

CSIRO

DIVISION OF FISHERIES

CRUISE REPORT

SS2/92

**HOBART TO HOBART
26 MAY – 18 JUNE 1992**

**FRV
*SOUTHERN
SURVEYOR***



Itinerary

- Leg 1** Departed Hobart: 1000 h Tuesday, 26 May 1992
 Arrived Hobart: 2200 h Monday, 2 June 1992
- Leg 2** Departed Hobart: 1700 h Tuesday, 3 June 1992
 Arrived Hobart: 1000 h Thursday, 18 June 1992

Area of operation

- Leg 1** Oceanic waters off the east coast of Tasmania within latitudes 42° and 44° S and longitudes 148° and 150° E (see Figure 1).
- Leg 2** Oceanic and shelf waters off eastern Tasmania in the area of the Japanese longline fishery and the Hippolyte Rocks (see Figure 2).

Cruise objectives

Leg 1

Since 1973, Pazminco Metals — Electrolytic Zinc Pty Ltd (EZ) has, under licence from the Commonwealth Government, been continually dumping jarosite waste at a deepwater (2000 m) station southeast of Storm Bay, Tasmania. In response to concern over the effects of this dumping on the local environment, EZ contracted CSIRO to make a preliminary investigation of the physical and biological structure of the waters of the dumpsite. Leg 1 of this cruise was the first part of this study. The objectives of the first leg of the cruise were to describe in detail the physical oceanography of the waters of and around the dumpsite (latitude 43°30'S, longitude 148°13'E) and to collect samples of midwater and benthic fishes to determine the presence, if any, of heavy metal concentration in the food chain of the area. The specific objectives were to:

1. Describe the physical oceanography of the waters in and around the EZ jarosite dumpsite through CTD transects; measure the zooplankton biomass and chlorophyll *a*.
2. Collect midwater and benthic fishes from the dumpsite and from waters to the north and east for future heavy metal analysis.
3. Determine the species composition and day/night vertical distribution of the midwater fish fauna of the dumpsite from stratified midwater trawls.
4. Determine the day/night vertical distribution and species composition of the zooplankton of the dumpsite.

Leg 2

Leg 2 of the cruise studied the physical and biological structure of the waters of the southern bluefin tuna (*Thunnus maccoyii*) fishing grounds off eastern Tasmania. Although this study focused mainly on the fishing grounds of the Japanese offshore longline fishery, sampling was also carried out around the Hippolyte Rocks area which is the focus of a small but lucrative southern bluefin tuna troll fishery. The aim was to quantify the biological productivity on fine and broad scales in these areas to further our understanding of the factors affecting aggregations and growth of southern bluefin tuna. The specific objectives were to:

- 1 Make preliminary investigations of the physical oceanography around the Hippolyte Rocks area off eastern Tasmania.
- 2 Determine the species composition of the midwater fauna around the Hippolytes.
- 3 Determine the species composition of the major zooplankton taxa around the Hippolytes.
- 4 Map the physical oceanography of the area east of Tasmania in which the Japanese longline fishery is located.
- 5 Make preliminary investigations of the biological production in these waters in relation to the position of the longline fleet, using micronekton and zooplankton trawls.
- 6 Liaise with inshore fishermen and Australian Fishing Zone longline observers to collect tuna stomachs for comparisons of gut contents with those from net captures.

A secondary objective of both legs was to deploy satellite drifter buoys to investigate long-term movements of ocean currents in the area (on behalf of Dr G. Cresswell, CSIRO Division of Oceanography).

Results

Leg 1

All objectives were met during the first leg of the cruise.

- 1 Three transects, one to the north, the second through the dumpsite and the third eastward of the dumpsite were completed (Fig. 1). To examine the vertical structure of the water column, CTD casts were made on each of these transects at between 6 and 10 m intervals to a depth of 1000 m. During night time the EZ plankton net system and midwater opening-closing (IYGPT) trawl were used to sample the fauna within discrete depth intervals.
- 2 Midwater fishes and crustacea were collected from the dumpsite and from control sites to the north and east, for heavy metal analysis. The demersal trawl (Engel High Rise trawl) was used along the 1000 m contour inshore of the dumpsite to collect orange roughy (*Hoplostethus atlanticus*) for heavy-metal analysis.
- 3 The trawl collections will be sorted and identified at a later date to determine species composition and day/night vertical distribution of the main zooplankton and midwater fishes associated with the dumpsite.
- 4 Three satellite buoys were deployed on the shelf at 42° 30' S to help further our understanding of the nearshore current processes in the area.

Leg 2

All objectives were met during the second leg of the cruise.

- 1 The physical structure and biological composition of the waters around the Hippolyte Rocks were studied in a series of short longshore and cross-shelf transects. A fourth satellite drifter buoy was released.
- 2 Transects were completed along 41°, 41°30' and 42° S between the shelf break and 150° E to map the physical structure and biological production of the tuna longline fishing grounds (Fig. 2). With the addition of the coverage gained on the first leg, we are confident of building a large-scale picture of the physical and biological structure of the waters of eastern Tasmania.
- 3 A detailed examination of a temperature front between warm tropical water and colder southern water (Fig. 2) was made to test the hypothesis that fronts are sources of nutrient enrichment via upwelling and therefore areas where tuna might aggregate.

Cruise Narrative

Leg 1

Southern Surveyor departed Hobart at 1000 h 26 May 1992, and on clearing Storm Bay, headed north along the 100 m contour to 42° 30'S to begin the first transect.

Satellite buoys were deployed at the 100 m contour, mid-shelf and shelf break. We then began a series of CTD stations to a depth of 1000 m spaced 6 nm apart across the warm East Australia Current filament. The transect was continued over the next three days, in which time we also made a number of trawls with the IYGPT and EZ nets. Both nets worked well and the use of the opening-closing cod end enabled the collection of discreet samples from depth strata between the surface and 400 m. From these and subsequent trawls, samples were collected for heavy-metal analysis.

Once this transect was completed, we began the SW transect through the dumpsite. The strategy of CTDs during the day and trawling with both nets at night was continued.

On 30 May, we arrived at the dumpsite and began a 24 h study of the vertical distribution of plankton and micronekton in the upper 400 m of water. On the following day, with the 24 h study completed, we made two demersal trawls in 1000 m of water for orange roughy (*Hoplostethus atlanticus*). Although the gear hooked up no damage occurred to the net and enough fish were collected for the heavy metal analysis. On the third transect due east of the dumpsite, we followed a similar pattern to that on the previous transects. Once completed, the vessel steamed westward to make further trawls along the transect. However, the weather conditions deteriorated so that we were unable to trawl or do any further work. As all objectives had been met, we headed for Hobart, where we arrived at the wharf at 2200 h on Tuesday 2 June 1992.

Leg 2

Southern Surveyor left Hobart at 1700 h on 3 June and arrived at the Hippolyte Rocks at 2200 h, and began a survey of the physical oceanography and fish and zooplankton of the area. The hydrography of the area was examined with a long-shore CTD transect between the Hippolytes and Schouten Island and two cross-shelf transects—one in front of the Hippolytes and the other level with Maria Island. A satellite buoy was deployed. EZ and IYGPT tows were made at night to sample plankton and micronekton. On this leg the EZ net was deployed with five 1000 µm mesh nets, interspersed with the five 333 µm nets already in use on the first leg as there was some suspicion that the smaller-meshed nets were not fishing properly.

The broad-scale survey of the oceanographic features of the tuna longline fishing grounds of the east coast of Tasmania began on Saturday 6 June. Three transects were completed: at 42°S, 41°S and 41°30'S. These transects followed much the same sampling format as on the first leg, with trawling confined to night time and CTDs to the daytime. By Monday 8 June the second transect was completed and we steamed to St Helens Point where we exchanged pylons for the CTD.

The vessel then headed east on 41° 30'S to the edge of the front between relatively warm East Australian Current water (15–16° C) and cooler subantarctic waters (13–14°C) to begin the fine-scale work (Fig. 2). The position of the front was mapped using surface temperatures, seacat profiles and CTD casts. Surface nutrients across the front were mapped with the underway nutrient analyser. The weather was deteriorating, but we were able to make a detailed survey of the front between these two water masses.

Over the next couple of days work was hampered by increasingly rough weather. Three trawls were completed on the cold side of the front. The timer on the IYGPT trawl, which had been unworkable for most of the second leg, was repaired with parts delivered during the equipment exchange at St Helens.

On Thursday 11 June we took on board Mr John Aoki (Australian Fisheries Zone observer) to help us avoid the many longlines set in our study areas—there were forty-eight Japanese longliners working off eastern Tasmania at this time.

Trawling and mapping continued until Friday evening when winds gusted to 60 knots. Rising seas stopped any further work and the vessel steamed to shelter in the lee of Maria Island.

On Sunday 14 June we returned to the fine-scale study area to begin the second study. This site was along the same front but slightly to the south. A series of CTD transects was completed across the front during daylight hours. At night, midwater and plankton trawls were deployed on both sides of the front. Sampling around the front continued until the morning of Wednesday 17 June.

On completion of this work *Southern Surveyor* steamed back to the Hippolytes, where we completed CTD stations around the perimeter of the rocks. After some night-time trawling in the area we steamed for Hobart, arriving at the wharf at 1000 h on 18 June 1992.

Summary

On the first leg, oceanographic and nutrient data were collected on three broad transects in the vicinity of the dumpsite. These data will be used in a model of the hydrography of the area to predict the likely transport paths of jarosite waste. Midwater and demersal fishes collected during the study will be used to determine the likelihood of heavy-metal contamination of fish in the area.

On the second leg a survey of the broad-scale oceanographic features of the tuna longline fishing grounds was made. Midwater fish and plankton collected on leg 2 of the cruise will indicate whether particular oceanographic features and water masses in the study area can be characterised by their constituent zooplankton and midwater fauna and by differing levels of biological production or both. A fine-scale study was made of the front between cold subantarctic and warm East Australia Current waters to assess whether this is an area of increased productivity in the region.

Reporting of results

A summary of the second leg of this cruise was given at the Inaugural Southern Bluefin Tuna Workshop run by the CSIRO Division of Fisheries Pelagic Resources Program in Port Lincoln, South Australia, immediately after the cruise. Full scientific findings will be reported in the scientific literature, and findings relevant to the fishing industry will be published in the industry literature.

Personnel

(Note: unless indicated otherwise, all personnel are staff of the CSIRO Division of Fisheries.)

Leg 1

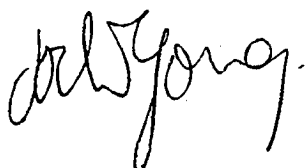
Mr Jock Young (Cruise leader)
 Dr Clive Stanley (Night-watch leader)
 Dr Vincent Lyne
 Mr Dave Wright
 Mr Thor Carter
 Mr Garry Critchley
 Mr Bob Griffiths
 Mr Mark Lewis
 Mr Jeff Cordell
 Mr David Mitchell (Pazminco EZ)
 Mr Keith Saunders

Leg 2

Mr Jock Young (Cruise leader)
 Dr Clive Stanley (Night-watch leader)
 Dr Vincent Lyne
 Dr Tim Davis
 Mr David Wright
 Mr Thor Carter
 Mr Gary Critchley
 Mr Bob Griffiths
 Ms Naomi Clear
 Mr Matt Sherlock
 Mr John Aoki (AFZ Observer program)
 (11–18 June)

Acknowledgements

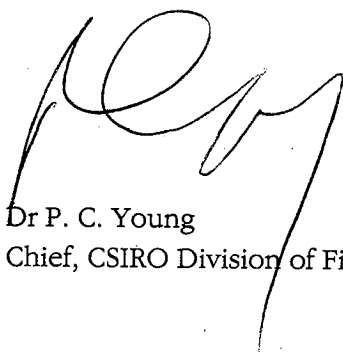
We thank the skipper Captain J. London, fishing master R. Pepper and crew of FRV *Southern Surveyor* for their effort and enthusiasm during this cruise. We also thank the AFZ observer program, in particular M. Baron and Mr John Aoki, for their constant communications, which enabled us to avoid Japanese longlines set in the study area.



Mr Jock Young
Cruise Leader
Principal Investigator



Dr Vincent Lyne
Principal Investigator



Dr P. C. Young
Chief, CSIRO Division of Fisheries

Date: 25/1/93

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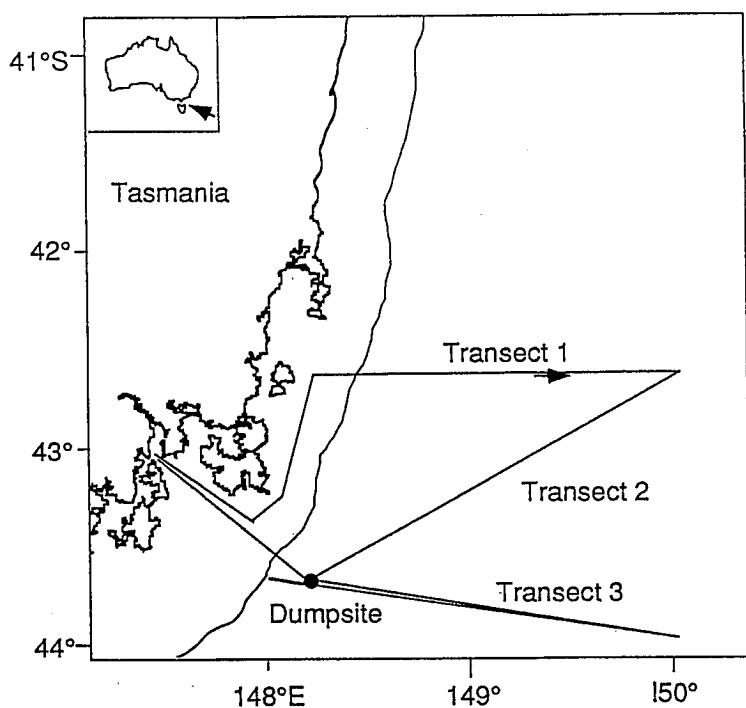


Figure 1. Cruise track of SS2/92 Leg 1

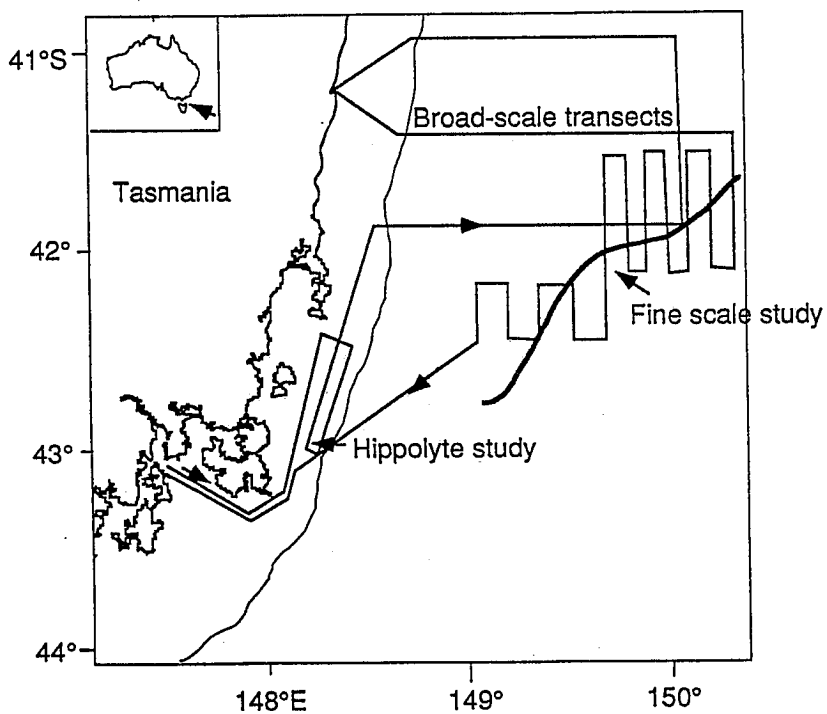


Figure 2. Cruise track of SS2/92 Leg 2. The heavy line represents the approximate position of the front between waters of tropical origin to the north and subantarctic waters to the south.

Cruise report SS2/92

Appendix 1

Table 1. Stations occupied during Cruise SS2/92. Stations 1–53 were completed on Leg 1, with the remainder completed on Leg 2.

CTD = conductivity–temperature–depth sampler; IYGPT = fine-meshed midwater trawl;

EZ net = multiple opening–closing plankton net; Seacat = hydrographic sampler

	Station	Date	Time	Latitude °S	Longitude °E	Activity
Leg 1	1	26/5	10:40	42.30.0	148.32.6	CTD
	2	26/5	13:55	42.29.7	148.38.8	CTD
	3	26/5	17:10	42.30.0	148.43.0	ITYGPT
	4	26/5	19:15	42.30.0	148.46.5	CTD
	5	26/5	22:00	42.29.0	148.55.1	CTD
	6	27/5	00:45	42.30.0	149.16.0	CTD
	7	27/5	08:00	42.30.0	149.16.0	CTD
	8	27/5	10:10	42.31.0	149.17.5	ITYGPT
	9	27/5	13:50	42.32.3	149.17.5	EZ NET
	10	27/5	17:15	42.29.5	149.17.8	ITYGPT
	11	27/5	20:30	42.32.9	149.30.1	CTD
	12	27/5	23:30	42.34.0	149.36.1	CTD
	13	28/5	01:40	42.36.8	149.50.0	CTD
	14	28/5	04:53	42.40.7	150.09.8	CTD
	15	28/5	08:10	42.46.1	150.00.0	CTD
	16	28/5	12:00	42.45.2	149.58.0	ITYGPT
	17	28/5	15:20	42.48.8	149.53.4	ITYGPT
	18	28/5	17:40	42.43.2	150.00.0	EZ NET
	19	28/5	20:15	42.51.8	149.47.8	CTD
	20	28/5	22:28	42.58.0	149.37.1	CTD
	21	29/5	00:48	43.02.5	149.24.7	CTD
	22	29/5	03:05	43.08.5	149.13.5	CTD
	23	29/5	05:45	43.13.9	149.00.7	CTD
	24	29/5	08:15	43.20.4	148.58.7	CTD
	25	29/5	09:50	43.21.6	148.48.3	EZ NET
	26	29/5	13:35	43.16.8	148.50.9	ITYGPT
	27	29/5	16:10	43.25.1	148.38.4	SEACAT
	28	29/5	17:10	43.28.0	148.33.1	CTD
	29	29/5	19:15	43.13.1	148.26.0	SEACAT
	30	29/5	22:00	43.38.8	148.13.3	ITYGPT
	31	30/5	00:40	43.37.8	148.13.3	EZ NET
	32	30/5	03:10	43.42.8	148.10.2	EZ NET

Cruise report SS2/92

Station	Date	Time	Latitude °S	Longitude °E	Activity
33	30/5	05:30	43.37.4	148.11.8	IYGPT
34	30/5	08:20	43.36.8	148.14.1	EZ NET
35	30/5	10:00	43.37.5	148.14.5	IYGPT
36	30/5	12:25	43.32.1	148.18.0	EZ NET
37	30/5	15:00	43.39.3	148.13.0	IYGPT
38	30/5	17:20	43.36.0	148.15.8	EZ NET
39	30/5	20:00	43.37.3	148.14.0	CTD
40	31/5	02:00	43.32.9	148.03.2	DEMERSAL TRAWL
41	31/5	03:40	43.32.4	148.06.1	SEACAT
42	31/5	05:45	43.33.7	148.02.9	DEMERSAL TRAWL
43	31/5	09:10	43.37.8	148.14.2	CTD
44	31/5	11:50	43.38.9	148.28.1	CTD
45	31/5	12:30	43.42.2	148.41.0	CTD
46	31/5	17:45	43.44.0	148.55.9	CTD
47	31/5	20:30	43.46.9	149.08.1	CTD
48	31/5	23:06	43.48.9	149.21.2	CTD
49	01/6	01:34	43.52.2	149.34.9	CTD
50	01/6	04:20	43.53.9	149.48.0	CTD
51	01/6	06:40	43.56.2	150.02.1	CTD
52	01/6	09:10	43.53.5	150.03.0	EZ NET
53	01/6	11:50	43.58.3	150.00.6	IYGPT

Leg 2

54	03/6	12:41	43.09.1	148.09.5	CTD
55	03/5	14:45	42.53.0	148.07.8	CTD
56	03/6	16:08	42.53.0	148.07.8	CTD
57	03/6	18:06	42.41.0	148.13.2	CTD
58	03/6	19:55	42.31.1	148.17.9	CTD
59	03/6	21:58	42.21.6	148.22.2	CTD
60	04/6	00:04	42.27.5	148.26.6	CTD
61	04/6	01:53	42.36.6	148.22.8	CTD
62	04/6	04:17	42.49.4	148.17.0	CTD
63	04/6	05:38	42.59.3	148.12.8	CTD
64	04/6	07:11	43.07.9	148.09.9	CTD
65	04/6	09:22	43.09.1	148.05.5	EZ NET
66	04/6	12.:21	43.06.2	148.06.5	EZ NET
67	04/6	17:14	43.09.5	148.06.4	IYGPT
68	04/6	18:38	43.08.2	148.06.5	IYGPT
69	04/6	19:57	43.07.5	148.05.3	CTD

Cruise report SS2/92



Station	Date	Time	Latitude °S	Longitude °E	Activity
70	04/6	21:19	43.07.2	148.07.8	SEACAT
71	04/6	22:22	43.07.5	148.10.1	SEACAT
72	04/6	22:51	43.07.5	148.12.9	CTD
73	05/6	00:16	43.07.4	148.17.3	CTD
74	05/6	02:09	43.07.4	148.24.0	CTD
75	05/6	04:51	42.59.8	148.10.2	SEACAT
76	05/6	06:44	42.45.0	148.28.0	CTD
77	05/6	08:35	42.44.9	148.22.1	CTD
78	05/6	09:40	42.44.6	148.24.2	IYGPT
79	05/7	12:31	42.42.9	148.13.1	IYGPT
80	05/6	14:04	42.43.0	148.13.1	EZ NET
81	05/6	17:03	42.42.8	148.13.0	EZ NET
82	05/6	23:09	41.59.8	148.35.9	CTD
83	06/6	00:58	41.59.9	148.49.1	SEACAT
84	06/6	02:31	42.00.1	149.01.4	CTD
85	06/6	04:45	42.00.2	149.16.6	SEACAT
86	06/6	05:44	42.00.0	149.29.5	CTD
87	06/6	07:46	41.59.8	149.42.8	SEACAT
88	06/6	08:46	41.49.8	149.56.2	CTD
89	06/6	10:34	41.59.9	150.08.7	SEACAT
90	06/6	10:52	41.59.4	150.09.0	EZ NET
91	06/6	13:33	41.37.3	150.08.2	IYGPT
92	06/6	15:50	41.36.2	150.07.8	CTD
93	06/6	17:02	41.32.8	150.07.9	IYGPT
94	06/6	19:27	41.21.2	150.07.9	ABORTED
95	06/6	20:07	41.14.6	150.08.2	EZ NET
96	06/6	22:40	40.59.5	150.08.3	CTD
97	07/6	00:58	40.59.7	149.60.0	SEACAT
98	07/6	01:34	41.00.0	149.53.4	SEACAT
99	07/6	02:21	41.00.0	149.46.1	CTD
100	07/6	04:07	41.00.1	149.39.0	SEACAT
101	07/6	04:52	41.00.1	149.31.8	IYGPT
102	07/6	06:01	40.59.3	149.31.2	EZ NETS
103	07/6	09:02	40.53.0	149.30.6	IYGPT
104	07/6	12:34	41.03.7	149.32.3	ABORTED
105	07/6	13:27	41.00.9	149.34.2	EZ NET
106	07/6	15:56	40.55.5	149.33.4	IYGPT
107	07/6	18:30	41.00.1	149.24.4	SEACAT
108	07/6	10:20	41.00.1	149.16.8	CTD

Station	Date	Time	Latitude °S	Longitude °E	Activity
109	07/6	21:10	40.59.9	149.10.1	SEACAT
110	07/6	22:16	41.00.0	149.03.1	SEACAT
111	07/6	23:06	41.00.1	148.54.9	CTD
112	08/6	00:36	41.00.1	148.48.5	SEACAT
113	08/6	01:20	40.59.8	148.41.5	CTD
114	08/6	06:14	41.29.9	148.36.2	SEACAT
115	08/6	07:20	41.30.1	148.49.0	SEACAT
116	08/6	08:31	41.30.1	148.49.0	SEACAT
117	08/6	09:32	41.30.1	149.15.8	SEACAT
118	08/6	10:33	41.29.9	149.28.8	SEACAT
119	08/6	11:32	41.30.0	149.41.9	SEACAT
120	08/6	12:42	41.30.0	149.54.6	SEACAT
121	08/6	13:53	41.29.8	150.08.1	SEACAT
122	08/6	14:58	41.29.9	150.22.1	SEACAT
123	08/6	16:17	41.29.9	150.22.1	SEACAT
124	08/6	17:41	41.40.1	150.35.2	SEACAT
125	08/6	18:58	41.50.2	150.35.2	SEACAT
126	08/6	20:14	42.00.0	150.34.6	SEACAT
127	08/6	21:29	42.10.1	150.34.6	SEACAT
128	08/6	22:43	42.20.1	150.35.0	SEACAT
129	08/6	23:49	42.15.0	150.28.1	SEACAT
130	09/6	01:07	42.04.9	150.28.1	SEACAT
131	09/6	02:32	41.54.7	150.28.2	SEACAT
132	09/6	03:48	41.44.7	150.28.2	SEACAT
133	09/6	05:51	41.44.7	150.27.7	SEACAT
134	09/6	07:12	41.49.9	15.21.0	SEACAT
135	09/6	08:31	42.00.0	150.20.9	SEACAT
136	09/6	09:38	42.10.3	150.21.1	CTD
137	09/6	11:49	42.04.7	150.14.1	CTD
138	09/6	13:34	41.55.3	150.14.2	CTD
139	10/6	00:00	41.45.0	150.14.1	CTD
140	10/6	04:38	41.49.9	150.06.3	CTD
141	10/6	05:57	41.59.9	150.06.9	CTD
142	10/6	07:20	42.10.1	150.06.5	CTD
143	10/6	08:54	42.20.7	150.07.2	CTD
144	10/6	10:25	42.18.4	150.10.7	IYGPT
145	11/6	12:18	42.09.5	150.08.2	IYGPT
146	11/6	16:26	42.04.5	150.15.0	IYGPT
147	11/6	21:51	42.02.7	150.17.1	CTD

Station	Date	Time	Latitude °S	Longitude °E	Activity
148	14/6	02:09	42.40.1	149.00.7	CTD
149	14/6	03:57	42.34.9	149.00.2	CTD
150	14/6	05:48	42.25.0	149.00.3	CTD
151	14/6	06:54	42.14.8	149.00.1	CTD
152	14/6	08:31	42.05.1	149.00.4	CTD
153	14/6	09:56	42.09.0	149.06.4	IYGPT
154	14/6	11:45	42.04.7	149.12.0	IGYPT
155	14/6	15:25	42.11.4	149.09.4	IGYPT
156	15/6	00:14	42.05.0	149.12.3	IGYPT
157	15/6	01:42	42.30.6	149.15.0	CTD
158	15/6	03:30	42.18.6	149.15.0	CTD
159	15/6	04:51	42.08.8	149.15.1	CT
160	15/6	06:20	42.09.8	149.30.6	CTD
161	15/6	08:14	42.19.5	149.30.6	CTD
162	15/6	09:47	42.28.6	149.29.9	CTD
163	15/6	11:06	42.32.5	149.30.3	EZ NET
164	15/6	14:08	42.41.7	149.29.9	EZ NET
165	15/6	17:08	42.38.5	149.29.1	IGYPT
166	15/6	20:20	42.39.9	149.40.2	CTD
167	15/6	22:15	42.29.9	149.40.3	CTD
168	16/6	00:01	42.19.8	149.40.2	CTD
169	16/6	01:18	42.10.2	149.40.8	CTD
170	16/6	02:35	41.59.8	149.40.3	CTD
171	16/6	04:01	42.00.3	149.50.2	CTD
172	16/6	05:06	41.59.9	150.00.2	CTD
173	16/6	06:11	41.59.2	150.12.4	CTD
174	16/6	07:31	42.00.0	150.19.8	CTD
175	16/6	10:21	41.57.8	150.00.2	EZ NET
176	16/6	13:13	41.52.0	149.47.2	EZ NET
177	16/6	18:33	42.30.6	149.44.7	IYGPT
178	17/6	04:17	43.05.9	148.06.5	CTD
179	17/6	05:04	43.07.0	148.03.3	CTD
180	17/6	05:59	43.07.4	148.01.8	CTD
181	17/6	06:46	43.07.7	148.01.8	CTD
182	17/6	07:51	43.05.1	148.05.1	IGYPT