged to cancel current effects, were plotted against distance traversed/revolution to establish a calibration curve. Water volumes recorded on net hauls were calculated by multiplying the net-mouth area by the distance traversed as indicated by the flow meter. No extensive clogging of the plankton net was evident during the cruise.

Trolling for albacore was conducted between stations at 6 to 8 knots with six to eight lines. Feather jigs were used, supplemented occasionally by bone-type jigs. About 205 hours were spent trolling, generally from one-half hour before sunrise to one-half hour after sunset. Sixty albacore were caught (fig. 13, table 9); six of these were released wearing tags supplied by the Fish Commission of Oregon. Blood samples were taken from 16 albacore for serological analysis by Lucian Sprague of the Bureau of Commercial Fisheries Biological Laboratory, Honolulu.

Nightly sets of eight shackles (400 fathoms) of gill nets were made between July 11 and July 17 (table 10). On the morning of July 18, the nets could not be found; probably the nets sank under a load of blue sharks, *Prionace glauca* (Linnaeus). Many had been enmeshed on previous sets. Two albacore and one bluefin tuna, *Thunnus thynnus* (Linnaeus), were caught on the set of July 14-15 at station H-7 (fig. 13).

LABORATORY PROCEDURES

Salinity determinations were made through the courtesy of the Department of Oceanography, University of Washington, on a conductivity bridge calibrated against Copenhagen Water (figs. 3, 6, and 9; table 2). Accuracy is better than $\pm$0.005 ‰.

Oxygen determinations (table 2) were made on board the vessel by the Winkler method according to procedures outlined by Wooster[3] and Chow.[4]

Chlorophyll samples were transported under refrigeration to San Diego for analysis (fig. 12, table 6). The method of analysis used was that described by Holmes and others (1958), except that extraction in acetone was allowed to proceed for 16-18 hours. Equations used in calculation of chlorophyll a are those of Richards with Thompson (1952).

[3] Warren S. Wooster. 1950. Methods in chemical oceanography employed in the California Cooperative Sardine Research Program. Technical Report of 25 November 1950, Scripps Institution of Oceanography, 27 p. Mimeographed.

[4] T. J. Chow. 1961. Field guide for the STEP-I Expédition. Scripps Institution of Oceanography, 35 p. Mimeographed.

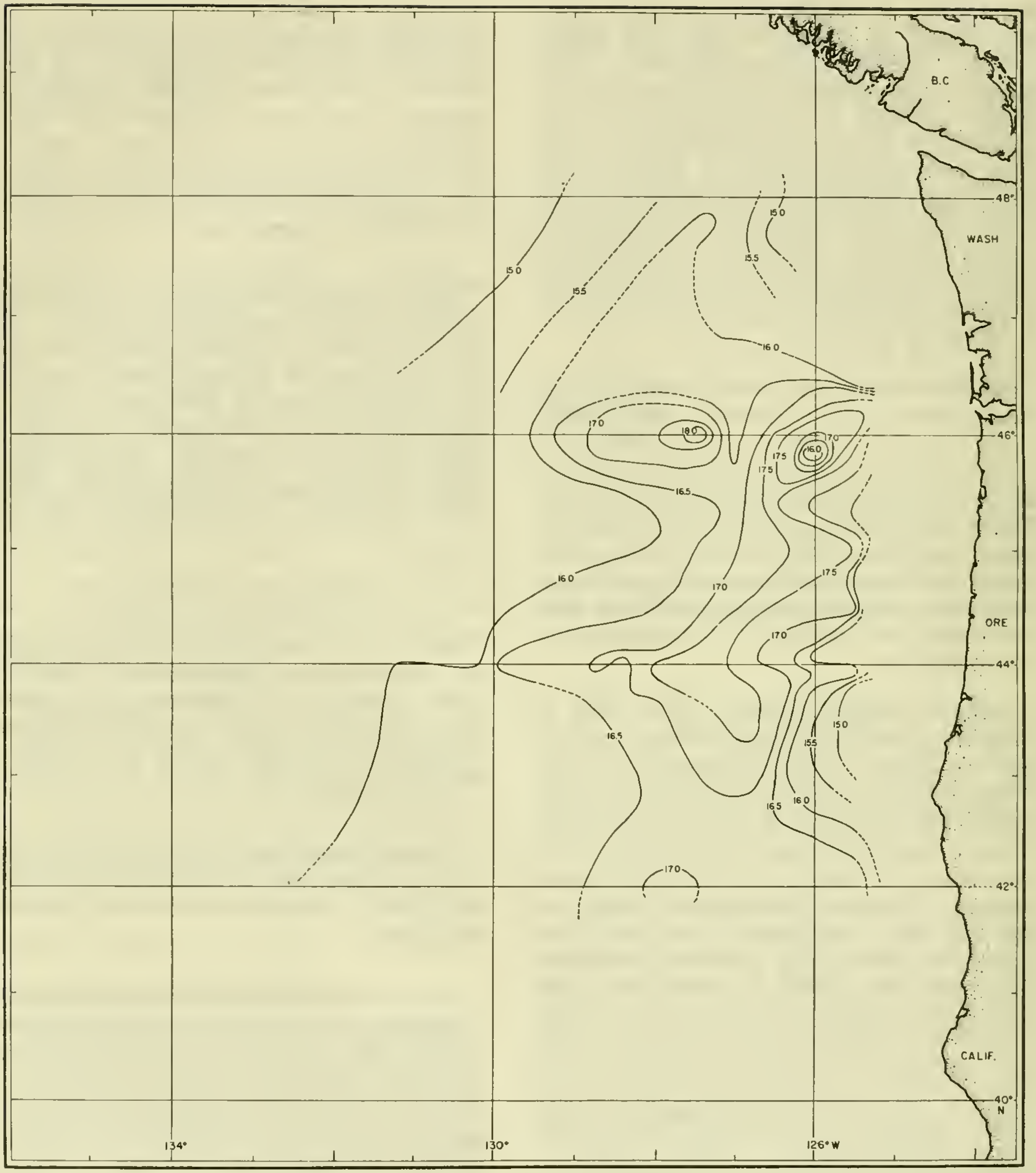

Figure 2.--Horizontal distribution of temperature at 10 m. Contour interval is 0.5° C.

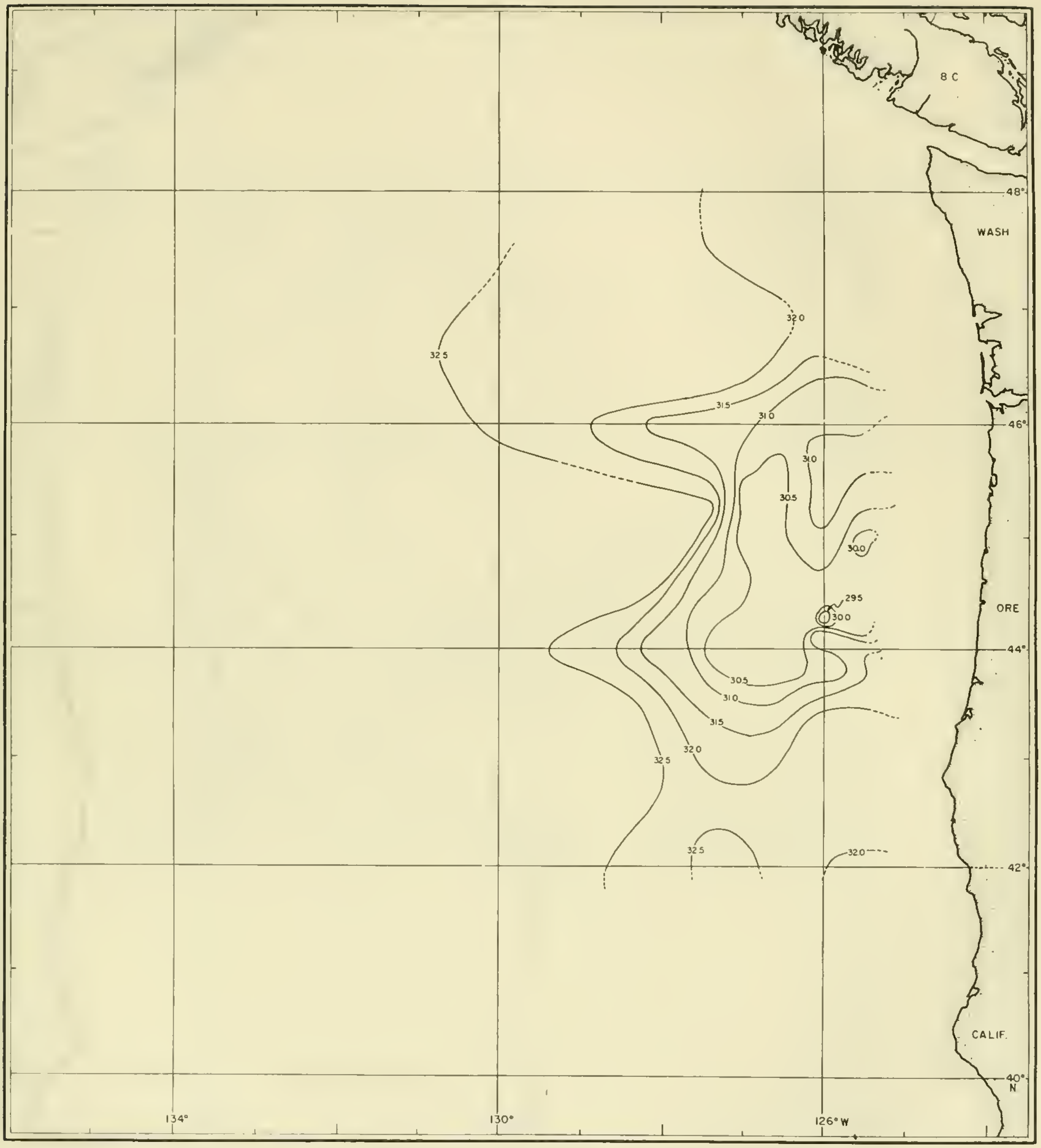

Figure 3.--Horizontal distribution of salinity at 10 m. Contour interval is 0.5 ‰.

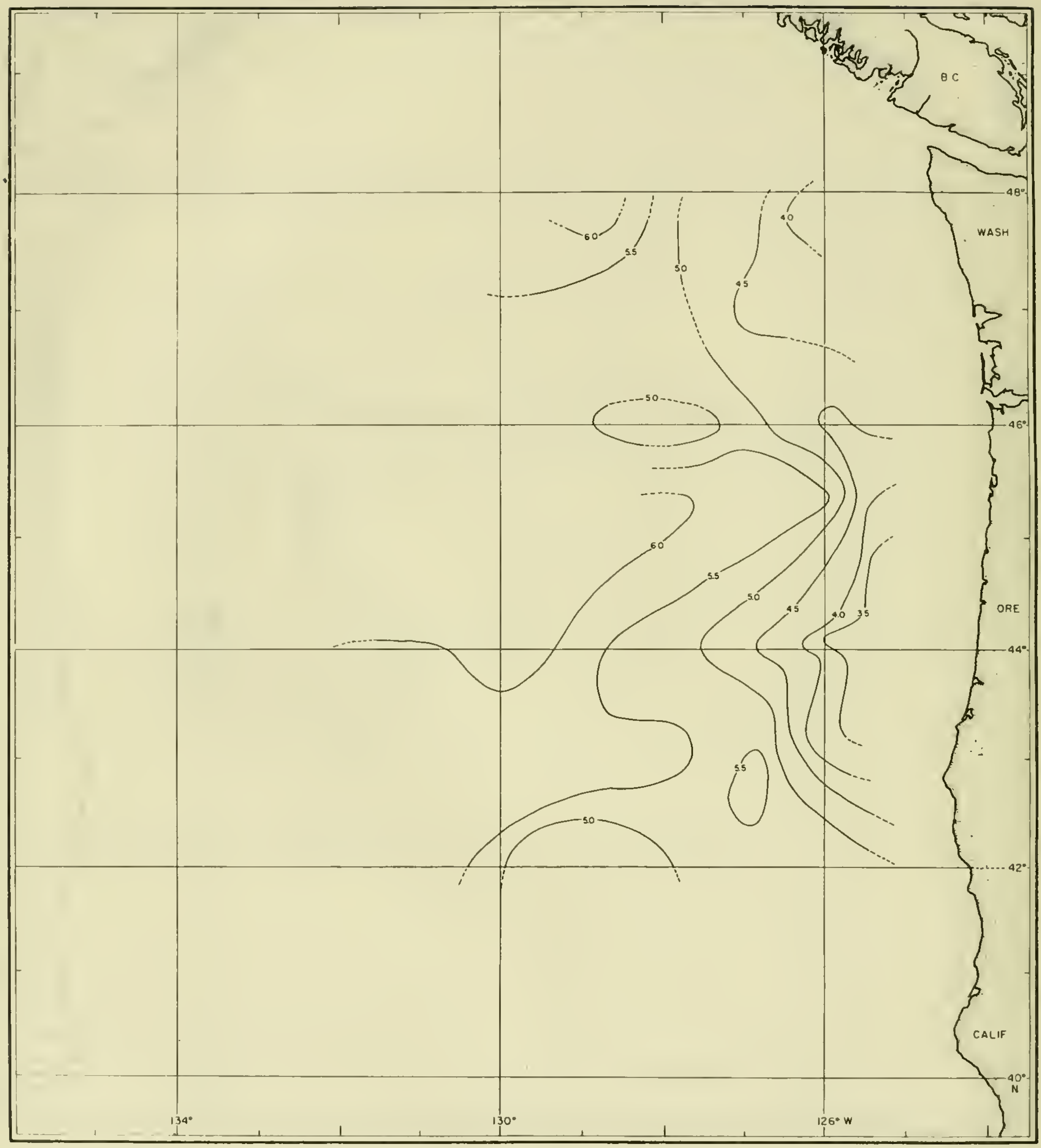

Figure 4.--Horizontal distribution of oxygen concentration at 10 m. Contour interval is 0.5 ml./1.

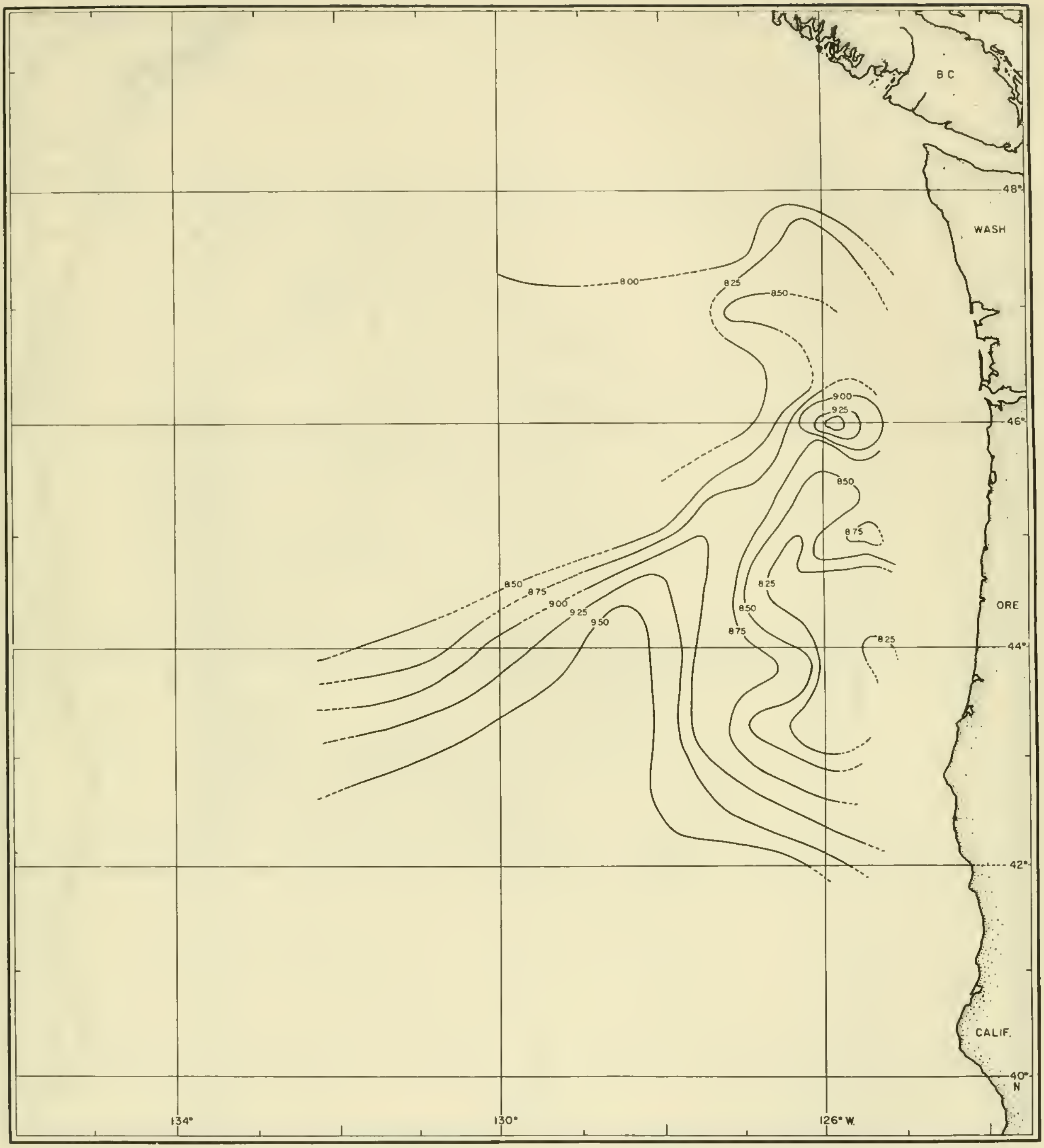

Figure 5.--Horizontal distribution of temperature at 100 m. Contour interval is 0.25° C.

Figure 6.--Horizontal distribution of salinity at 100 m. Contour interval is 0.1 ‰.

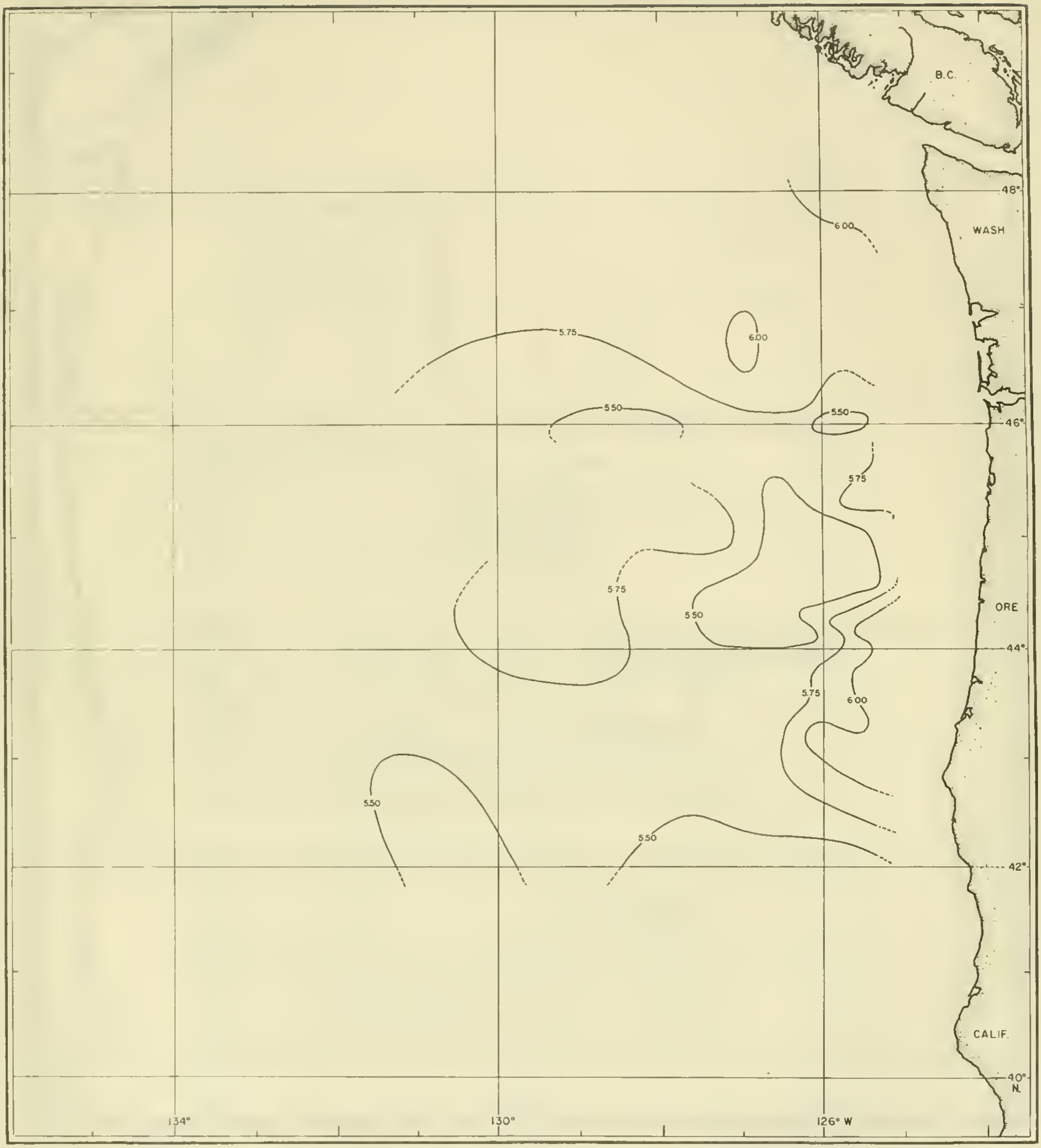

Figure 7.--Horizontal distribution of oxygen concentration at 100 m. Contour interval is 0.25 ml./l.

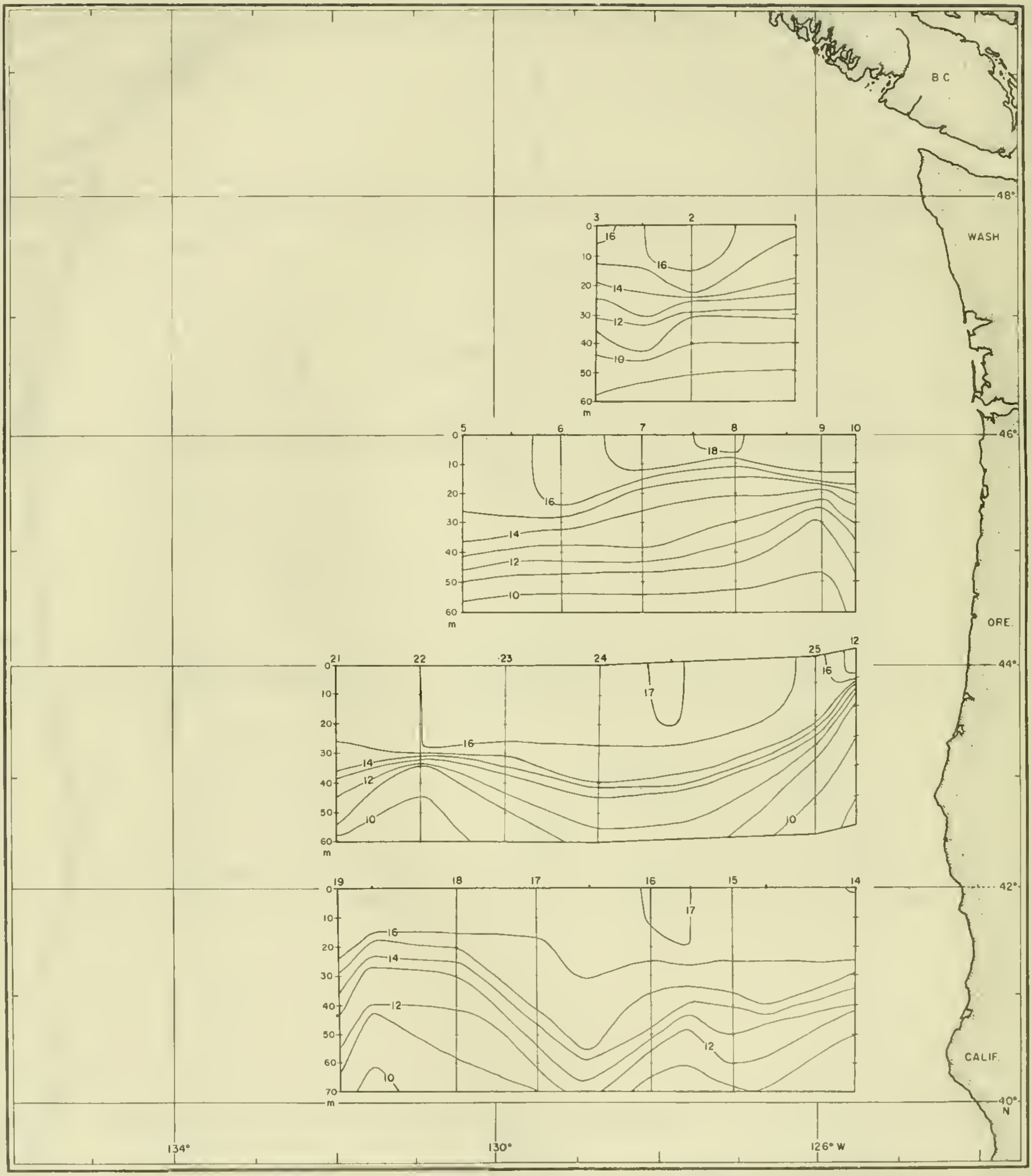

Figure 8.--Vertical profiles of temperature. Profiles are along track lines defined by station numbers at top of each. Contour interval is 1 °C.

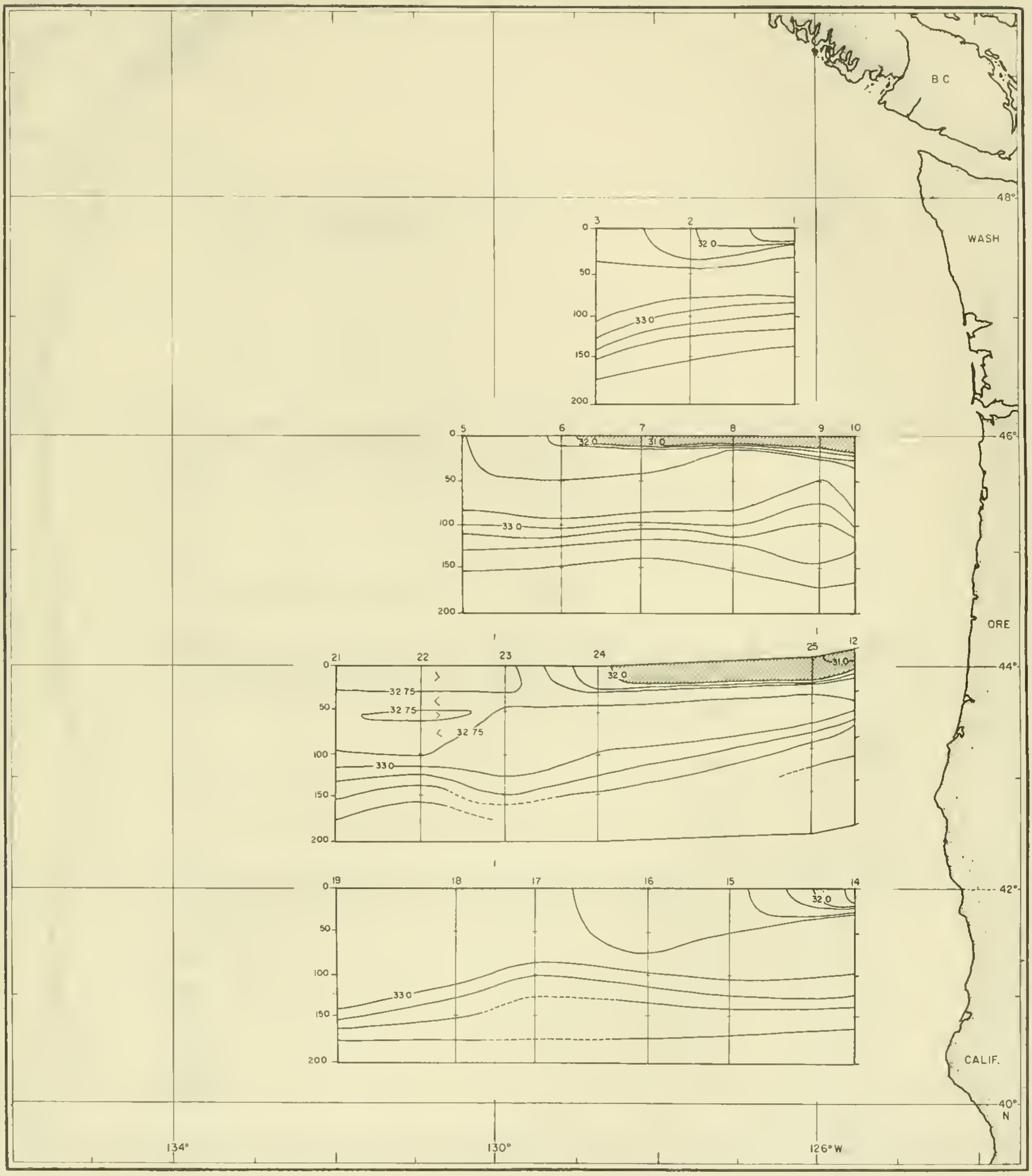

Figure 9.--Vertical profiles of salinity. Profiles are along track lines defined by station numbers at top of each. Contour interval is 0.25 ‰ except in shaded portions where contour interval is 1 ‰.

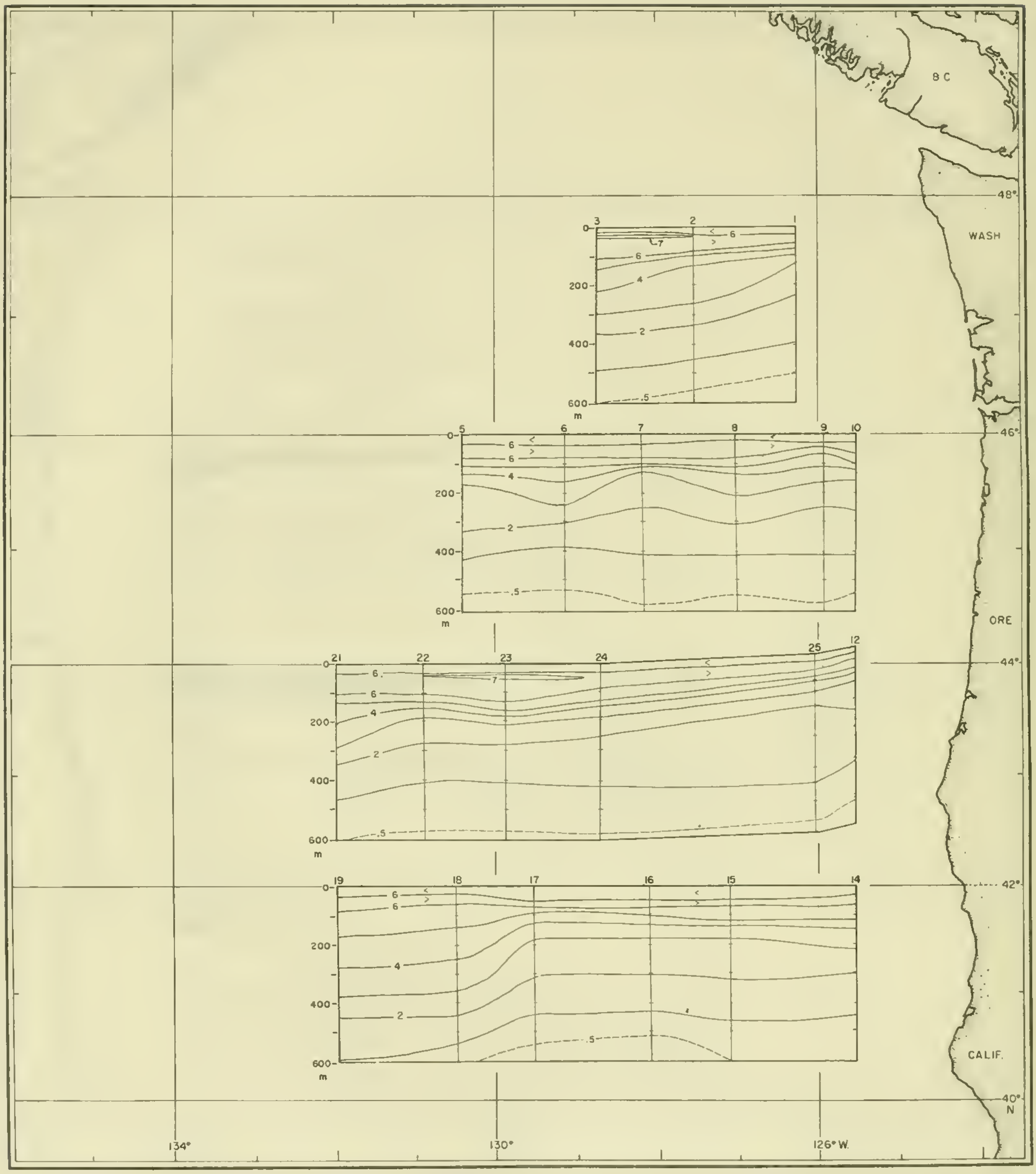

Figure 10.--Vertical profiles of oxygen concentration. Profiles are along track lines defined by station numbers at top of each. Contour interval is 1 ml./1. except for dashed line.

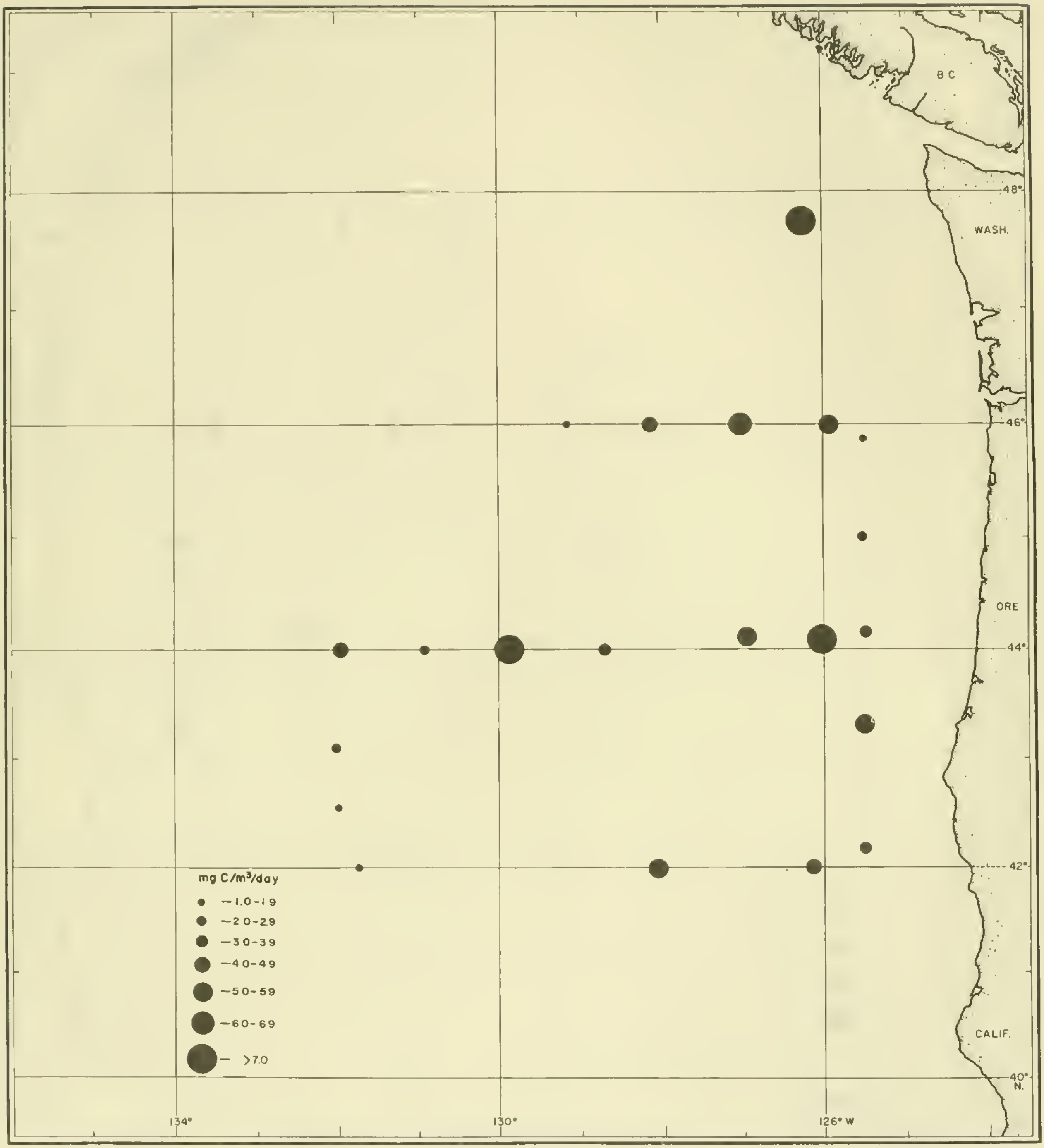

Figure 11.--Primary productivity at sea surface.

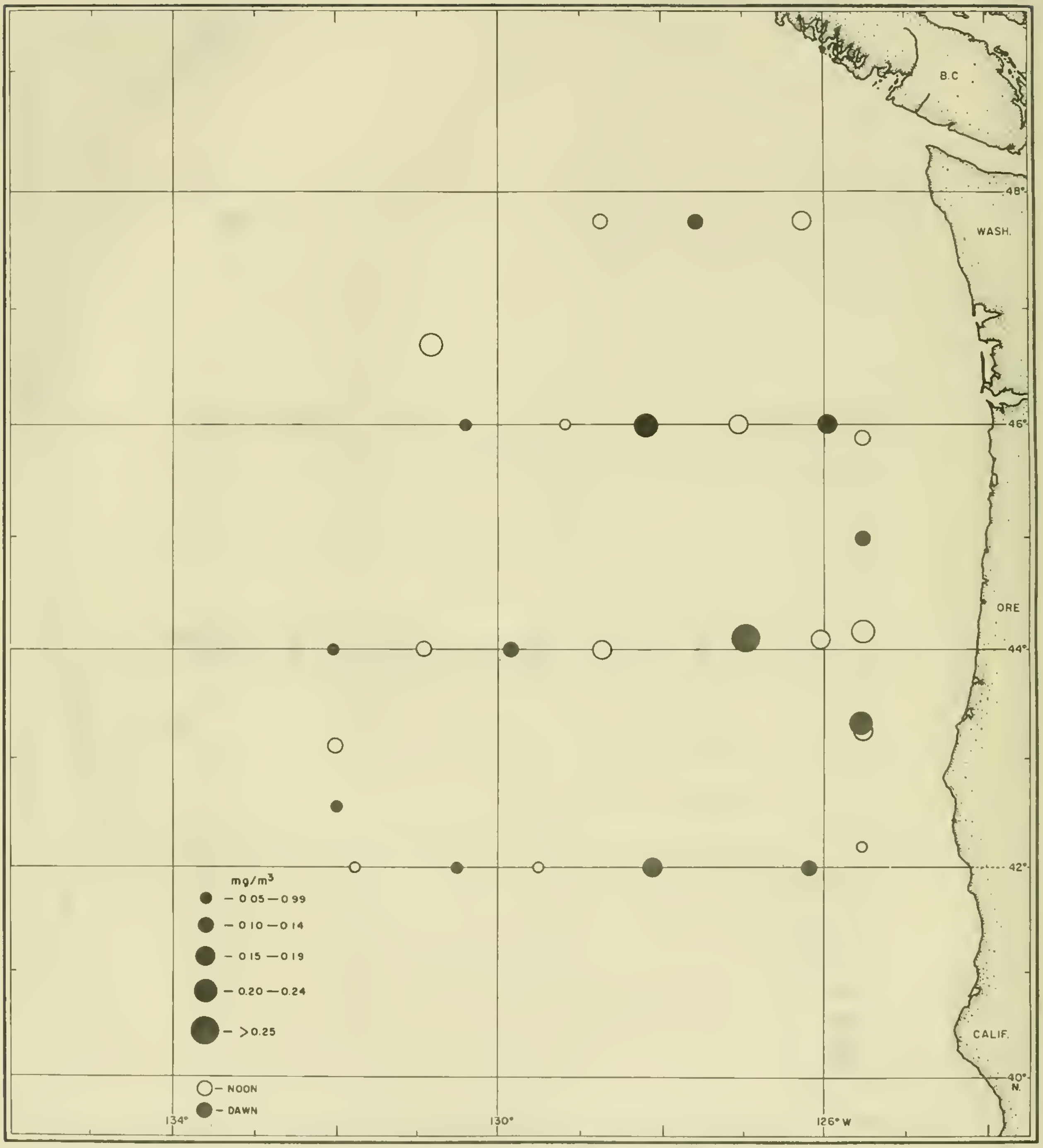

Figure 12.--Chlorophyll a concentrations at sea surface.

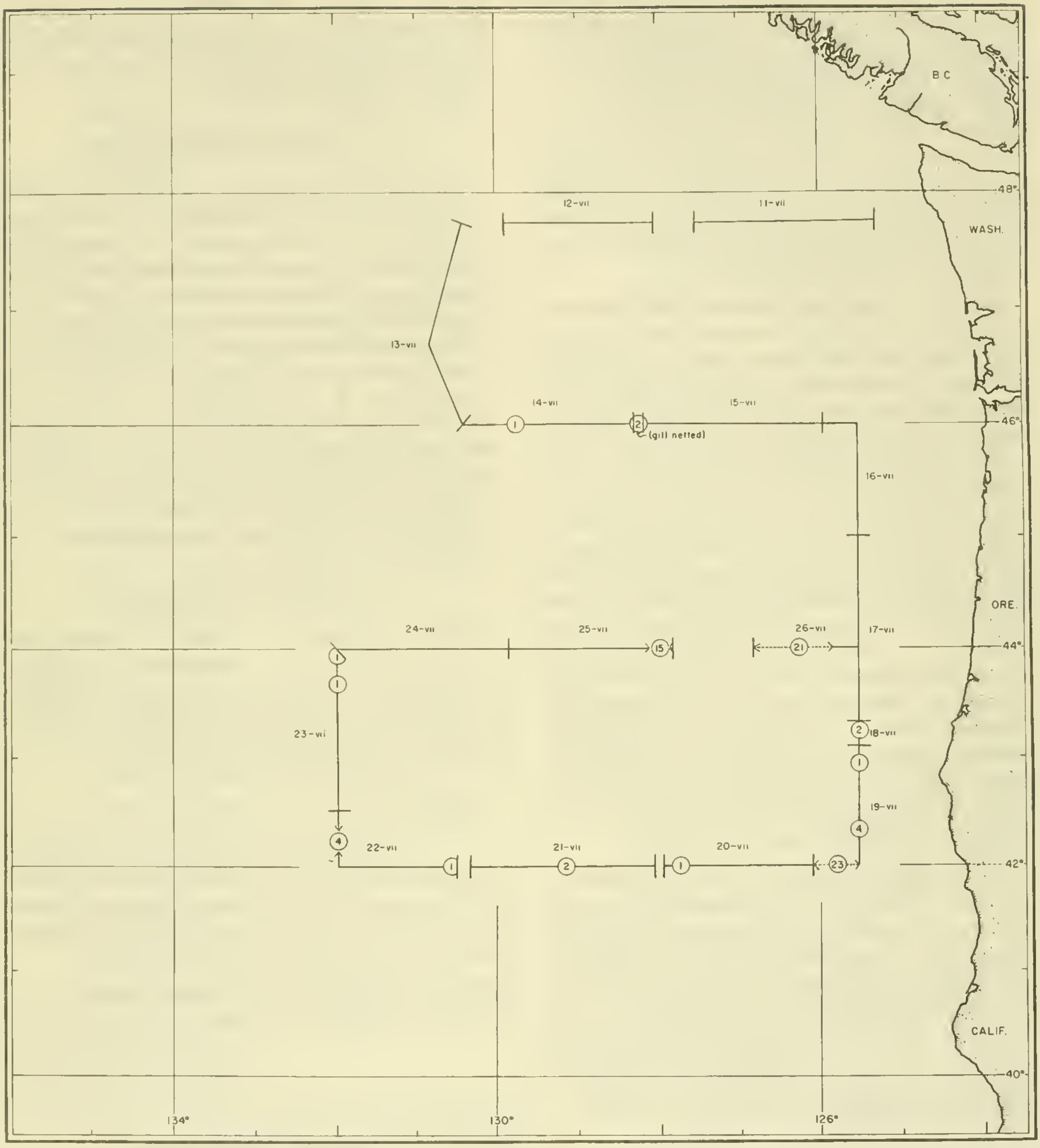

Figure 13.--Albacore tuna catches made with trolling gear and gill nets. Numbers above or beside track line segments are July dates. Circled numbers on track line segments represent catch location and number of fish caught. Fish were troll-caught except as noted.

Measurements of primary production, estimated by rates of carbon fixation by phytoplankton, were made using standardized C^{14} solution (fig. 11, table 5). The solution was made up in the manner described by Steemann Nielsen (1952), except that triple glass-distilled water was used as the carrier instead of artificial sea water. The solution was adjusted to pH 9.0, filtered through a membrane filter and placed in clean 5-ml. ampoules, which then were sealed and autoclaved.

Filters retaining the incubated phytoplankton were given to the Department of Oceanography, University of Washington, for counting. The activity on the filter was measured with a continuous gas flow geiger counter equipped with a mylar end-window. Dark bottle uptake measurements indicated an accumulated bacterial population and were not used in calculations of primary productivity. Light bottles were scrubbed daily and had no such accumulation. Homes et al (1958: p. 8) previously found that ". . . dark bottle uptake averages 10-13% of the uptake in illuminated bottles . . . . " His observation is supported by initial measurements on the July 1961 *Cobb* cruise. On this basis dark bottle uptake was assumed to be 10 percent of that in light bottles. Since this is offset by the "isotope-effect" correction (Steemann Nielsen, 1952), both terms were omitted in calculation of primary productivity.

Hydrographic cast data were processed by the Data Collection and Processing Group of Scripps Institution of Oceanography following procedures described by Klein[5] (table 2). Bathythermograph slides also were processed at Scripps Institution of Oceanography under the supervision of Margaret K. Robinson (table 3). Traces were used to verify temperature-depth configuration obtained from hydrographic station data.

Zooplankton samples were analyzed to identify and determine relative abundance of the organisms present for selection of species to be more closely examined later. Letters which designate abundance of the various taxonomic groups (table 8) are relative only to the total in each sample. They have no absolute numerical significance. Groups in parentheses are tentative identifications.

[5] Hans T. Klein. A new technique for processing physical oceanographic data. Contributions from the Scripps Institution of Oceanography, New Series, No. 000. Undated, typed M.S.

ACKNOWLEDGMENTS

Special acknowledgment is made to the Data Collection and Processing Group of Scripps Institution of Oceanography for processing hydrographic cast and BT data and to the Department of Oceanography, University of Washington, for their analysis of salinity and C^{14} productivity samples. Also greatly appreciated is the loan of hydrographic data by the Department of Oceanography, University of Washington, for verification of horizontal salinity, temperature, and oxygen distribution (figs. 2-7). These data were obtained on M/V *Brown Bear* cruise 290 from July 6-25, 1961, and will be published by the collecting agency.

SCIENTIFIC PERSONNEL

Harold C. Johnson	Fishery methods and equipment specialist, Exploratory Fishing and Gear Research Base, Seattle, Wash.; party chief
Peter Larson	Master, M/V *John N. Cobb*, Seattle, Wash.
Jan B. Lawson	Senior Marine Technician, Scripps Institution of Oceanography, La Jolla, Calif.
Robert W. Owen, Jr.	Fishery Biologist (Research), Bureau of Commercial Fisheries, San Diego, Calif.

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EXPLANATION OF DATA TABLES

Table 1.--Summary of station observations. Hydrographic stations have the prefix "H", while productivity stations are numbered independently and have the prefix "P". Time entries at productivity stations are times of initial water collection. Time entries at hydrographic stations are times of first messenger release. All times are to the nearest 5 minutes and are Pacific Standard Time (PST: +8 zone).

Table 2.--Tabulated hydrographic station data. Time entries are times of first messenger releases on each cast and are GCT. Messenger times and wire angles are given in order of increasing depth when more than one cast was made on a station. A line is left blank between observed data of each cast.
To indicate degree of accuracy, temperatures are recorded in tenths of a degree Celsius (C.) when obtained by bucket thermometer or bathythermograph while temperatures from reversing thermometers are recorded in hundredths of a degree C. Extrapolated values and values interpolated between widely spaced observations are entered in parentheses. Hyphens indicate missing observed values.

Table 3.--Bathythermograph observations. Observations presented in accordance with H.O. Publication No. 606-c (1956). Lowerings to 450 ft. are indicated by postscript "a" after the slide number. All other lowerings were made to 900 ft. Observations made at hydrographic stations are indicated in the last column by the station number. Between-station BTs are indicated by hyphens in that column.

Table 4.--Solar radiation measurements. Integrated values are given for morning and afternoon to allow better comparisons between productivity measurements. Values in parentheses are approximate because of occasional recorder pen difficulties.

Table 5.--Surface C^{14} productivity measurements. Time entries are times of water collection and are PST (+8 zone). Values in parentheses are questionable by virtue of either slow filtration or damaged filter. These values are not included in station averages or in figure 4.

Table 6.--Surface chlorophyll a measurements. Time entries are times of initial water collection and are PST (+8 zone). Values in parentheses are questionable by virtue of either slow filtration or high optical density at 750 mμ wave length. These values are not included in station averages or in figure 3.

Table 7.--Zooplankton collection data. Time entries are PST (+8 zone). Volume of water recorded is here considered to be volume of water strained by the net although no corrections for net resistance or clogging have been applied to calibrations of the meter. Zooplankton displacement volume is the drained wet volume of organisms captured, after removal of organisms whose volume exceeds 5 $cm.^3$.

Table 8.--Relative abundance of zooplankton organisms. Taxa in parentheses are tentative identifications. The author is responsible for these and other identifications.

Table 9.--Trolling results. Time entries are PST (+8 zone).

Table 10.--Gill net results. Time entries are PST (+8 zone).

Abbreviations and Headings used in Data Tables

GCT	- Greenwich Civil Time.
Lat. N.	- north latitude in degrees and minutes.
Long. W.	- west longitude in degrees and minutes.
$m.^3$	- cubic meters.
$cm.^3$	- cubic centimeters.
l.	- liters.
T, $^\circ$C.	- temperature in degrees Celsius.
S, ‰.	- salinity in parts per mille rounded to nearest value at 2 decimal places from 3 decimal places.
$^\circ$T	- true bearing.
mb.	- millibars.
0_2, ml./l.	- oxygen concentration.
σ_t	- expression for sea water density at atmospheric pressure where $\rho = \frac{\sigma_t}{1000} + 1$.
δ_T, $10^{-5}cm.^3/g.$	- thermosteric anomaly, the anomaly of specific volume attained if water were changed isothermally to a standard pressure of 1 atmosphere, relative to a standard sample of 35 ‰ salinity, 0° C. at the same pressure. Tabular values multiplied by 10^{-5} will give the anomaly in $cm.^3/g.$
ΔD, dyn. m.	- geopotential anomaly in dynamic meters of the water layer between surface and designated pressure. (Depth in meters is assumed numerically equal to pressure in decibars.)

TABLE 1.--Summary of Station Observations

Date (July 1961)	Time (PST)	Position		Station number	Hydrographic cast	BT	C^{14} productivity	Chlorophyll	Phytoplankton	Zooplankton	Drift bottle release
		Lat. N.	Long. W.								
11	1250	47°42'	126°12'	H-1,P-1	X	X	X	X	-	X	X
11	2200	47°45'	127°35'	H-2	X	X	-	-	-	-	X
12	0435	47°44'	127°33'	P-2	-	-	-	X	X	-	-
12	1340	47°46'	128°45'	H-3,P-3	X	X	-	X	X	-	X
13	1350	46°41'	130°48'	H-4,P-4	X	X	-	X	X	-	X
13	2055	46°00'	130°25'	H-5	X	X	-	-	-	-	-
14	0500	45°53'	130°30'	P-5	-	-	-	X	X	-	-
14	1320	45°59'	129°11'	H-6,P-6	X	X	X	X	X	X	X
14	2130	45°58'	128°10'	H-7	X	X	-	-	-	-	X
15	0500	45°58'	128°10'	P-7	-	-	X	X	X	-	-
15	1305	46°00'	127°02'	H-8,P-8	X	X	X	X	X	X	X
15	2135	46°00'	125°53'	H-9	X	X	-	-	-	-	X
16	0525	45°54'	125°59'	P-9	-	-	X	X	X	-	-
16	1040	46°00'	125°31'	H-10	X	X	-	-	-	-	X
16	1240	45°53'	125°30'	P-10	-	-	X	X	X	X	-
16	2140	44°59'	125°30'	H-11	X	X	-	-	-	-	X
17	0455	44°58'	125°31'	P-11	-	-	X	X	X	-	-
17	1250	44°09'	125°29'	H-12,P-12	X	X	X	X	X	X	X
17	2135	43°18'	125°32'	H-13	X	X	-	-	-	-	X
18	0530	43°18'	125°32'	P-13	-	-	X	X	X	-	-
18	1250	43°18'	125°32'	P-13A	-	-	-	X	X	-	-
19	1230	42°13'	125°30'	P-14	-	-	X	X	X	-	-
19	1440	42°00'	125°30'	H-14	X	X	-	-	-	X	X
20	0505	41°57'	126°09'	P-15	-	-	X	X	X	-	-
20	1335	42°00'	127°04'	H-15,P-16	X	X	-	-	X	X	X
20	2150	41°59'	128°06'	H-16	X	X	-	-	-	-	-
21	0520	41°59'	128°18'	P-17	-	-	X	X	X	-	-
21	1305	42°00'	129°20'	H-17,P-18	X	X	-	X	X	X	X
21	2130	42°00'	130°30'	H-18	X	X	-	-	-	-	X
22	0515	41°57'	130°36'	P-19	-	-	-	X	X	-	-
22	1240	42°00'	132°00'	H-19,P-20	-	-	X	X	X	-	-
22	1450	42°00'	132°00'	H-19	X	X	-	-	-	X	-
23	0510	42°32'	132°03'	P-21	-	-	X	X	X	-	-
23	1055	43°00'	132°00'	H-20	X	X	-	-	-	X	-
23	1240	43°12'	132°01'	P-22	-	-	X	X	X	-	-
23	2135	44°00'	132°00'	H-21	X	X	-	-	-	-	-
24	0520	44°00'	131°56'	P-23	-	-	X	X	X	-	-
24	1250	44°00'	130°56'	H-22,P-24	X	X	X	X	X	-	-
24	2145	44°01'	129°51'	H-23	X	X	-	-	-	-	-
25	0520	43°55'	129°47'	P-25	-	-	X	X	X	-	-
25	1345	44°02'	128°42'	H-24,P-26	X	X	X	X	X	-	X
26	0535	44°06'	126°44'	P-27	-	-	X	X	X	-	-
26	1250	44°06'	126°01'	H-25,P-28	X	X	X	X	X	-	X

TABLE 2.--Tabulated hydrographic station data

OBSERVED					INTERPOLATED				COMPUTED		
Depth m.	T. °C.	S. ‰	O_2 ml./l.	δ_T 10^{-5} cm.^{3}/g.	Depth m.	T. °C.	S. ‰	O_2 ml./l.	σ_t g./l.	δ_T 10^{-5} cm.^{3}/g.	ΔD dyn.m.

July 11, 1961; 2048 GCT, 2119 GCT; 47°42'N., 126°12'W.; wire angle, 04°, 13°; drift bottles, 12; BT serial no. 1, 1a. H-1

0	15.71	31.64	5.96	463	0	15.71	31.64	5.96	23.25	463	0.00
5	14.88	31.64	6.00	446	10	14.72	31.65	5.96	23.48	442	0.05
10	14.72	31.65	5.96	442	20	13.86	32.37	6.02	24.21	372	0.09
20	13.86	32.37	6.02	372	30	11.76	32.46	6.72[1]	24.68	327	0.12
30	11.76	32.46	6.72[1]	327	50	8.94	32.59	6.12	25.26	272	0.18
50	8.94	32.59	6.12	272	75	8.16	32.72	5.45	25.48	251	0.25
70	8.27	32.66	5.64	256	100	8.26	33.32	3.88	25.94	207	0.30
95	8.30	33.26	4.08	213	125	7.93	33.65	3.05	26.25	178	0.35
125	7.98	33.61	3.09	182	150	7.59	33.92	2.53	26.51	153	0.39
					200	6.96	33.93	2.23	26.60	144	0.47
122[2]	7.91	33.69	3.02	175	250	6.50	33.99	1.90	26.71	134	0.54
157	7.50	33.92	2.49	152	300	6.14	34.02	1.50	26.78	127	0.61
190	7.08	33.91	2.34	147	400	5.51	34.06	0.95	26.89	117	0.74
224	6.70	33.96	2.04	138	500	4.92	34.16	0.48	27.04	103	0.85
268	6.38	34.00	1.80	132							
325	5.95	34.02	1.26	125							
400	5.51	34.06	0.95	117							
473	5.09	34.13	0.60	107							
553	4.68	34.18	0.38	98							

July 12, 1961; 0557 GCT, 0626 GCT; 47°45'N., 127°35'W.; wire angle, 02°, 07°; drift bottles, 12; BT serial no. 2, 2a. H-2

1	16.16	32.06	5.80	442	0	(16.16)	(32.06)	(5.80)	(23.48)	(442)	(0.00)
6	16.17	32.02	5.79	445	10	16.16	32.02	5.81	23.45	445	0.04
11	16.16	32.02	5.82	445	20	15.89	32.05	5.80	23.53	437	0.09
21	15.80	32.05	5.79	435	30	11.80	32.14	6.98	24.43	351	0.13
31	11.48	32.15	7.00	345	50	9.05	32.55	6.40	25.22	276	0.19
51	8.99	32.56	6.39	274	75	8.20	32.63	6.18	25.41	258	0.26
71	8.29	32.61	6.24	261	100	7.80	33.17	4.64	25.89	212	0.32
96	7.86	33.09	4.87	219	125	7.51	33.54	4.06	26.22	181	0.37
126	7.50	33.53	4.07	181	150	7.29	33.75	3.81	26.42	162	0.41
					200	6.73	33.88	3.40	26.60	145	0.49
124[2]	7.52	33.55	4.05	180	250	5.95	33.91	3.08	26.72	133	0.56
158	7.21	33.78	3.76	159	300	5.47	33.92	2.55	26.79	127	0.63
193	6.84	33.87	3.44	147	400	5.13	34.02	1.32	26.91	116	0.75
228	6.27	33.90	3.24	138	500	(4.69)	(34.10)	(0.77)	(27.02)	(105)	(0.87)
272	5.70	33.91	2.89	130							
331	5.30	33.94	2.08	123							
405	5.12	34.03	1.29	115							
480	4.80	34.09	0.82	106							

July 12, 1961; 2146 GCT, 2215 GCT; 47°46'N., 128°45'W.; wire angle, 06°, 12°; drift bottles, 12; BT serial no. 4. H-3

1	16.02	32.39	5.81	415	0	(16.02)	(32.39)	(5.81)	(23.76)	(415)	(0.00)
6	16.00	32.38	5.73	415	10	15.86	32.40	5.80	23.80	411	0.04
12	15.78	32.41	5.86	409	20	15.13	32.44	6.20	23.99	392	0.08
26	12.85	32.50	7.05	343	30	12.10	32.53	6.85	24.68	328	0.12
36	11.13	32.56	6.58	308	50	9.42	32.61	6.57	25.20	277	0.18
61	8.66	32.62	6.56	265	75	8.22	32.63	6.47	25.40	258	0.25
90	7.96	32.65	6.32	253	100	7.80	32.70	5.15	25.52	247	0.31
116	7.60	32.90	5.72	230	125	7.48	33.04	5.47	25.83	218	0.37
141	7.28	33.44	4.80	185	150	7.25	33.54	4.77	26.26	177	0.42
					200	6.81	33.89	4.15	26.59	145	0.50
137[2]	7.38	33.25	5.28	201	250	5.93	33.89	3.50	26.71	134	0.57
181	7.10	33.83	4.34	153	300	5.36	33.90	2.89	26.78	127	0.64
225	6.34	33.90	3.87	139	400	4.68	33.99	1.59	26.93	113	0.76
259	5.82	33.90	3.42	133	500	4.38	34.08	0.92	27.04	103	0.87
313	5.25	33.91	2.72	125	600	4.15	34.16	0.50	27.12	95	0.98
377	4.79	33.96	1.82	116							
476	4.44	34.05	1.09	106							
564	4.23	34.13	0.60	98							
640	4.07	34.18	0.44	92							

1/ Alternate value, 6.89 ml./l.; not used.
2/ Overlapping casts; reconciliation of property curves when necessary.

TABLE 2.--Tabulated hydrographic station data--Continued

OBSERVED					INTERPOLATED				COMPUTED		
Depth m.	T. °C.	S. ‰	O_2 ml./l.	δ_T $10^{-5}cm^3/g$	Depth m.	T. °C.	S. ‰	O_2 ml./l.	σ_t g./l.	δ_T $10^{-5}cm^3/g$	ΔD dyn.m.

July 13, 1961; 2152 GCT, 2224 GCT; 46°41'N., 130°48'W.; wire angle, 07°, 27°; drift bottles, 12; BT serial no. 7. H-4

Depth	T.	S.	O_2	δ_T	Depth	T.	S.	O_2	σ_t	δ_T	ΔD
1	15.01	32.58	5.83	379	0	(15.01)	(32.58)	(5.83)	(24.13)	(380)	(0.00)
6	14.98	32.62U	5.76	-	10	15.00	32.58	5.79	24.13	380	0.04
11	15.00	32.58	5.80	379	20	14.97	32.59	5.84	24.14	378	0.08
21	14.96	32.59	5.84	378	30	13.25	32.58	6.70	24.49	345	0.11
31	12.96	32.58	6.73	340	50	10.73	32.56	6.48	24.95	302	0.18
51	10.65	32.56	6.46	301	75	9.22	32.64	6.00	25.26	272	0.25
71	9.41	32.61	6.10	277	100	8.17	32.96	5.17	25.67	233	0.31
95	8.36	32.87	5.33	242	125	7.58	33.43	4.62	26.12	190	0.37
125	7.55	33.34	4.78	196	150	7.48	33.68	4.36	26.33	170	0.41
					200	6.92	33.86	3.60	26.55	149	0.49
122[3]	7.62	33.52	4.46	184	250	6.32	33.90	3.20	26.66	138	0.57
153	7.46	33.70	4.33	168	300	5.68	33.93	2.60	26.77	129	0.63
187	6.92	33.84	3.98	151	400	4.77	34.02	1.40	26.95	112	0.76
217	6.93	33.88	3.55	148	500	4.47	34.11	0.70	27.05	102	0.87
266	6.04	33.91	3.06	134							
315	5.52	33.94	2.36	126							
391	4.81	34.01	1.49	113							
470	4.54	34.08	0.82	105							
561	4.30	34.14	0.54	98							

July 14, 1961; 0454 GCT, 0532 GCT; 46°00'N., 130°25'W.; wire angle, 08°, 24°; drift bottles, 0; BT serial no. 8, 8a. H-5

Depth	T.	S.	O_2	δ_T	Depth	T.	S.	O_2	σ_t	δ_T	ΔD
2	15.42	32.52	5.65	393	0	(15.42)	(32.52)	(5.65)	(23.99)	(393)	(0.00)
7	15.40	32.52	5.59	393	10	15.40	32.52	5.63	24.00	392	0.04
12	15.40	32.52	5.64	393	20	15.40	32.52	5.65	24.00	392	0.08
22	15.40	32.52	5.65	392	30	15.00	32.52	5.78	24.08	384	0.12
32	14.52	32.52	5.96	375	50	10.87	32.56	6.22	24.92	304	0.19
57	9.96	32.58	6.26	287	75	8.57	32.67	5.92	25.38	260	0.26
81	8.35	32.70	5.84	255	100	8.09	33.02	5.06	25.73	227	0.32
106	8.02	33.14	4.76	217	125	7.80	33.41	4.25	26.08	194	0.37
136	7.66	33.57	3.92	180	150	7.51	33.74	3.31	26.38	166	0.42
					200	6.98	33.88	2.97	26.56	148	0.50
128	7.76	33.45	4.18	191	250	6.57	33.95	2.31	26.67	138	0.57
169	7.35	33.83	2.98	157	300	5.92	33.96	2.20	26.76	129	0.64
209	6.88	33.90	2.96	146	400	5.01	34.04	1.12	26.94	113	0.76
241	6.64	33.94	2.36	139	500	4.65	34.09	0.67	27.02	105	0.88
293	6.02	33.96	2.24	130	600	4.28	34.14	-	27.10	98	0.98
355	5.23	33.99	1.65	119							
451	4.84	34.08	0.85	108							
540	4.48	34.10[4]	0.51	103							
615	4.24	34.16[4]	0.85U	96							

July 14, 1961; 2117 GCT, 2149 GCT; 45°59'N., 129°11'W.; wire angle, 02°, 02°; drift bottles, 12; BT serial no. 10. H-6

Depth	T.	S.	O_2	δ_T	Depth	T.	S.	O_2	σ_t	δ_T	ΔD
3	16.85	32.21	5.49	446	0	(16.85)	(32.21)	(5.49)	(23.43)	(446)	(0.00)
8	16.82	32.20	5.49	446	10	16.79	32.21	5.49	23.45	445	0.04
13	16.60	32.30	5.48	434	20	16.29	32.38	5.51	23.69	421	0.09
23	16.07	32.40	5.54	415	30	14.90	32.46	5.82	24.06	386	0.13
33	13.95	32.48	6.09	366	50	10.59	32.55	6.78	24.96	300	0.20
53	10.14	32.55	6.78	293	75	8.91	32.59	5.98	25.27	271	0.27
73	8.97	32.58	6.05	273	100	8.21	32.90	5.18	25.62	238	0.33
98	8.29	32.86	5.24	242	125	7.36	33.50	4.40	26.21	182	0.39
128	7.33	33.57	4.26	176	150	7.30	33.78	4.11	26.44	160	0.43
					200	6.65	33.92	3.26	26.64	141	0.51
124	7.37	33.47	4.46	184	250	6.04	33.93	2.87	26.72	133	0.58
159	7.26	33.84	4.01	155	300	5.79	33.98	1.90	26.80	126	0.64
193	6.74	33.91	3.32	143	400	5.37	34.08	0.98	26.93	114	0.77
229	6.32	33.93	3.06	136	500	4.86	34.18	0.54	27.06	101	0.88
272	5.84	33.94	2.62	130							
332	5.72	34.04	1.28	121							
407	5.33	34.09	0.85	113							
482	4.95	34.16	0.59	103							
561	4.62	34.20	0.40	97							

3/ Overlapping casts; reconciliation of property curves when necessary.

4/ Salinity samples at 540 and 615 meters appear to have been reversed; they are assumed to be in the order listed above.

TABLE 2.--Tabulated hydrographic station data--Continued

OBSERVED					INTERPOLATED				COMPUTED		
Depth m.	T. °C.	S. ‰	O_2 ml./l.	δ_T $10^{-5}cm^3/g$	Depth m.	T. °C.	S. ‰	O_2 ml./l.	σ_t g./l.	δ_T $10^{-5}cm^3/g$	ΔD dyn.m.

July 15, 1961; 0528 GCT, 0556 GCT; 45°58'N., 128°10'W.; wire angle, 00°, 05°; drift bottles, 12; BT serial no. 12. H-7

1	17.33	31.38	5.34	518	0	(17.33)	(31.38)	(5.34)	(22.69)	(517)	(0.00)
6	17.32	31.38	5.41	517	10	17.28	31.46	5.41	22.76	510	0.05
11	17.26	31.55	5.41	503	20	14.55	32.49	5.33	24.16	377	0.10
21	14.44	32.49	5.35	375	30	13.74	32.48	6.15	24.32	362	0.13
31	13.72	32.48	6.17	361	50	10.35	32.53	6.43	24.99	298	0.20
51	10.16	32.54	6.44	294	75	8.87	32.60	6.02	25.28	270	0.27
71	9.03	32.58	6.14	274	100	8.06	33.08	4.48	25.78	222	0.33
96	8.16	32.97	4.80	232	125	7.56	33.64	3.18	26.29	174	0.38
126	7.54	33.66	3.12	172	150	7.16	33.84	2.76	26.51	154	0.42
					200	6.56	33.93	2.51	26.66	139	0.50
135	7.37	33.77	2.84	162	250	6.04	33.97	1.92	26.76	130	0.57
170	6.92	33.89	2.67	147	300	5.62	33.98	1.64	26.82	124	0.63
210	6.44	33.94	2.46	137	400	5.23	34.07	0.97	26.93	113	0.75
245	6.09	33.96	1.97	131	500	4.59	34.12	0.73	27.05	102	0.87
300	5.62	33.98	1.64	124	600	4.30	34.20	0.45	27.14	93	0.97
354	5.42	34.03	1.18	118							
439	5.02	34.09	0.84	109							
525	4.45	34.14	0.68	99							
610	4.28	34.20	0.42	93							

July 15, 1961; 2106 GCT, 2140 GCT; 46°00'N., 127°02'W.; wire angle, 16°, 27°; drift bottles, 12; BT serial no. 14. H-8

1	18.06	29.39	5.46	679	0	(18.06)	(29.39)	(5.46)	(21.00)	(679)	(0.00)
6	18.02	29.41	5.52	676	10	16.36	31.39	5.69	22.92	495	0.06
10	16.36	31.39	5.69	495	20	14.12	32.58	6.24	24.32	362	0.10
20	14.12	32.58	6.24	362	30	12.96	32.57	6.52	24.54	340	0.14
30	12.96	32.57	6.52	340	50	10.23	32.65	6.33	25.10	287	0.20
49	10.27	32.65	6.34	288	75	8.94	32.68	6.03	25.33	265	0.27
68	9.24	32.66	6.18	271	100	8.20	33.00	5.17	25.70	230	0.33
92	8.38	32.86	5.51	243	125	7.80	33.54	4.19	26.18	185	0.38
121	7.90	33.45	4.30	193	150	7.43	33.75	3.86	26.40	164	0.43
					200	6.79	33.91	2.98	26.61	144	0.51
128	7.73	33.60	4.11	179	250	6.11	33.95	2.27	26.73	132	0.58
168	7.17	33.84	3.56	154	300	5.60	33.98	2.06	26.82	124	0.64
210	6.66	33.92	2.78	141	400	5.22	34.06	1.01	26.93	114	0.76
242	6.23	33.95	2.30	134	500	4.66	34.12	0.60	27.04	103	0.88
292	5.63	33.97	2.12	125	600	4.36	34.20	0.43	27.13	94	0.98
352	5.44	34.03	1.29	119							
446	4.96	34.09	0.81	108							
532	4.52	34.15	0.51	100							
607	4.36	34.21	0.42	93							

July 16, 1961; 0533 GCT, 0600 GCT; 46°00'N., 125°53'W.; wire angle, 00°, 00°; drift bottles, 12; BT serial no. 16. H-9

1	17.44	30.90	5.34	555	0	(17.44)	(30.90)	(5.34)	(22.30)	(555)	(0.00)
6	17.42	30.92	5.36	553	10	17.42	30.90	5.38	22.30	554	0.06
11	17.42	30.90	5.39	554	20	13.80	32.14	6.00	24.04	388	0.10
21	13.46	32.21	6.22	377	30	11.05	32.56	6.66	24.89	307	0.14
31	10.96	32.56	6.65	305	50	9.94	32.75	5.20	25.23	275	0.20
51	9.94	32.76	5.17	275	75	9.85	32.99	4.77	25.43	256	0.26
71	9.86	32.93	4.84	260	100	9.80	33.29	4.27	25.67	233	0.32
96	9.82	33.24	4.38	236	125	9.57	33.44	3.66	25.83	218	0.38
126	9.56	33.45	3.64	217	150	8.72	33.60	3.29	26.09	193	0.43
					200	7.42	33.88	2.54	26.50	154	0.52
136	9.38	33.48	3.58	212	250	6.49	33.98	1.85	26.71	135	0.59
170	7.96	33.77	2.86	170	300	6.12	34.01	1.53	26.78	128	0.66
210	7.25	33.90	2.45	150	400	5.58	34.08	1.01	26.90	116	0.79
245	6.56	33.98	1.89	136	500	5.14	34.14	0.64	27.00	107	0.91
300	6.12	34.01	1.53	128	600	4.80	34.20	0.42	27.09	99	1.01
354	5.86	34.04	1.29	123							
440	5.37	34.10	0.85	112							
525	5.06	34.16	0.57	105							
610	4.76	34.21	0.39	98							

OBSERVED					INTERPOLATED				COMPUTED		
Depth m.	T. °C.	S. ‰	O_2 ml/l.	δ_T $10^{-5}cm^3/g$	Depth m.	T. °C.	S. ‰	O_2 ml/l.	σ_t g./l.	δ_T $10^{-5}cm^3/g$	ΔD dyn.m.
July 16, 1961; 1839 GCT, 1911 GCT; 46°00'N., 125°31'W.; wire angle, 02°, 05°; drift bottles, 12; BT serial no. 17.											H-10
1	17.70	30.18	5.44	613	0	(17.70)	(30.18)	(5.44)	(21.68)	(613)	(0.00)
6	17.69	30.17	5.42	613	10	17.66	30.20	5.41	21.71	611	0.06
11	17.64	30.21	5.41	610	20	15.10	31.78	6.00	23.49	440	0.11
21	14.84	31.93	6.09	424	30	12.90	32.37	6.40	24.40	354	0.15
31	12.71	32.39	6.44	349	50	10.76	32.58	6.65	24.96	301	0.22
51	10.72	32.59	6.66	300	75	9.89	32.70	5.34	25.20	278	0.29
71	9.94	32.67	5.42	281	100	9.44	32.93	4.94	25.45	254	0.36
96	9.52	32.85	5.10	261	125	8.91	33.44	3.68	25.93	208	0.42
126	8.90	33.46	3.65	207	150	8.31	33.68	3.12	26.21	181	0.47
					200	7.33	33.88	2.60	26.51	153	0.55
139	8.56	33.61	3.32	190	250	6.69	33.97	2.17	26.67	138	0.63
183	7.62	33.84	2.67	160	300	6.20	34.02	1.63	26.77	128	0.69
228	6.95	33.94	2.46	144	400	5.56	34.08	1.00	26.90	116	0.82
263	6.54	33.99	1.97	135	500	5.10	34.16	0.64	27.02	105	0.94
316	6.07	34.02	1.53	126	600	4.62	34.19	0.44	27.10	97	1.04
380	5.64	34.07	1.07	117							
479	5.20	34.14	0.73	107							
569	4.74	34.22U	0.42	-							
644	4.48	34.21	0.47	94							
July 17, 1961; 0541 GCT, 0605 GCT; 44°59'N., 125°30'W.; wire angle, 03°, 07°; drift bottles, 12; BT serial no. 19.											H-11
1	18.17	29.46	5.26	677	0	(18.17)	(29.46)	(5.26)	(21.03)	(676)	(0.00)
6	18.16	29.44	5.29	677	10	18.00	29.74	5.28	21.28	652	0.07
11	17.82	29.88	5.28	638	20	13.15	31.95	6.15	24.03	389	0.12
21	12.84	32.33	6.22	356	30	11.19	32.51	6.50	24.83	313	0.15
31	11.12	32.52	6.50	311	50	9.98	32.60	5.75	25.10	287	0.21
51	9.90	32.61	5.69	284	75	9.29	32.78	5.33	25.36	263	0.28
71	9.32	32.72	5.44	267	100	8.92	33.27	4.02	25.80	221	0.34
96	9.01	33.20	4.21	227	125	7.92	33.56	3.68	26.18	185	0.39
126	7.89	33.56	3.68	184	150	7.50	33.75	3.57	26.39	165	0.44
					200	7.01	33.90	2.83	26.57	147	0.52
138	7.60	33.68	3.70	171	250	6.60	33.97	2.19	26.68	137	0.59
163	7.38	33.81	3.32	159	300	6.30	34.03	1.70	26.77	128	0.66
192	7.10	33.89	2.92	149	400	5.68	34.08	1.13	26.89	117	0.79
227	6.75	33.96	2.46	140	500	5.24	34.16	0.65	27.00	106	0.90
271	6.47	33.99	1.92	133							
331	6.12	34.06	1.50	124							
405	5.66	34.09 5/	1.10	117							
479	5.34	34.15 5/	0.72	108							
559	4.99	34.20 5/	0.56	101							
July 17, 1961; 2049 GCT, 2124 GCT; 44°09'N., 125°29'W.; wire angle, 08°, 16°; drift bottles, 12; BT serial no. 21.											H-12
1	17.20	30.08	5.58	610	0	(17.20)	(30.08)	(5.58)	(21.73)	(609)	(0.00)
6	17.14	30.10	5.66	607	10	15.80	30.37	6.16	22.26	558	0.06
11	15.20	30.52	6.18	535	20	11.78	32.05	6.06	24.36	357	0.10
21	10.71	32.28	6.04	322	30	10.00	32.49	6.18	25.02	295	0.14
30	10.00	32.49	6.18	295	50	9.05	32.63	5.61	25.28	270	0.19
55	8.89	32.67	5.43	265	75	8.77	33.09	4.41	25.68	232	0.26
81	8.74	32.21	4.13	297	100	8.22	33.56	3.18	26.13	189	0.31
105	8.10	33.62	3.02	183	125	7.73	33.77	2.81	26.37	167	0.35
135	7.60	33.83	2.72	160	150	7.38	33.90	2.55	26.52	152	0.39
					200	6.86	33.99	2.01	26.66	139	0.47
143	7.45	33.87	2.66	155	250	6.32	34.01	1.77	26.75	130	0.54
167	7.18	33.94	2.35	146	300	5.96	34.04	1.60	26.82	124	0.60
200	6.86	33.99	2.01	139	400	5.47	34.12	0.94	26.94	112	0.72
232	6.49	34.00	1.81	133	500	5.02	34.15	0.55	27.02	105	0.84
286	6.04	34.03	1.70	125	600	(4.66)	(34.25)	-	(27.14)	(93)	(0.94)
338	5.74	34.08	1.16	118							
420	5.38	34.13	0.86	110							
503	5.00	34.16	0.53	104							
587	4.70	34.23	0.40	95							

5/ Salinity samples at 405, 479 and 559 meters appear to have been reversed; they are assumed to be in the order listed above.

TABLE 2.--Tabulated hydrographic station data--Continued

OBSERVED					INTERPOLATED				COMPUTED		
Depth m.	T. °C.	S. ‰	O_2 ml/l.	δ_T $10^{-5}cm^3/g$	Depth m.	T. °C.	S. ‰	O_2 ml/l.	σ_t g./l.	δ_T $10^{-5}cm^3/g$	ΔD dyn.m.
July 18, 1961; 0535 GCT, 0601 GCT; 43°18'N., 125°32'W.; wire angle, 08°, 06°; drift bottles, 12; BT serial no. 23. H-13											
1	15.09	32.24	5.69	406	0	(15.09)	(32.24)	(5.69)	(23.85)	(406)	(0.00)
6	15.08	32.24	5.73	406	10	14.95	32.24	5.82	23.88	403	0.04
11	14.70	32.26	5.85	397	20	11.53	32.64	6.16	24.87	309	0.08
21	11.42	32.64	6.16	307	30	10.48	32.73	5.59	25.12	285	0.11
31	10.37	32.74	5.49	283	50	9.09	32.95	4.29	25.52	247	0.16
56	9.05	32.97	4.21	245	75	8.68	33.34	3.40	25.89	212	0.22
80	8.54	33.42	3.25	204	100	8.06	33.65	3.05	26.23	180	0.27
105	7.95	33.69	3.00	175	125	7.61	33.81	2.68	26.42	162	0.31
135	7.49	33.86	2.53	157	150	7.31	33.91	2.39	26.54	150	0.35
					200	6.50	33.96	2.34	26.69	136	0.42
149	7.32	33.91	2.40	151	250	6.30	34.02	1.65	26.76	129	0.49
173	6.99	33.95	2.22	143	300	5.92	34.05	1.31	26.83	122	0.55
208	6.42	33.96	2.35	135	400	5.29	34.11	0.83	26.96	111	0.68
242	6.35	34.01	1.70	131	500	4.82	34.18	0.50	27.07	100	0.79
296	5.96	34.04	1.33	123	600	4.52	34.25	0.36	27.16	92	0.89
350	5.56	34.08	1.02	116							
436	5.11	34.12	0.72	108							
520	4.76	34.20	0.42	98							
605	4.50	34.26	0.35	91							
July 19, 1961; 2240 GCT, 2304 GCT; 42°00'N., 125°30'W.; wire angle, 09°, 26°; drift bottles, 12; BT serial no. 25. H-14											
1	17.04	31.69	5.12	488	0	(17.04)	(31.69)	(5.12)	(22.99)	(488)	(0.00)
11	16.95	31.70	5.40	486	10	16.96	31.70	5.39	23.02	486	0.05
31	14.72	32.69	5.77	365	20	16.86	31.72	5.53	23.06	482	0.10
40	11.61	32.79	6.34	300	30	14.82	32.67	5.73	24.24	369	0.14
51	10.92	32.80	6.14	287	50	10.99	32.80	6.16	25.09	288	0.21
65	10.12	32.81	5.88	273	75	9.89	32.81	5.86	25.28	270	0.28
80	9.76	32.81	5.84	268	100	9.19	33.02	5.19	25.56	243	0.34
100	9.19	33.02	5.19	243	125	8.36	33.32	4.57	25.92	209	0.40
125	8.30	33.34	4.59	207	150	7.99	33.68	3.82	26.26	177	0.45
					200	7.50	33.88	3.32	26.49	155	0.53
138[6/]	8.19	33.54	4.08	190	250	6.97	33.95	2.51	26.62	143	0.61
163	7.85	33.77	3.66	168	300	6.53	34.00	1.93	26.72	134	0.68
194	7.54	33.87	3.40	156	400	5.84	34.06	1.20	26.85	121	0.81
221	7.28	33.92	2.90	149	500	(5.31)	(34.13)	-	(26.97)	(109)	(0.93)
265	6.82	33.96	2.35	140							
314	6.42	34.01	1.79	131							
391	5.88	34.05	1.27	122							
470	5.48	34.11	0.84	113							
553	5.00	34.01U	0.83U	-							
July 20, 1961; 2136 GCT, 2201 GCT; 42°00'N., 127°04'W., wire angle, 05°, 10°; drift bottles, 12; BT serial no. 27. H-15											
1	16.54	32.68	5.40	405	0	(16.54)	(32.68)	(5.40)	(23.86)	(405)	(0.00)
11	16.45	32.68	5.42	403	10	16.46	32.68	5.41	23.88	403	0.04
31	15.34	32.71	5.54	377	20	16.28	32.68	5.44	23.92	399	0.08
41	13.92	32.74	5.78	346	30	15.38	32.71	5.53	24.15	378	0.12
56	12.40	32.76	6.11	316	50	12.95	32.75	6.02	24.68	327	0.19
71	10.78	32.77	5.95	287	75	10.59	32.78	5.86	25.14	283	0.27
96	9.84	32.88	5.38	263	100	9.75	32.92	5.27	25.39	259	0.34
115	9.48	33.10	4.85	242	125	9.12	33.32	4.30	25.81	220	0.40
135	8.89	33.47	3.94	206	150	8.72	33.59	3.62	26.08	194	0.45
					200	7.62	33.91	2.82	26.49	155	0.54
156	8.64	33.64	3.49	189	250	6.83	33.98	2.40	26.66	139	0.61
180	8.03	33.84	2.97	165	300	6.28	33.98	2.21	26.73	132	0.68
214	7.36	33.94	2.71	149	400	5.45	34.06	1.39	26.90	116	0.81
243	6.91	33.98	2.42	140	500	5.08	34.14	0.76	27.01	106	0.93
291	6.40	33.98	2.30	133	600	(4.70)	(34.20)	(0.48)	(27.10)	(97)	(1.03)
345	5.74	34.01	1.64	123							
429	5.34	34.08	1.20	113							
514	5.02	34.15	0.69	105							
598	4.72	34.19	0.48	98							

6/ Double casts; reconciliation of property curves when necessary.

TABLE 2.--Tabulated hydrographic station data--Continued

OBSERVED					INTERPOLATED				COMPUTED		
Depth m.	T. °C.	S. ‰	O_2 ml./l.	δ_T 10^{-5} cm^3/g.	Depth m.	T. °C.	S. ‰	O_2 ml./l.	σ_t g./l.	δ_T 10^{-5} cm^3/g.	ΔD dyn.m.

July 21, 1961; 0548 GCT, 0615 GCT; 41°59'N., 128°06'W.; wire angle, 03°, 15°; drift bottles, 0; BT serial no. 29, 29a. H-16

1	17.04	32.35	-	440	0	(17.04)	(32.35)	-	(23.50)	(440)	(0.00)
11	17.01	32.35	-	439	10	17.01	32.35	-	23.50	439	0.04
31	15.38	32.70	-	379	20	16.57	32.45	-	23.68	422	0.09
41	14.74	32.74	-	363	30	15.44	32.69	-	24.12	381	0.13
56	12.16	32.77	-	311	50	13.48	32.76	-	24.58	336	0.20
71	10.52	32.76	-	283	75	10.34	32.78	-	25.18	279	0.28
96	9.72	33.01	-	252	100	9.64	33.07	-	25.53	247	0.34
115	9.35	33.26	-	228	125	9.02	33.39	-	25.88	213	0.40
135	8.70	33.52	-	199	150	8.57	33.59	-	26.10	192	0.45
					200	7.95	33.88	-	26.42	161	0.54
154	8.54	33.60	-	191	250	7.41	33.96	-	26.56	148	0.62
183	8.26	33.83	-	170	300	6.90	34.00	-	26.67	138	0.69
217	7.69	33.92	-	155	400	5.97	34.07	-	26.84	121	0.83
245	7.46	33.96	-	149	500	5.42	34.12	-	26.95	111	0.95
295	6.96	34.00	-	139	600	(4.85)	(34.20)	-	(27.08)	(99)	(1.06)
348	6.38	34.03	-	130							
431	5.77	34.08	-	118							
514	5.34	34.13	-	110							
598	4.87	34.20	-	99							

July 21, 1961; 2105 GCT, 2130 GCT; 42°00'N., 129°20'W.; wire angle, 09°, 27°; drift bottles, 12; BT serial no. 31. H-17

2	16.36	32.81	5.53	392	0	(16.36)	(32.81)	(5.53)	(24.00)	(391)	(0.00)
12	16.38	32.80	5.58	392	10	16.38	32.80	5.57	23.99	393	0.04
32	15.56	32.78	5.68	376	20	16.36	32.80	5.62	24.00	392	0.08
41	15.04	32.79	5.69	365	30	15.58	32.78	5.66	24.16	377	0.12
56	12.44	32.78	6.32	315	50	13.23	32.78	6.10	24.65	330	0.19
71	10.90	32.84	5.95	284	75	10.62	32.88	5.74	25.21	276	0.26
96	9.66	33.18	4.63	239	100	9.50	33.26	4.47	25.70	230	0.33
115	9.02	33.44	4.02	210	125	8.77	-	3.94	-	-	-
135	8.56	-	3.89	-	150	8.37	-	3.75	-	-	-
					200	7.50	-	2.87	-	-	-
163	8.18	-	3.56	-	250	6.84	-	2.46	-	-	-
179	7.77	-	3.10	-	300	6.35	-	2.08	-	-	-
216	7.30	-	2.72	-	400	5.51	-	1.20	-	-	-
241	6.95	-	2.52	-	500	4.98	-	0.67	-	-	-
287	6.48	-	2.19	-	600	(4.57)	-	(0.37)	-	-	-
346	5.91	-	1.62	-							
438	5.28	-	0.99	-							
525	4.87	-	0.57	-							
599	4.58	-	0.37	-							

July 22, 1961; 0527 GCT, 0550 GCT; 42°00'N., 130°30'W.; wire angle, 07°, 11°; drift bottles, 12; BT serial no. 32. H-18

1	16.20	-	5.24	-	0	(16.20)	-	(5.24)	-	-	-
11	16.13	-	5.40	-	10	16.15	-	5.37	-	-	-
31	12.73	-	6.28	-	20	14.95	-	5.80	-	-	-
41	12.08	-	6.36	-	30	12.94	-	6.26	-	-	-
56	11.08	-	6.05	-	50	11.47	-	6.20	-	-	-
70	10.54	32.92	5.78	272	75	10.40	32.92	5.73	25.28	270	-
95	9.85	32.93	5.63	260	100	9.68	32.94	5.58	25.42	257	-
115	9.18	33.09	5.42	238	125	9.03	33.28	5.22	25.79	222	-
135	8.94	33.38	5.07	213	150	8.81	33.49	4.93	25.99	203	-
					200	8.32	33.89	4.58	26.38	166	-
152	8.78	33.51	4.91	201	250	7.65	33.95	4.02	26.52	152	-
181	8.46	33.80	4.73	174	300	6.63	33.94	3.70	26.66	139	-
215	8.20	33.93	4.46	161	400	5.23	33.96	2.44	26.85	121	-
245	7.76	33.96	4.05	153	500	4.52	34.04	1.30	26.99	108	-
294	6.74	33.94	3.76	141	600	4.10	34.14	0.66	27.11	96	-
348	5.85	33.93	3.10	130							
432	3.96	33.98	2.04	106							
516	4.45	34.05	1.17	106							
600	4.10	34.14	0.66	96							

TABLE 2.--Tabulated hydrographic station data--Continued

OBSERVED					INTERPOLATED				COMPUTED		
Depth m.	T. °C.	S. ‰	O_2 ml./l.	δ_T $10^{-5}cm^3/g$	Depth m.	T. °C.	S. ‰	O_2 ml./l.	σ_t g./l.	δ_T $10^{-5}cm^3/g$	ΔD dyn.m.

July 22, 1961; 2248 GCT, 2313 GCT; 42°00'., 132°00'W.; wire angle, 10°, 23°; drift bottles, 0; H-19
BT serial no. 33.

2	16.11	32.85	5.61	383	0	(16.11)	(32.85)	(5.61)	(24.09)	(383)	(0.00)
12	16.08	32.87	5.60	381	10	16.08	32.87	5.60	24.11	381	0.04
32	14.56	32.87	5.91	350	20	16.08	32.87	5.60	24.11	381	0.08
41	13.33	32.84	6.39	327	30	14.77	32.87	5.83	24.40	354	0.11
56	11.76	32.85	6.75	298	50	12.30	32.85	6.67	24.89	308	0.18
81	10.05	32.86	6.04	269	75	10.23	32.85	6.12	25.26	272	0.25
95	9.80	32.88	5.94	263	100	9.70	32.88	5.94	25.37	262	0.32
115	9.41	32.88	5.92	257	125	9.25	32.90	5.86	25.46	253	0.38
135	9.11	32.98	5.74	245	150	8.78	33.24	5.44	25.80	221	0.44
					200	8.35	33.90	4.71	26.38	166	0.54
159	8.62	33.43	5.24	204	250	7.99	33.98	4.21	26.50	155	0.62
187	8.40	33.82	4.79	172	300	6.99	33.96	3.83	26.62	142	0.70
224	8.24	33.97	4.53	159	400	5.33	33.94	2.60	26.82	124	0.84
252	7.96	33.98	4.18	154	500	4.60	34.00	1.62	26.95	111	0.96
299	7.00	33.96	3.84	143	600	4.30	-	1.03	-	-	-
360	5.83	33.94	3.23	130							
455	4.85	33.96	1.90	117							
542	4.43	34.06	1.29	105							
615	4.28	34.00U	0.96	-							

July 23, 1961; 1855 GCT, 1918 GCT; 43°00'N., 132°00'W.; wire angle, 03°, 10°; drift bottles, 0; H-20
BT serial no. 35.

1	15.72	32.84	5.45	376	0	(15.72)	(32.84)	(5.45)	(24.17)	(376)	(0.00)
11	15.62	32.84	5.55	373	10	15.63	32.84	5.53	24.19	374	0.04
31	12.55	32.82	6.53	314	20	15.57	32.84	5.56	24.21	372	0.07
41	11.38	32.84	6.53	292	30	12.65	32.82	6.51	24.80	316	0.11
56	10.26	32.89	5.87	270	50	10.63	32.89	6.08	25.22	276	0.17
71	9.84	32.87	5.82	264	75	9.77	32.87	5.80	25.35	263	0.24
96	9.48	32.91	5.73	256	100	9.40	32.93	5.71	25.46	253	0.30
116	9.04	33.02	5.58	241	125	8.85	33.15	5.44	25.72	229	0.36
135	8.70	33.34	5.26	212	150	8.59	33.49	5.12	26.02	200	0.42
					200	8.17	33.83	4.66	26.35	168	0.51
155	8.56	33.52	5.08	197	250	7.37	33.93	4.01	26.55	150	0.59
184	8.26	33.74	4.84	176	300	6.35	33.91	3.50	26.67	138	0.66
217	8.06	33.90	4.46	161	400	5.13	33.96	2.27	26.86	120	0.80
248	7.42	33.93	4.03	150	500	4.51	34.04	1.15	26.99	107	0.92
297	6.40	33.91	3.51	139	600	4.14	34.09	0.94	27.07	100	1.03
352	5.63	33.92	2.87	128							
435	4.85	33.99	1.90	115							
519	4.44	34.05	1.04	106							
603	4.13	34.09	0.93	100							

July 24, 1961; 0536 GCT, 0602 GCT; 44°00'N., 132°00'W.; wire angle, 03°, 09°; drift bottles, 0; H-21
BT serial no. 37.

1	15.83	32.77	5.48	383	0	(15.83)	(32.77)	(5.48)	(24.09)	(383)	(0.00)
11	15.83	32.77	5.60	383	10	15.83	32.77	5.59	24.09	383	0.04
31	14.32	32.74	6.15	354	20	15.71	32.76	5.67	24.11	381	0.08
41	12.46	32.72	6.53	320	30	14.45	32.74	6.10	24.37	357	0.11
56	10.52	32.71	6.50	287	50	11.30	32.72	6.52	24.97	300	0.18
71	9.24	32.73	6.17	266	75	9.18	32.73	6.16	25.34	265	0.25
96	8.58	32.74	6.04	255	100	8.49	32.77	5.97	25.47	252	0.32
115	8.15	32.98	5.29	231	125	7.97	33.14	5.02	25.84	217	0.37
135	7.81	33.29	4.83	203	150	7.70	33.51	4.53	26.17	185	0.42
					200	7.14	33.86	3.81	26.52	152	0.51
155	7.67	33.57	4.44	180	250	6.35	33.91	3.35	26.67	138	0.58
184	7.46	33.79	4.09	161	300	5.78	33.93	2.78	26.76	130	0.65
219	6.76	33.89	3.58	144	400	5.10	34.02	1.36	26.91	115	0.78
248	6.38	33.91	3.36	138	500	4.58	34.11	0.80	27.04	103	0.89
297	5.80	33.92	2.84	130	600	4.25	34.18	0.50	27.13	94	1.00
352	5.47	33.98	1.73	122							
436	4.89	34.05	1.12	111							
520	4.50	34.12	0.72	101							
605	4.24	34.19	0.48	94							

TABLE 2.--Tabulated hydrographic station data--Continued

July 24, 1961; 2050 GCT, 2112 GCT; 44°00'N.,130°56'W.; wire angle, 08°, 13°; drift bottles, 0; BT serial no. 39. H-22

OBSERVED Depth m.	T. °C.	S. ‰	O_2 ml./l.	δ_T 10^{-5} cm.^{3}/g.	INTERPOLATED Depth m.	T. °C.	S. ‰	O_2 ml./l.	COMPUTED σ_t g./l.	δ_T 10^{-5} cm.^{3}/g.	ΔD dyn.m.
2	16.03	32.81	5.54	384	0	(16.03)	(32.81)	(5.54)	(24.08)	(384)	(0.00)
12	16.00	32.80	5.64	384	10	16.01	32.80	5.64	24.08	385	0.04
32	12.48	32.68	7.01	324	20	16.00	32.80	5.64	24.08	384	0.08
42	10.08	32.73	6.56	278	30	14.20	32.72	6.48	24.41	353	0.11
56	9.55	32.76	6.19	268	50	9.79	32.75	6.35	25.25	273	0.18
71	9.10	32.75	6.12	262	75	9.00	32.74	6.08	25.37	261	0.24
96	8.66	32.74	5.99	256	100	8.60	32.74	5.97	25.43	255	0.31
116	8.28	33.04	5.41	228	125	8.10	33.28	4.78	25.93	208	0.37
136	7.84	33.48	4.21	190	150	7.57	33.69	3.64	26.33	170	0.41
					200	6.96	33.92	2.70	26.60	145	0.50
167	7.30	33.85	3.13	155	250	6.51	33.97	2.18	26.70	136	0.57
196	7.00	33.91	2.72	146	300	6.16	34.02	1.66	26.78	128	0.63
235	6.59	33.95	2.36	138	400	5.50	34.07	1.00	26.90	116	0.76
265	6.45	33.98	1.94	134	500	4.87	34.14	0.60	27.03	104	0.88
314	6.04	34.03	1.54	126	600	4.39	-	-	-	-	-
377	5.62	34.05	1.10	119							
475	5.04	34.12	0.69	107							
564	4.50	34.16	0.50	98							
638	4.34	34.15U	-	-							

July 25, 1961; 0547 GCT; 44°01'N., 129°51'W.; wire angle, 09°; drift bottles, 0; BT serial no. 41. H-23

OBSERVED Depth m.	T. °C.	S. ‰	O_2 ml./l.	δ_T 10^{-5} cm.^{3}/g.	INTERPOLATED Depth m.	T. °C.	S. ‰	O_2 ml./l.	COMPUTED σ_t g./l.	δ_T 10^{-5} cm.^{3}/g.	ΔD dyn.m.
2	16.20	32.84	5.71	386	0	(16.20)	(32.84)	(5.71)	(24.06)	(386)	(0.00)
12	16.21	32.81	5.87	388	10	16.20	32.81	5.86	24.04	388	0.04
37	13.11	32.72	7.10	332	20	16.20	32.81	5.88	24.04	388	0.08
46	11.47	32.75	6.92	301	30	14.85	32.76	6.48	24.30	363	0.12
61	10.10	32.79	6.57	275	50	10.77	32.78	6.75	25.11	286	0.18
76	9.56	32.77	6.44	268	75	9.59	32.77	6.43	25.30	268	0.25
101	9.14	32.77	6.40	261	100	9.16	32.77	6.41	25.37	261	0.32
120	8.62	32.87	5.88	246	125	8.50	32.97	5.67	25.63	237	0.38
140	8.13	33.20	5.19	214	150	(7.90)	(33.27)	-	(25.95)	(206)	(0.44)

July 25, 1961; 2143 GCT; 44°02'N., 128°42'W.; wire angle, 09°; drift bottles, 12; BT serial no. 42. H-24

OBSERVED Depth m.	T. °C.	S. ‰	O_2 ml./l.	δ_T 10^{-5} cm.^{3}/g.	INTERPOLATED Depth m.	T. °C.	S. ‰	O_2 ml./l.	COMPUTED σ_t g./l.	δ_T 10^{-5} cm.^{3}/g.	ΔD dyn.m.
2	16.83	32.04	5.81	458	0	(16.83)	(32.04)	(5.81)	(23.31)	(458)	(0.00)
12	16.82	32.02	5.86	459	10	16.82	32.03	5.84	23.30	459	0.05
32	15.35	32.73	6.17	376	20	16.81	32.03	5.87	23.30	458	0.09
41	13.98	32.73	6.37	348	30	15.37	32.73	6.17	24.16	376	0.13
56	11.94	32.74	6.87	309	50	12.32	32.73	6.82	24.79	317	0.20
71	10.56	32.80	6.39	282	75	10.34	32.83	6.20	25.22	275	0.28
96	9.77	32.98	5.54	255	100	9.69	33.02	5.47	25.48	251	0.34
115	9.39	33.16	5.12	236	125	9.10	33.29	4.85	25.79	222	0.40
135	8.73	33.43	4.58	206							

July 26, 1961; 2048 GCT, 2121 GCT; 44°06'N., 126°01'W.; wire angle, 11°, 20°; drift bottles, 36; BT serial no. 44. H-25

OBSERVED Depth m.	T. °C.	S. ‰	O_2 ml./l.	δ_T 10^{-5} cm.^{3}/g.	INTERPOLATED Depth m.	T. °C.	S. ‰	O_2 ml./l.	COMPUTED σ_t g./l.	δ_T 10^{-5} cm.^{3}/g.	ΔD dyn.m.
2	15.92	31.21	5.36	499	0	(15.92)	(31.21)	(5.36)	(22.88)	(499)	(0.00)
7	15.94	31.21	5.63U	499	10	15.93	31.21	5.47	22.88	499	0.05
12	15.92	31.21	5.48	499	20	15.55	31.30	5.54	23.03	485	0.10
31	11.78	32.47	6.48	326	30	12.00	32.43	6.48	24.62	333	0.14
41	10.48	32.62	6.21	293	50	9.87	32.63	5.86	25.15	283	0.20
56	9.56	32.65	5.66	276	75	8.93	32.97	4.90	25.56	243	0.27
70	9.12	32.82	5.21	257	100	8.08	33.56	3.50	26.15	187	0.32
95	8.14	33.52	3.62	191	125	7.69	33.78	2.80	26.38	165	0.37
115	7.90	33.68	3.11	175	150	7.12	33.93	2.35	26.58	146	0.41
134	7.46	33.86	2.56	156	200	6.56	34.00	1.72	26.71	134	0.48
					250	6.31	34.03	1.61	26.77	129	0.54
160	6.96	33.96	2.22	142	300	6.06	34.05	1.28	26.82	124	0.61
188	6.65	33.98	1.79	136	400	5.77	34.09	1.09	26.88	118	0.73
224	6.42	34.02	1.65	131	500	5.37	34.16	0.69	26.99	108	0.85
253	6.30	34.04	1.58	128	600	4.94	34.21	0.47	27.08	99	0.96
300	6.06	34.05	1.28	124							
361	5.90	34.07	1.16	120							
456	5.56	34.12	0.88	113							
544	5.20	34.11U	0.54	-							
617	4.88	34.22	0.44	98							

TABLE 3.--Bathythermograph observations

Ser. No.	Hydro-graphic station	Greenwich mean time Hour	Date	Lat. N.	Long. W.	Sea surface temp. (°F.)	Wind Dir. (°T.)	Wind Force	Air temp. Dry bulb (°F.)	Air temp. Wet bulb (°F.)	Baro-meter (mb.)	Wea-ther	Clouds Type	Clouds Amt.	Vis. (miles)	Swell Dir. (°T.)	Swell Amt. (ft.)
1	H-1	2015	11	47°42'	126°12'	61.0	290	3	66.7	62.5	1016	02	-	0	8	290	3
1a	H-1	2025	11	47°42'	126°12'	61.0	290	3	66.7	62.5	1016	02	-	0	8	290	3
2	H-2	0445	12	47°45'	127°33'	61.2	290	2	62.5	60.8	1015	02	-	0	8	290	3
2a	H-2	0525	12	47°45'	127°33'	61.2	290	2	62.5	60.8	1015	02	-	0	8	290	3
3	-	1710	12	47°44'	128°12'	60.6	310	5	61.2	60.0	1013	02	-	0	8	320	4
4	H-3	2120	12	47°46'	128°45'	61.0	320	5	61.3	60.1	1014	02	-	0	8	310	3
5	-	1255	13	47°44'	130°26'	57.9	310	5	-	-	1016	10	1	8	4	310	4
6	-	1715	13	47°12'	130°40'	58.5	310	5	57.5	57.5	1017	10	1	8	6	310	4
7	H-4	2120	13	46°41'	130°48'	59.0	300	5	60.6	58.8	1018	02	1	8	6	320	4
8	H-5	0415	14	46°00'	130°25'	59.7	080	5	58.3	57.9	1018	02	1	8	7	000	3
8a	H-5	0425	14	46°00'	130°25'	59.7	080	5	58.3	57.9	1018	02	1	8	7	000	3
9	-	1705	14	45°59'	129°53'	60.3	310	3	60.0	57.6	1018	02	4,6,8	7	8	300	3
																320	1
10	H-6	2035	14	45°59'	129°11'	62.1	310	3	62.2	58.8	1019	02	6	7	7	320	-
11	-	0130	15	45°59'	128°40'	63.3	310	2	61.8	59.9	1018	02	6	8	8	320	-
12	H-7	0455	15	45°58'	128°09'	63.1	310	2	61.0	59.8	1018	50	6	8	7	300	4
13	-	1740	15	45°59'	127°29'	64.6	310	3	63.0	60.0	1018	02	6	7	8	320	3
14	H-8	2030	15	45°59'	127°02'	64.4	270	4	62.9	60.1	1018	02	6	7	7	310	3
15	-	0155	16	45°57'	126°20'	63.9	290	4	62.0	59.9	1018	02	6	7	7	300	-
16	H-9	0505	16	46°00'	125°53'	63.5	270	3	61.2	60.5	1018	50	6	7	6	310	3
17	H-10	1815	16	45°59'	125°31'	63.7	280	4	61.8	60.2	1018	02	6	7	7	310	3
18	-	0000	17	45°35'	125°31'	64.2	240	3	65.1	59.8	1022	02	8	1	8	290	-
19	H-11	0505	17	44°59'	125°29'	64.8	270	2	62.5	59.5	1022	02	6,8	2	8	310	1
																270	1
20	-	0910	17	44°32'	125°30'	63.5	340	5	63.0	61.6	1023	02	8	2	8	280	-
21	H-12	2015	17	44°09'	125°29'	62.8	330	5	63.0	61.0	1024	02	8	5	8	280	1
22	-	2335	17	43°55'	125°30'	63.0	330	5	63.4	61.2	1024	02	8	7	8	280	-
23	H-13	0500	18	43°19'	125°32'	59.4	330	4	60.9	59.3	1023	02	6,8	3	8	280	1
24	-	1825	19	42°26'	125°30'	61.0	330	4	61.6	58.2	1022	02	4,6,8	6	8	290	-
25	H-14	2200	19	42°00'	125°29'	62.6	330	5	63.0	61.8	1022	02	6,8	7	7	280	-
26	-	1715	20	42°01'	126°42'	61.9	330	3	60.9	60.0	1023	80	4,6,8	6	7	290	-
27	H-15	2115	20	42°00'	127°04'	61.7	330	5	61.7	60.0	1023	15	6,8	6	8	280	3
28	-	0150	21	42°00'	127°36'	62.6	330	4	62.1	61.8	1022	50	0,8	8	4	330	-
																290	-
29	H-16	0505	21	41°59'	128°06'	62.6	330	4	62.2	61.2	1023	02	6,8	7	7	330	-
																280	-
29a	H-16	0510	21	41°59'	128°06'	62.6	330	4	62.2	61.2	1023	02	6,8	7	7	330	-
																280	-
30	-	1705	21	42°00'	128°49'	61.7	330	4	61.0	60.0	1023	16	0,6	7	5	330	-
																290	1
31	H-17	2025	21	42°00'	129°20'	61.5	330	5	61.3	60.0	1023	25	6,8	7	7	330	1
																280	-
32	H-18	0505	22	42°01'	130°30'	61.2	330	5	60.2	59.5	1023	50	6,8	7	7	330	1
																280	-
33	H-19	2215	22	42°00'	132°00'	61.0	330	5	60.3	56.7	1026	02	8	6	8	350	-
																330	-
																290	-
34	-	0520	23	42°32'	132°03'	60.6	330	5	59.8	57.2	1026	02	6,8	6	8	-	-
35	H-20	1820	23	43°01'	132°00'	60.4	330	5	60.0	59.0	1027	02	0,6,8	7	8	000	1
																290	1
36	-	0000	24	43°30'	132°02'	60.3	330	4	61.0	59.0	1027	02	6	7	7	000	-
																290	-
37	H-21	0515	24	44°00'	132°00'	60.4	330	4	59.6	58.3	1027	02	6	7	8	000	1
																290	1
38	-	1720	24	43°59'	131°19'	60.8	330	4	60.0	58.7	1028	02	6	8	6	000	-
																330	-
39	H-22	2010	24	44°00'	130°56'	60.8	340	5	60.0	58.7	1027	02	6,8	6	7	000	3
40	-	0130	25	43°58'	130°20'	61.0	340	5	60.8	59.0	1026	02	6	7	8	000	-
41	H-23	0505	25	44°01'	129°51'	61.3	340	7	60.5	59.0	1026	02	6,8	7	7	000	6
42	H-24	2110	25	44°01'	128°43'	62.2	340	8	62.0	60.4	1025	02	6,8	7	7	340	7
43	-	0440	26	44°06'	127°52'	63.0	340	8	62.0	60.0	1022	02	6	7	7	000	-
44	H-25	2015	26	44°06'	126°01'	60.8	330	5	61.7	59.2	1023	02	6	7	8	340	-
																010	-

TABLE 4.--Solar radiation measurements

Date (July 1961)	Calculated length of day (hours)	Insolation ($g.-cal./cm.^2$)		
		AM	PM	Total
11	15.7	328	390	718
12	15.7	317	374	691
13	15.5	150	159	309
14	15.5	(151)	149	(300)
15	15.4	182	147	329
16	15.2	(180)	(254)	(434)
17	15.1	(275)	252	(527)
18	15.0	368	380	748
19	14.8	(203)	255	(458)
20	14.8	264	294	558
21	14.7	203	236	439
22	14.7	199	345	544
23	14.8	249	217	466
24	14.9	(249)	(249)	(498)
25	14.9	182	253	435
26	14.8	121	159	280

TABLE 5.--Surface C^{14} productivity observations

Station	Date (July 1961)	Time (PST)	Incubation (hours)	Productivity replicates ($mg.C/m.^3/day$)			
				1	2	3	Average
P-1	11	1235	5.8	9.62	8.93	6.20	8.25
P-6	14	1245	7.2	1.66	1.99	1.82	1.82
P-7	15	0500	7.5	-	4.23	-	4.23
P-8	15	1315	7.1	6.62	-	5.94	6.28
P-9	16	0525	7.2	-	4.85	6.41	5.63
P-10	16	1240	7.5	1.03	1.44	1.82	1.43
P-11	17	0500	7.3	3.97	(1.66)	2.91	3.44
P-12	17	1240	7.5	3.13	3.56	(5.30)	3.34
P-13	18	0530	6.9	4.67	-	6.33	5.50
P-14	19	1230	7.3	2.58	3.60	-	3.09
P-15	20	0505	7.1	-	4.81	-	4.81
P-17	21	0520	7.0	5.41	-	-	5.41
P-20	22	1240	7.5	1.06	1.36	-	1.21
P-21	23	0510	7.5	1.52	1.83	-	1.67
P-22	23	1240	7.5	2.23	2.62	-	2.43
P-23	24	0520	7.5	3.75	4.88	-	4.31
P-24	24	1310	7.5	1.93	2.83	-	2.38
P-25	25	0520	7.1	7.35	-	-	7.35
P-26	25	1240	8.1	2.20	4.65	-	3.42
P-27	26	0535	7.0	4.78	6.29	-	5.53
P-28	26	1320	6.9	5.83	8.33	-	7.08

TABLE 6.--Surface chlorophyll a measurements

Station	Date (July 1961)	Time (PST)	Sample volumes (l. each)	Chlorophyll a replicates (mg./m.^{3})			
				1	2	3	Average
P-1	11	1235	3.0	0.13	0.23	-	0.18
P-2	12	0435	3.0	0.12	0.08	0.11	0.10
P-3	12	1445	3.0	0.10	0.11	0.10	0.10
P-4	13	1335	3.0	0.19	(0.07)	0.23	0.21
P-5	14	0500	2.0	0.09	0.04	0.11	0.08
P-6	14	1245	2.0	0.06	0.09	0.09	0.08
P-7	15	0600	2.0	0.21	0.22	0.24	0.22
P-8	15	1300	2.0	0.18	0.19	0.16	0.18
P-9	16	0525	2.0	0.19	(0.26)	0.20	0.19
P-10	16	1240	2.0	0.12	(0.22)	0.15	0.13
P-11	17	0500	2.0	0.17	0.11	0.14	0.14
P-12	17	1240	2.0	0.21	(0.11)	0.20	0.21
P-13	18	0530	2.0	(0.17)	0.21	0.19	0.20
P-13A	18	1250	2.0	0.16	(0.26)	0.19	0.17
P-14	19	1230	2.0	0.08	0.05	0.10	0.08
P-15	20	0505	2.0	0.10	0.13	0.13	0.12
P-17	21	0520	2.0	0.16	0.17	(0.11)	0.16
P-18	21	1245	2.0	0.06	0.06	(0.10)	0.06
P-19	22	0515	2.0	0.08	0.10	0.09	0.09
P-20	22	1240	2.0	0.07	0.05	*0.05	0.06
P-21	23	0510	2.0	0.10	0.07	*0.08	0.08
P-22	23	1240	2.0	(0.15)	0.12	*0.10	0.11
P-23	24	0520	2.0	0.11	0.12	*0.07	0.10
P-24	24	1315	2.0	0.09	0.10	*0.11	0.10
P-25	25	0520	2.0	0.09	0.13	*0.11	0.11
P-26	25	1240	2.0	0.17	0.17	*(0.11)	0.17
P-27	26	0535	2.0	0.28	0.24	*0.29	0.27
P-28	26	1320	2.0	0.19	0.14	*0.15	0.16

*Taken from separate bucket of water obtained up to 1/4 nautical mile from the first two (1 and 2).

TABLE 7.--Zooplankton collection data

Items	Station									
	P-3	P-6	P-8	P-10	P-12	H-14	P-16	P-18	H-19	H-20
Date (July 1961)	12	14	15	16	17	19	20	21	22	23
Time of haul (PST)	1258	1230	1217	1214	1200	1342	1207	1206	1403	1148
Maximum haul depth (m.)	220	120	120	120	130	135	135	135	135	135
Volume of water recorded (m.^{3})	950	300	380	370	510	790	530	520	500	510
Zooplankton displacement volume (cm.^{3})	64	13	528	43	58	43	22	11	250	52
Observed zooplankton density (cm.^{3}/1000m.^{3})	67	43	1389	116	114	54	42	21	500	102

TABLE 8. Relative abundance of zooplankton organisms

[Symbols: D = dominant, C = common, F = few, T = trace]

Organisms	Stations									
	P-3	P-6	P-8	P-10	P-12	H-14	P-16	P-18	H-19	H-20
Fish eggs	T	T	F	F	F	T	-	-	F	F
Fish larvae (myctophids)	T	F	F	F	F	F	F	T	T	-
Appendicularia										
Oikopleura spp.	T	F	-	T	T	F	-	-	T	F
Thaliacea										
Salpa (fusiformis)	-	-	D	D	D	-	-	-	-	-
Doliolidae	-	-	-	F	-	F	-	-	D	D
Pteropoda										
Limacina helicina	F	-	-	F	F	F	T	-	F	F
Limacina sp.	-	-	-	-	-	-	-	-	F	-
Clione (limacina)	F	-	-	-	-	-	-	-	-	-
Euclio sp.	-	-	F	-	-	-	-	-	-	-
Heteropoda										
Atlanta (peroni)	-	-	-	F	-	-	-	-	F	F
Cephalopoda	T(egg)	-	T	T	T	-	-	-	T	T
Echinodermata										
Ophioplutei	-	-	-	-	T	-	-	-	-	-
Amphipoda										
gammarid	-	-	F	F	F	T	-	-	T	-
hyperiid										
Parathemisto pacifica	F	C	F	F	F	C	C	F	F	F
Phronema sp.	-	-	F	-	-	F	-	F	F	T
Streetsia sp.	-	-	F	-	T	-	T	-	F	F
*Type I	F	-	-	-	T	-	-	-	-	F
*Type II	-	-	-	-	-	-	T	F	T	F
*Type III	-	-	T	-	-	-	-	-	-	F
*Type IV	-	-	F	-	T	T	T	T	-	-
*Type V	-	-	-	-	-	-	-	T	-	-
Cirripedia										
Lepas nauplii, cyprids	-	-	-	-	-	T	-	T	T	-
Copepoda										
Acartia longiremis	-	-	-	-	-	T	-	T	-	-
Aetidius armatus	F	-	F	-	-	-	F	-	-	-
Calanus cristatus	C	-	F	-	F	F	F	-	F	-
C. tonsus	C	F	F	T	T	F	C	T	F	T
C. finmarchicus s.l.	C	C	F	F	C	-	F	-	F	F
Candacia bipinnata	-	-	F	-	-	-	T	-	F	F
C. catula	-	-	-	T	-	-	F	-	F	F
Centropages (abdominalis)	-	-	-	-	T	-	-	-	-	-
Clausocalanus arcuicornis	-	-	-	-	-	-	-	-	F	C
Corycaeus s.p.	F	-	-	-	-	-	-	-	T	-
Eucalanus bungii bungii	C	C	F	-	F	-	-	-	-	-
E. bungii californicus	-	C	-	C	-	C	C	F	C	C
E. elongatus hyalinus	-	-	-	-	-	-	F	-	C	C
Euchaeta (japonica)	F	T	-	F	F	F	F	T	T	-
Euchirella bella	F	-	-	F	F	T	F	F	-	-
Heterorhabdus papilliger	F	T	F	T	F	T	F	-	T	T
Mecynocera clausi	F	C	F	F	F	C	F	F	-	-
Metridia lucens	F	F	-	F	C	F	C	F	-	T
Microcalanus sp.	F	C	F	F	F	C	F	C	F	F
Oithona plumifera	F	F	F	F	T	F	F	-	T	T
O. (similis)	-	T	-	T	-	-	-	-	-	-
O. sp.	-	-	-	-	-	-	-	T	-	-
Oncaea sp.	-	-	-	-	F	-	F	-	F	F
Paracalanus parvus	-	C	F	F	-	C	F	C	F	-
Rhincalanus nasutus	-	-	-	T	-	-	-	-	-	-
Scolecithricella minor	F	-	-	F	T	-	-	-	F	-
parasitic copepods	-	-	-	-	-	-	-	-	T	-
copepod eggs	C	-	F	-	F	F	T	-	T	-
copepod nauplii	F	-	-	F	-	-	-	-	-	-

TABLE 8.--Relative abundance of zooplankton organisms--Continued

[Symbols: D = dominant, C = common, F = few, T = trace]

Organisms	Stations									
	P-3	P-6	P-8	P-10	P-12	H-14	P-16	P-18	H-19	H-20
Euphausiacea										
Nematoscelis difficilis	-	-	-	-	-	-	-	-	-	F
Stylocheiron sp.	T	-	-	T	-	-	-	T	-	-
Thysanoëssa longipes	-	F	F	F	F	F	F	F	F	F
calyptopis (unidentified)	F	F	F	-	-	-	-	-	-	F
furcilia "	-	F	F	F	F	-	-	T	-	T
Ostracoda										
Conchoecia (*elegans*)	T	-	-	F	F	-	T	F	T	-
C. (*daphnoides*)	T	-	-	-	-	-	T	-	T	-
C. (*haddoni*)	-	T	-	-	-	-	-	-	-	-
C. sp.	T	-	-	-	F	F	-	-	-	-
decapod larvae (miscellaneous)	T	-	T	T	-	T	F	-	T	F
Polycheata										
Tomopteris sp.	-	-	F	T	T	-	-	F	F	C
Alciopidae	-	-	-	-	-	-	-	-	-	F
Chaetognatha										
Sagitta elegans	C	C	-	-	-	-	C	-	-	-
S. scrippsae	F	F	F	F	F	D	D	C	F	C
S. decipiens	-	-	-	-	-	-	-	-	-	C
S. tenuis	-	-	F	C	F	C	C	-	-	-
S. neglecta	-	-	-	-	-	-	-	C	-	-
S. sp.	-	-	-	-	-	-	-	C	F	-
Eukrohnia hamata	C	F	-	F	T	-	-	-	-	-
Ctenophora	T	-	F	F	C	-	-	-	-	-
Siphonophora	-	F	C	C	C	-	-	-	F	C
Hydromedusae	F	C	F	F	F	F	F	-	F	C
Radiolaria	F	F	F	F	F	F	F	D	F	C

*Unidentified hyperiid amphipods.

TABLE 9.--Albacore trolling results

Date (July 1961)	Trolled between positions				Time start (PST)	Time stop (PST)	Total (hours)	Lines fished	Number of fish		Strikes observed
	Lat. N.	Long. W.	Lat. N.	Long. W.					caught	tagged	
11	47°45'	125°22'	47°45'	127°35'	0730	2045	12.0	7	-	-	-
12	47°44'	128°07'	47°47'	129°56'	0815	2040	12.0	7	-	-	-
13	47°44'	130°27'	46°00'	130°25'	0520	2010	12.5	7	-	-	-
14	45°52'	130°30'	45°58'	128°10'	0515	2000	12.2	7	1	-	-
15	45°58'	128°10'	46°00'	125°54'	0620	2030	12.1	7/8[1/]	-	-	-
16	45°56'	125°57'	44°59'	125°29'	0640	2030	10.8	7	-	-	-
17	44°57'	125°31'	43°18'	125°32'	0600	2030	14.3	7/8[1/]	-	-	-
18	42°57'	125°31'	42°57'	125°31'[2/]	1130	2030	9.0	7	1	-	1
19	43°05'	125°30'	42°00'	126°04'	0440	2030	13.2	7/8[1/]	21	-	7
20	41°55'	126°06'	42°00'	128°03'	0430	2030	15.2	8	1	-	-
21	41°56'	128°06'	42°00'	130°22'	0445	2035	13.5	8	2	-	-
22	41°59'	130°33'	42°30'	132°02'	0500	2050	14.0	8	3	-	2
23	42°28'	132°03'	44°00'	132°00'	0515	2050	13.8	8	2	-	-
24	44°00'	132°00'	44°00'	129°52'	0500	2040	13.7	8	-	-	-
25	43°54'	129°46'	44°04'	127°55'	0500	2035	14.1	6/8[1/]	7	-	8
26	44°07'	126°48'	44°13'	125°22'	0500	2015	13.5	5	16	6	5
Totals							206	--	54	6	23

1/ Line(s) added during fishing period.

2/ Within a 10-nautical mile square during trolling period.

TABLE 10.--Gill net results

Date (July 1961)	Position		Time set (PST)	Time hauled (PST)	Total hours fished	Catch
	Lat. N.	Long. W.				
11	47°45'	127°35'	2120	0540	8.4	6 sharks, 2 anchovies
14	45°58'	128°10'	2018	0600	9.7	1 shark, 3 scad, 2 albacore, 1 bluefin
15	46°00'	125°53'	2045	0610	9.4	19 sharks, 11 scad
16	44°59'	125°30'	2045	0540	9.0	10 sharks, 4 scad
Totals					36.5	36 sharks, 18 scad, 2 anchovies, 2 albacore, 1 bluefin

MS #1255

GPO 934-771

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