OCEANOGRAPHICAL STATION LIST

VOLUME 60

INVESTIGATIONS BY F.R.V. INVESTIGATOR ON THE SOUTH AUSTRALIAN TUNA GROUNDS IN 1962

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION

AUSTRALIA

MELBOURNE, 1968

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When citing this station list, abbreviate as follows:
CSIRO Aust. Oceanogr. Stn List 60.

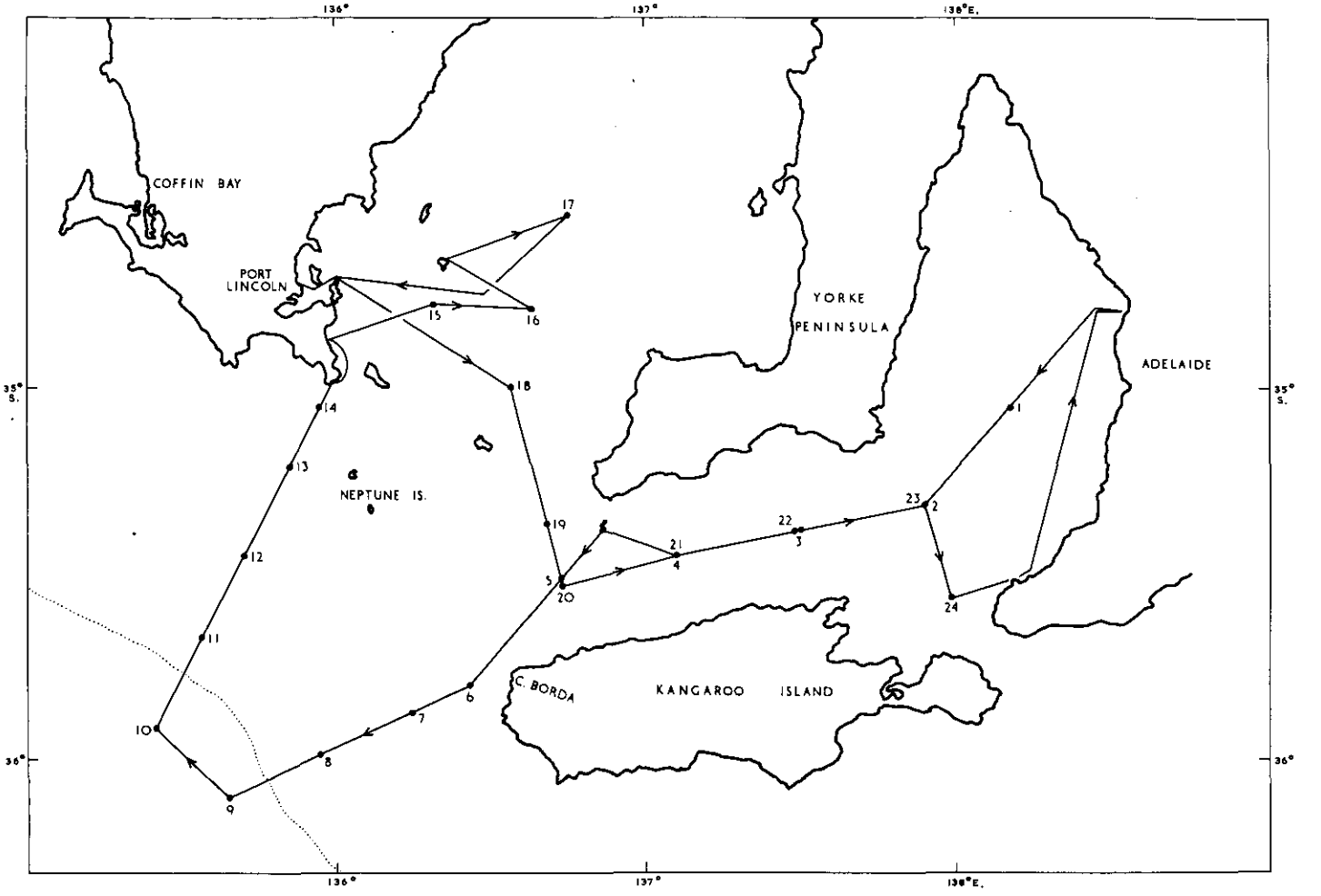

Fig. 1:- Track chart Cruise In 1/62

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Investigations by F.R.V. Investigator
on the South Australian Tuna Grounds in 1962

I. INTRODUCTION

This report records the hydrological data collected during Cruise In1/62, the only cruise made by F.R.V. Investigator in 1962. The track chart and station positions are shown in Figure 1.

This cruise was planned to investigate hydrological conditions on the tuna grounds. In addition, experimental trawling was carried out around 35°24'S., 138°17'E. Results of this work are not presented here.

The hydrological sampling programme was carried out by Messrs R. Bradley and L. Olsen.

F.R.V. Investigator, formerly named F.R.V. Weerutta, is a converted 55-ft wooden fishing vessel built in 1948 and bought, in 1955, by the South Australian Department of Fisheries and Fauna Conservation for research and inspection projects. At the end of 1961, she was extensively refitted.

Investigator is powered by a 72 hp Gardner diesel engine with an auxiliary Southern Cross diesel of 16-24 hp, and is equipped with a magnetic compass, a radio transceiver with four transmitting frequencies, and a Kelvin Hughes MS-22A (Mk. II) echo-sounder. She has two hydraulic drum winches with 450 m of wire on each.

II. WORK ACCOMPLISHED

Twenty-four stations were worked (In1/1/62-In1/24/62). A bathythermograph cast was made, and surface and subsurface hydrology samples were collected, at each station. Table 1 shows the work done at each station.

TABLE 1

WORK DONE AT EACH STATION

Station	BT	Hydrology	Station	BT	Hydrology
1	27	25	13	60	65
2	36	20	14	60	65
3	33	25	15	31	25
4	40	40	16	44	40
5	60	60	17	37	25
6	60	90	18	34	25
7	120	100	19	60	65
8	115	100	20	60	70
9	270	300	21	36	25
10	270	300	22	30	25
11	114	100	23	34	25
12	92	85	24	31	25

BT Bathythermographs - Surface to depth (m)

Hydrology Surface to depth (m)

III. METHOD OF COLLECTION AND ANALYSIS OF SAMPLES

1. Physics

Temperature.—Water temperatures were taken with deep-sea reversing thermometers. Up to six Nansen water-bottles were used on each cast, each bottle being fitted with two protected thermometers. In addition, four of the water-bottles were fitted with an unprotected thermometer. The temperatures obtained are considered accurate to $\pm$ 0.03 degC.

Bathythermographs.—A 450-ft or a 900-ft bathythermograph was used, depending on the depth of water. Slides were digitized by the U.S. National Oceanographic Data Centre according to their own method (U.S.N.O.D.C. 1964), and from their punched cards computer listings were produced. The listings are held at Cronulla.

Thermometric Depth.—Depth calculations were made by the second method described by La Fond (1951), plotting thermometric depth against the difference between thermometric and wire depths. Depths are considered accurate to about 3%.

Sigma-t.—Sigma-t values were computed from temperature and salinity values, using the equations of Knudsen (La Fond 1951).

2. Chemistry

Salinity.—A chlorinity-temperature meter of the conductivity type (Hamon 1956) was used at Port Lincoln, South Australia, to estimate chlorinity, which was subsequently converted to salinity by the relation

$$\text{Salinity} = 0.03 + 1.805 \times \text{Chlorinity}$$

Salinities are considered accurate to about ± 0.05‰.

Dissolved Oxygen.—Samples were sent to Cronulla where a version of the standard Winkler method was used to determine the amount of dissolved oxygen in the seawater samples. The version used is a modification of that described by Thompson and Robinson (1939) and differs in some respects from the revision by Jacobsen, Robinson, and Thompson (1950). Potassium iodate was used as the iodometric standard, and the reagents necessary to fix the oxygen in solution were used at different concentrations (Rochford 1963). Duplicate titrations were made on approximately every tenth sample. Saturation values, given as ml/l, were computed, using the simpler of the equations given by Richards and Corwin (1956) -

$$O_2(\%\ \text{Satn.}) = \frac{O_2(\text{ml/l}) \times (33.5 + T^\circ C) \times 100}{332.4 - (1.854 \times S‰)}$$

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U.S. NATIONAL OCEANOGRAPHIC DATA CENTRE (1964).—Manual for processing bathythermograph data. Part 1 Instructions for manually digitizing bathythermograph data. Publ. M-3. (U.S. Naval Oceanographic Office : Washington, D.C.)

U.S. NAVY HYDROGRAPHIC OFFICE (1955).—Instruction manual for oceanographic observations. Publ. No. 607.

IV. DATA SHEETS

The data were processed in a C.D.C. 3600 Computer. An explanation of the headings used is given at the beginning of the surface listing.

DATA

PART 1

HYDROLOGY

SURFACE SAMPLES

EXPLANATION OF HEADINGS

Parts 1 and 2	Hydrology
STATION	Gives the station identification. For example, In1/1/62 signifies the 1st station worked by Investigator in 1962, on her 1st cruise for that year
DATE	Given as day/month/year
TIME	Given in Zone Time, and is the time at the beginning of the first cast. Zone Time in all cases was Central Australian Standard Time, GMT $+9\frac{1}{2}$ hr, Code J
LATITUDE LONGITUDE	Given in degrees and minutes
SONIC DEPTH	Given in metres, measured at standard sound velocity of 800 fm (1463 m) per second
WIND DIR. SP.	Wind direction and speed are coded using Tables 8 and 9 in U.S. Navy Hydrogr. Office (1955)
VIS.	Visibility is coded using Table 4 in U.S. Navy Hydrogr. Office (1955)
WEA.	Weather is coded using Table 1 in U.S. Navy Hydrogr. Office (1955)
SEA DIR. AMT.	Sea direction and amount are coded using Tables 5 and 8 in U.S. Navy Hydrogr. Office (1955)
SWELL DIR. AMT.	Sea swell direction and amount are coded using Tables 6 and 8 in U.S. Navy Hydrogr. Office (1955)
BAROM. or ATMOS. PRESSURE	Atmospheric pressure given in millibars
WIRE ANGLES CAST 1 CAST 2 CAST 3	Wire angles are measured at the surface and expressed in degrees for each cast
CAST	Gives the cast number

DEPTH	Sampling depth given in metres
SALINITY	Given in parts per thousand
SIGMA-T	Sigma-t to 2 decimal places
OXYGEN	Given in ml/l
OXYGEN % SAT.	Oxygen percentage saturation

*, ***, or a blank indicates no data available

VESSEL	CRUISE	STATION NUMBER	YR.	MTH.	DAY	TIME	Z	LATITUDE			LONGITUDE			TEMP.	SALINITY	WIND DN.	WIND AMT.	SEA DN.	SEA AMT.	SWELL DN.	SWELL AMT.	WEA.	VIS.	BAROM.	SAMPLING METHOD
76	1	1	62	12	10	0458	J	35	03	S	138	10	E	18.8	36.94*	99	0	99	1	99	0	03	7	1013.0	1
76	1	2	62	12	10	0800	J	35	19	S	137	54	E	17.7	36,62	28	1	28	1	99	0	03	7	1013.0	1
76	1	3	62	12	10	1100	J	35	23	S	137	30	E	17.7	36.55	26	2	28	2	28	2	03	7	1012.0	1
76	1	4	62	12	10	1420	J	35	27	S	137	06	E	17.7	36.45	26	4	26	3	28	2	03	7	1010.0	1
76	1	5	62	12	12	1210	J	35	31	S	136	42	E	16.7	36.09	29	2	29	1	24	4	50	6	1020.0	1
76	1	6	62	12	12	1600	J	35	48	S	136	26	E	16.3	35.88	24	2	24	2	24	4	03	7	1019.0	1
76	1	7	62	12	12	1739	J	35	53	S	136	15	E	16.4	35.62	20	2	20	1	24	4	03	7	1020.0	1
76	1	8	62	12	12	2035	J	35	59	S	135	57	E	16.1	35.62	19	3	19	2	24	4	03		1022.0	1
76	1	9	62	12	12	2323	J	36	06	S	135	39	E	15.8	35.44	16	2	18	1	24	2	03		1022.5	1
76	1	10	62	12	13	0240	J	35	55	S	135	25	E	15.8	35.50	15	3	15	3	24	1	03		1022.0	1
76	1	11	62	12	13	0555	J	35	41	S	135	34	E	16.6	35.75	13	3	14	3	24	2	03	7	1023.0	1
76	1	12	62	12	13	0838	J	35	27	S	135	42	E	16.4	35.70	10	4	12	3	24	2	03	7	1024.0	1
76	1	13	62	12	13	1110	J	35	13	S	135	52	E	16.6	35.88	13	3	13	3	24	2	03	7	1024.0	1
76	1	14	62	12	13	1248	J	35	03	S	135	58	E	16.9	35.99	15	3	99	3	24	2	03	8	1024.0	1
76	1	15	62	12	14	1245	J	34	46	S	136	19	E	17.9	36.35	12	2	99	3	99	1	00	8	1023.0	1
76	1	16	62	12	14	1540	J	34	49	S	136	38	E	18.6	36.69	15	4	15	3	18	2	00	8	1021.0	1
76	1	17	62	12	15	0530	J	34	32	S	136	45	E	18.9	37.00	07	3	99	3	24	1	00	8	1016.0	1
76	1	18	62	12	17	0553	J	35	00	S	136	34	E	18.0	36.60	13	3	99	3	00	0	03	7	1014.0	1
76	1	19	62	12	17	1005	J	35	22	S	136	40	E	16.8	35.84	10	3	13	3	24	1	03	7	1013.0	1
76	1	20	62	12	17	1217	J	35	32	S	136	42	E	17.0	35.95	34	1	99	1	24	1	03	8	1013.0	1
76	1	21	62	12	17	1602	J	35	27	S	137	06	E	18.1	36.56	20	2	20	1	24	1	03	8	1012.0	1
76	1	22	62	12	17	1842	J	35	23	S	137	29	E	18.0	36.60	24	2	24	2	24	1	03	8	1012.0	1
76	1	23	62	12	17	2136	J	35	19	S	137	54	E	17.9	36,58	18	1	18	1	24	1	03	8	1014.0	1
76	1	24	62	12	18	0003	J	35	34	S	137	59	E	17.9	36.60	18	3	18	1	00	0	02		1013.0	1

DATA

PART 2

HYDROLOGY

SUBSURFACE SAMPLES

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 1/62	10/12/62	0458 J	35 03 S	138 10 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
35	***	***	99	0	*	*	*	7	99	1	99	0	1013.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	18.84	36.940*	26.56	5.09	101	***	***	***
1	25	18.83	36.850*	26.49	4.96	98	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 2/62	10/12/62	0800 J	35 19 S	137 54 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
36	***	***	28	1	*	*	*	7	28	1	99	0	1013.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	17.69	36.620	26.61	5.20	101	***	***	***
1	10	17.66	36.600	26.60	5.25	102	***	***	***
1	20	17.59	36.600	26.62	5.17	100	***	***	***

* PROPERTY DOUBTFUL
\+ PROPERTY INTERPOLATED

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 3/62	10/12/62	1100 J	35 23 S	137 30 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
27	***	***	26	2	*	*	*	7	28	2	28	2	1012.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	17.73	36.550	26.54	5.31	103	***	***	***
1	25	17.53	36.670	26.68	5.25	101	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 4/62	10/12/62	1420 J	35 27 S	137 06 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
45	***	***	26	4	*	*	*	7	26	3	28	2	1010.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	17.75	36.450	26.46	5.36	104	***	***	***
1	25	17.67	36.470	26.50	5.31	103	***	***	***
1	40	17.66	36.470	26.50	5.15	100	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 5/62	12/12/62	1210 J	35 31 S	136 42 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
68	15,6	16,2	29	2	*	*	*	6	29	1	24	4	1020,0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	16,74	36,090	26,43	5,39	102	***	***	***
1	25	16,61	36,090	26,46	5,44	103	***	***	***
1	50	16,56	36,170	26,53	5,14	97	***	***	***
1	60	16,19	36,200	26,64	5,13	96	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 6/62	12/12/62	1600 J	35 48 S	136 26 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
97	15,7	16,7	24	2	*	*	*	7	24	2	24	4	1019,0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	16,28	35,880	26,38	5,46	102	***	***	***
1	25	15,96	35,880	26,45	5,53	103	***	***	***
1	50	15,89	35,970	26,54	5,30	99	***	***	***
1	75	15,88	36,000	26,56	5,20	97	***	***	***
1	90	15,66	36,000	26,61	4,97	92	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 7/62	12/12/62	1739 J	35 53 S	136 15 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
125	15.1	15.9	20	2	*	*	*	7	20	1	24	4	1020.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	16.39	35.620	26.15	5.47	102	***	***	***
1	25	16.06	35.620	26.23	5.47	102	***	***	***
1	50	16.11	35.770	26.33	5.41	101	***	***	***
1	75	15.72	35.880	26.51	5.26	97	***	***	***
1	100	15.27	35.840	26.58	5.15	94	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 8/62	12/12/62	2035 J	35 59 S	135 57 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
130	13.6	15.1	19	3	*	*	*	*	19	2	24	4	1022.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	16.07	35.620	26.23	5.53	103	***	***	***
1	25	15.93	35.620	26.26	5.47	102	***	***	***
1	50	15.83	35.570	26.24	5.43	101	***	***	***
1	75	14.99	35.570	26.43	5.43	99	***	***	***
1	100	14.67	35.590	26.52	5.15	93	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 9/62	12/12/62	2323 J	36 06 S	135 39 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
***	13.3	14.5	16	2	*	*	*	*	18	1	24	2	1022.5	5	0	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
2	0	15.75	35.440	26.16	5.57	103	***	***	***
2	25	15.67	35.440	26.18	5.53	102	***	***	***
2	50	15.20	35.350	26.22	5.64	103	***	***	***
2	75	14.10	35.280	26.40	5.76	103	***	***	***
2	100	13.78	35.280	26.47	5.63	100	***	***	***
2	150	13.62	35.350	26.55	5.47	97	***	***	***
1	200	13.44	35.350	26.59	5.46	96	***	***	***
1	300	12.24	35.190	26.71	5.36	92	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 10/62	13/12/62	0240 J	35 55 S	135 25 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
***	13.2	15.1	15	3	*	*	*	*	15	3	24	1	1022.0	0	30	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
2	0	15.77	35.500	26.20	***	***	***	***	***
2	25	15.64	35.480	26.22	5.44	100	***	***	***
2	50	14.93	35.460	26.36	5.64	102	***	***	***
2	75	14.73	35.530	26.46	5.58	101	***	***	***
2	100	14.39	35.530	26.53	5.36	96	***	***	***
2	150	14.03	35.480	26.57	5.40	96	***	***	***
1	170	14.02	35.480	26.57	5.41	96	***	***	***
1	248	13.90	35.480	26.60	5.29	94	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 11/62	13/12/62	0555 J	35 41 S	135 34 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
125	13,4	15,1	13	3	*	*	*	7	14	3	24	2	1023,0	5	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	16,63	35,750*	26,20	5,49	103	***	***	***
1	25	16,62	35,710	26,17	5,43	102	***	***	***
1	50	16,45	35,710	26,21	5,23	98	***	***	***
1	75	16,02	35,820	26,39	5,23	97	***	***	***
1	100	14,96	35,710	26,55	5,08	92	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 12/62	13/12/62	0838 J	35 27 S	135 42 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
91	13,8	15,1	10	4	*	*	*	7	12	3	24	2	1024,0	5	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	16,42	35,700	26,20	5,47	103	***	***	***
1	25	16,42	35,700	26,21	5,44	102	***	***	***
1	50	16,22	35,680	26,24	5,52	103	***	***	***
1	75	16,11	35,790	26,35	5,43	101	***	***	***
1	85	15,78	35,900	26,51	5,23	97	***	***	***

* PROPERTY DOUBTFUL
\+ PROPERTY INTERPOLATED

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 13/62	13/12/62	1110 J	35 13 S	135 52 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
73	13.9	16.3	13	3	*	*	*	7	13	3	24	2	1024.0	5	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	16.59	35.880	26.30	5.41	102	***	***	***
1	25	16.51	35.880	26.32	5.54	104	***	***	***
1	50	16.00	35.950	26.50	5.26	98	***	***	***
1	65	16.14	35.990	26.49	5.14	96	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 14/62	13/12/62	1248 J	35 03 S	135 58 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
73	14.1	16.4	15	3	*	*	*	8	99	3	24	2	1024.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	16.87	35.990	26.32	5.47	104	***	***	***
1	25	16.81	36.040	26.37	5.44	103	***	***	***
1	50	16.80	36.040	26.38	5.37	102	***	***	***
1	65	16.73	36.020	26.38	5.35	101	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 15/62	14/12/62	1245 J	34 46 S	136 19 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
35	16.4	18.2	12	2	*	*	*	8	99	3	99	1	1023.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	17.90	36.350	26.35	5.50	107	***	***	***
1	25	17.49	36.350	26.45	5.37	103	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 16/62	14/12/62	1540 J	34 49 S	136 38 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
50	16.2	19.5	15	4	*	*	*	8	15	3	18	2	1021.0	5	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	18.58	36.690	26.44	5.29	104	***	***	***
1	25	17.70	36.650	26.63	5.29	102	***	***	***
1	40	17.67	36.650	26.63	***	***	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 17/62	15/12/62	0530 J	34 32 S	136 45 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
45	16,6	18,9	07	3	*	*	*	8	99	3	24	1	1016,0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	18,87	37,000	26,60	5,13	102	***	***	***
1	25	18,89	37,010	26,60	5,12	102	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 18/62	17/12/62	0553 J	35 00 S	136 34 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
45	17,0	18,4	13	3	*	*	*	7	99	3	00	0	1014,0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	17,95	36,600	26,53	5,28	103	***	***	***
1	25	17,55	36,600	26,63	5,65	109	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 19/62	17/12/62	1005 J	35 22 S	136 40 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
66	17.1	18.2	10	3	*	*	*	7	13	3	24	1	1013.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	16.75	35.840	26.24	5.44	103	***	***	***
1	25	16.51	35.820	26.28	5.55	104	***	***	***
1	50	16.22	36.180	26.62	5.12	96	***	***	***
1	65	16.22	36.180	26.62	5.12	96	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 20/62	17/12/62	1217 J	35 32 S	136 42 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
73	17.1	18.1	34	1	*	*	*	8	99	1	24	1	1013.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	16.97	35.950	26.27	5.63	107	***	***	***
1	25	16.66	35.970	26.36	5.55	105	***	***	***
1	50	15.83	35.990	26.56	5.39	100	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 21/62	17/12/62	1602 J	35 27 S	137 06 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
40	17,9	19,3	20	2	*	*	*	8	20	1	24	1	1012.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	18.08	36.560	26.46	5.37	105	***	***	***
1	25	17.90	36.560	26.51	5.36	104	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 22/62	17/12/62	1842 J	35 23 S	137 29 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
31	17,5	18,9	24	2	*	*	*	8	24	2	24	1	1012.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	17.98	36.600	26.52	5.43	106	***	***	***
1	25	17.97	36.600	26.52	5.45	106	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 23/62	17/12/62	2136 J.	35 19 S	137 54 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
35	17,6	19,1	18	1	*	*	*	8	18	1	24	1	1014.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	17,92	36,580	26,52	5,34	104	***	***	***
1	25	17,89	36,600	26,54	5,37	104	***	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
IN 1/ 24/62	18/12/62	0003 J	35 34 S	137 59 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
31	17,1	18,8	18	3	*	*	*	*	18	1	00	0	1013.0	0	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	17.89	36,600	26,54	5.38	105	***	***	***
1	25	17.89	36,600	26.54	***	***	***	***	***

OCEANOGRAPHICAL STATION LISTS

1. Hydrological and planktological observations by F.R.V. *Warreen* in south-eastern Australian waters, 1938–39
2. Hydrological and planktological observations by F.R.V. *Warreen* in south-eastern Australian waters, 1940–42
3. Hydrological and plantological obskervations by F.R.V. *Warreen* in south-western Australian waters, 1947–50
4. Onshore hydrological investigations in eastern Australia, 1942–50
5. Estuarine hydrological investigations in eastern Australia, 1940–50. Queensland: Nerang and Coomera Rivers, Moreton Bay and Brisbane River, Logan River, Dunwich Oyster Lease; New South Wales: Richmond River, Clarence River, Macleay River, Hastings River, Manning River, Port Stephens, Tilligerry Creek, Hawkesbury River
6. Estuarine hydrological investigations in eastern Australia, 1940–50. New South Wales: Middle Harbour and Port Jackson, Georges River–Botany Bay
7. Estuarine hydrological investigations in eastern Australia, 1940–50. New South Wales: Port Hacking, Lake Illawarra, Shoalhaven River, Jervis Bay, Clyde River, Moruya River, Tuross River, Wagonga Inlet; Victoria: Port Phillip; Tasmania: Tamar River, Derwent River, Huon River, D'Entrecasteaux Channel, Pittwater, Lake Dobson (freshwater), Penna Dam (freshwater)
8. Hydrological investigations in south-western Australia, 1944–50
9. Records of twenty-four hourly hydrological observations at selected stations in eastern Australian estuarine systems, 1942–50. Queensland: Logan River; New South Wales: Richmond River, Clarence River, Macleay River, Hastings River, Manning River, Port Stephens, Hawkesbury River, Georges River, Port Hacking, Clyde River, Tuross River; Tasmania: Tamar River, Derwent River
10. Records of twenty-four hourly hydrological observations at Shell Point, Georges River, New South Wales, 1942–50
11. Analyses of bottom deposits in eastern Australia, 1946–50
12. Estuarine hydrological investigations in eastern and south-western Australia, 1951
13. Analysis of bottom deposits in eastern and south-western Australia, 1951 and records of twenty-four hourly hydrological observations at selected stations in eastern Australian estuarine systems, 1951
14. Onshore hydrological investigations in eastern and south-western Australia, 1951
15. Estuarine hydrological investigations in eastern and south-western Australia, 1952
16. Analysis of bottom deposits in eastern and south-western Australia, 1952 and records of twenty-four hourly hydrological observations at selected stations in eastern Australian estuarine systems, 1952
17. Onshore hydrological investigations in eastern and south-western Australia, 1952
18. Onshore hydrological investigations in eastern and south-western Australia, 1953
19. Onshore planktological investigations in eastern Australia, 1945–54
20. Surface sampling in the Tasman Sea, 1953
21. Estuarine hydrological investigations in eastern and south-western Australia, 1953
22. Further onshore planktological investigations in eastern Australia, 1945–54
23. Planktological investigations made by F.R.V. *Derwent Hunter* in eastern Australian waters, 1952–54
24. Onshore hydrological investigations in eastern and south-western Australia, 1954
25. Surface sampling in the Tasman Sea, 1954
26. Estuarine hydrological investigations in eastern and south-western Australia, 1954
27. Onshore and oceanic hydrological investigations in eastern and south-western Australia, 1955
28. Surface sampling in the Tasman and Coral Seas, 1955
29. Estuarine hydrological investigations in eastern and south-western Australia, 1955
30. Onshore and oceanic hydrological investigations in eastern and south-western Australia, 1956
31. Surface sampling in the Tasman and Coral Seas and the south-eastern Indian Ocean, 1956
32. Estuarine hydrological investigations in eastern and south-western Australia, 1956
33. Coastal hydrological investigations in eastern and south-western Australia, 1957
34. Coastal hydrological investigations at Port Hacking, New South Wales, 1957
35. Coastal hydrological investigations at Eden, New South Wales, 1957

OCEANOGRAPHICAL STATION LISTS

(Continued)

36. Surface sampling in the Tasman and Coral Seas, 1957
37. Hydrological investigations from F.R.V. *Derwent Hunter*, 1957
38. Coastal hydrological investigations in the New South Wales tuna fishing area, 1958
39. Surface sampling in the Coral and Tasman Seas, 1958
40. Coastal hydrological investigations in south-eastern Australia, 1958
41. Oceanic investigations in eastern Australian waters, F.R.V. *Derwent Hunter*, 1958
42. Coastal investigations at Port Hacking, New South Wales, 1958
43. Oceanic investigations in eastern Australia, H.M.A. Ships *Queenborough*, *Quickmatch*, and *Warrego*, 1958
44. Oceanic observations in Antarctic waters, M.V. *Magga Dan*, 1959
45. Coastal hydrological investigations in eastern Australia, 1959
46. Coastal hydrological investigations in the New South Wales tuna fishing area, 1959
47. Coastal investigations at Port Hacking, New South Wales, 1959
48. Oceanic investigations in eastern Australian waters, F.R.V. *Derwent Hunter*, 1959
49. Coastal hydrological sampling Rottnest Island, W.A., and Port Moresby, Papua, during the I.G.Y. (1957–58), and surface sampling in the Tasman and Coral Seas, 1959
50. Surface sampling in the Coral and Tasman Seas, 1960
51. Coastal hydrological investigations in eastern Australia, 1960
52. Coastal investigations at Port Hacking, New South Wales, 1960
53. Coastal hydrological investigations in the New South Wales tuna fishing area, 1960
54. Investigations by F.R.V. *Derwent Hunter* on the eastern Australian tuna grounds in 1961
55. Investigations by F.R.V. *Weerutta* on the South Australian tuna grounds in 1961
56. Investigations by F.R.V. *Marelda* on the eastern Australian tuna grounds in 1961
57. Investigations by F.V. *Estelle Star* in Western Australian waters in 1961
58. Temperature observations from Australian tuna fishing vessels in 1961
59. Investigations by F.R.V. *Derwent Hunter* on the eastern Australian tuna grounds in 1962
60. Investigations by F.R.V. *Investigator* on the South Australian tuna grounds in 1962