CRUISE SUMMARY

Tasmania - coastal, shelf and slope currents.

RV FRANKLIN

CRUISE FR 03/97

Sail: Hobart, TAS 1000 hours Wednesday 19 March, 1997
Dock: Hobart, TAS 0830 hours Thursday, 27 March, 1997

PRINCIPAL INVESTIGATOR

Dr George Cresswell

CSIRO Division of Marine Research

RESEARCH VOYAGE FR 3/97 - SUMMARY

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ITINERARY

Dep HOBART 1000h 19 March 1997
Arr HOBART 0830h 27 March 1997

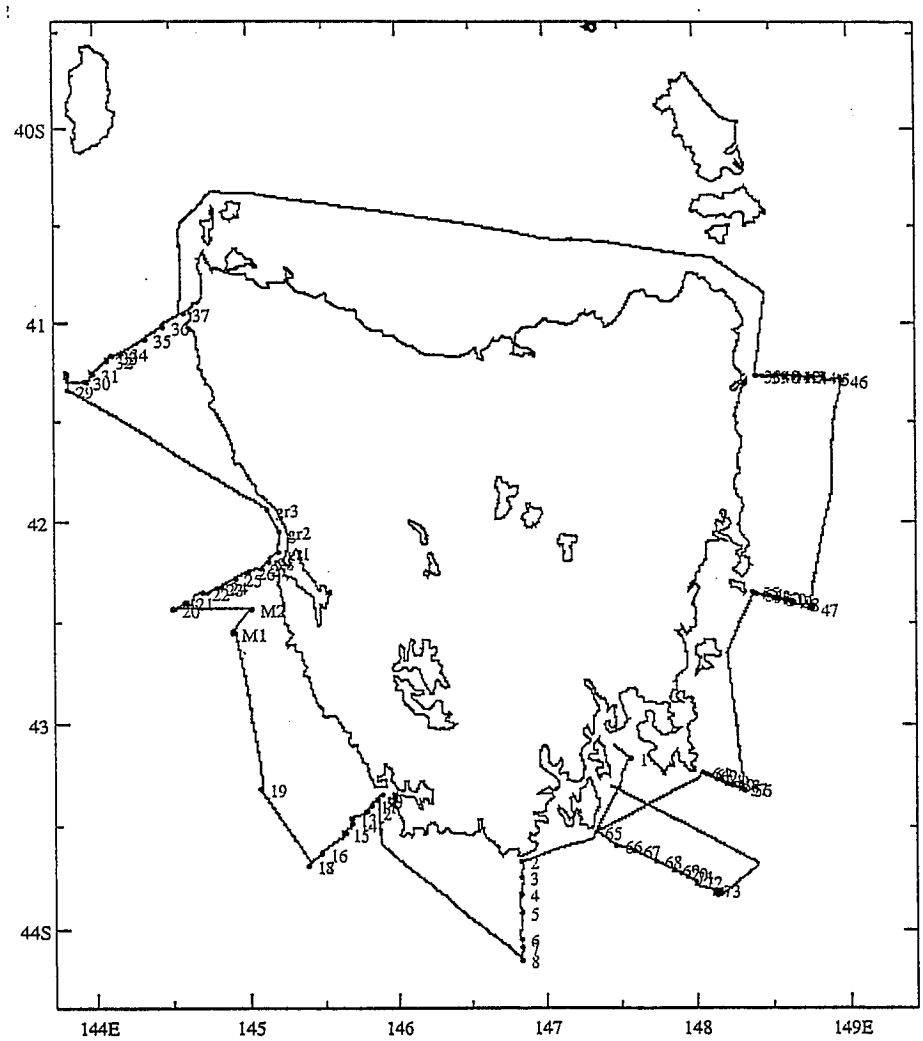


Figure 1 The ship's track

INTRODUCTION

The aim of this voyage around Tasmania, the first of two in 1997, was to study the interplay of coastal, shelf and slope currents, thereby extending our understanding of the patterns of movement that have emerged from satellite drifter and imagery studies since the early 1990s. An accompanying aim was to collect zooplankton and to relate the catches to the physical data.

The components of the voyage included:

- Eight transects from nearshore to the 2000 m isobath, generally with 9 CTD/rosette stations and plankton hauls.
- The installation of 2 moorings (near-bottom ADCPs) at the 100 and 200 m isobaths southwest from Macquarie Harbour. The moorings lie on a ground track for the Topex/Poseidon satellite.
- Sediment samples at nearshore stations off Port Davey, Macquarie Harbour, Henty River and Trial harbour for the Tasmanian Department of Environment and Land Management.
- Tests of the "Aquashuttle" towed vehicle.

The usual underway instruments measured weather conditions, depth, current profiles (ADCP) and surface temperature and salinity.

SCIENTIFIC PARTY

George Cresswell	Chief Scientist	CSIRO DMR
Erik Madsen	Electronics	CSIRO DMR
Lindsay Pender	Computing	CSIRO DMR
Mark Rayner	Chemistry	CSIRO DMR
Rebecca Deed	Chemistry	CSIRO DMR
Kevin Miller	Moorings	CSIRO DMR
Dan McLaughlin	Moorings	CSIRO DMR
Russell Bradford	Plankton	CSIRO DMR
David Terhell	Chem/computing	CSIRO DMR
Jan Peterson	Computing	CSIRO DMR
Valentin Trifonov		NIMH, Bulgarian Academy of Sciences
Zaharuddin bin Maiden		Royal Malaysian Navy

SHIP'S OFFICERS AND CREW

Master	Dick Dougal
1st Mate	Ian Menzies
2nd Mate	Wendy Doran
C/Eng	Syd Allen
1/Eng	Dave Jonker
Elec/Eng	Donald Roberts
Bosun	Jannik Hansen
AB	James Carson
AB	Norm Marsh
AB	Gerry O'Halloran
Greaser	Derek Farrell
Chief Cook	Garry Hall
2nd Cook	Peter Dux
Chief Stwd	Dianne Kelly

NARRATIVE

We use Australian eastern summer time (Greenwich plus 11 hours) in the narrative.

The ship sailed from Hobart in pleasant conditions at 1000 on Wednesday 19 March and after a muster and talks by the Master and Chief Scientist the first CTD station was occupied in Storm Bay.

The inshore end of the Southeast Cape transect was reached at sunset. Numerous birds, dolphins and seals were active. There was a preponderance of krill in the net sample. Stations 2-8 were occupied out to the 1000 m isobath. The transect was completed at 0200 Thursday 20 March. There were problems with the recently upgraded ADCP on the ship. These were resolved with help from Jeff Dunn at the CSIRO Marine Labs.

The inshore end of the Port Davey transect was reached at 1100. After a fire drill and a bottom sediment grab (it was sand) we occupied stations 9-18 out to the 2000 m isobath, which we reached at about 0200 Friday 21 March. At 0400, en route to the mooring sites SW of Macquarie Harbour, we carried out a leak test on the Niskin bottles (stn 19) by lowerng the CTD/rosette to the Antarctic Intermediate salinity minimum near 1000 m depth and triggering all bottles.

The two moorings were installed at the 100 and 200 m isobaths without incident before midday. These lie along the track of the Topex/Poseidon satellite that measures sea surface elevation for inferring ocean currents.

The 9 stations (20-28) of the Cape Sorrell transect from the 2000 m isobath inwards were occupied from late afternoon through until 0130 on Saturday 22 March. Bottom grabs were then taken at about the 50 m isobath out from Macquarie Harbour, Henty River and Trial Harbour. The sand in the grabs became progressively coarser and more and more like river sand.

Early in the afternoon we started the Marawah transect with 9 stations (29-37) from the 2000 m isobath in to near the coast. The towed undulating body, 'Aquashuttle', was given a 1-hour test between stations 29 and 30. The transect was completed very early on the morning of Sunday 23 March and the ship proceeded northward to enter western Bass Strait. 'Aquashuttle' was towed from 1130-1630 "flying" over the depth range 5-40 m. It appeared to function properly and it collected data on T, S, pressure, and fluorescence, as well as on pitch, roll and yaw. The was one breakdown in the data collection.

It is worth emphasizing that seabirds were abundant all along southern and western Tasmania. However, in Bass Strait there seemed to be few or none until Banks Strait was reached.

Franklin arrived at the inshore end of the St Helens transect at 0030 on Monday 24 March. The 9 stations (38-46) out to the 2000 m isobath were completed by 1230. Weather conditions continued to be ideal.

The ship reached the outer end of the Schouten Island transect at 1900, having had a line squall pass over at 1840. The stations (47-55) were completed by 0630 Tuesday 25 March. The wind was fresh from the south overnight and this appeared to set up a northward current at this transect and south as far as the subsequent Cape Pillar transect.

The Cape Pillar transect (stations 56-64) was occupied from midday through til 2300. The weather conditions were particularly favourable.

We arrived at the inshore end of the Bruny transect (stations 65-73) at 0400 Wednesday 26 March and completed the 2000 m station at 1500. A series of casts (74-76) was then carried out with a view to calibrating and better understanding the CTD oxygen sensor.

At 1800 the main engine was declutched and then closed down in an attempt to determine if it was vibration that was causing the poor signal to noise ratio in the new auto analyser. These tests did not enable Mark Rayner to identify the primary source of the noise, but it did reveal that the very large ocean swell was, in some way, influencing the instrument, with each packet of swells being clearly evident on the record.

We then deployed Aquashuttle for further tests, travelling NE for a couple of hours and then NW to Adventure Bay and then on to Hobart. The pilot was picked up at 0800 and the ship docked at 0830.

PRELIMINARY RESULTS

Western and southern Tasmania
(Southeast Cape — Marawah sections)

The ADCP measurements (Figure 2) for the bin at 15 m show southward and onshore flow on the Marawah transect, and on the transit between Cape Sorrell and Marawah. The current was also southward along the Cape Sorrell transect and between there and the Port Davey transect, along which the current vectors are quite weak. We hope to recover the ADCP measurements made from Hobart-Southeast Cape-Port Davey with post-voyage processing. The instrument had only just been returned from upgrading in the USA and initially had inappropriate switch settings.

The temperature sections (Figure 3a) show a mixed layer >16°C down to 50 m to extend all along the Marawah transect. On both the Cape Sorrell and Port Davey sections the warmest upper waters extend from nearshore to the outer shelf or upper continental slope.

Figure 3b shows the Marawah mixed layer to have salinity >35.0 and for a high salinity extension from the seasonal thermocline at Marawah to extend southward along the middle to outer shelf past Cape Sorrell and on to Port Davey. The low salinity surface outflow from Macquarie Harbour extended 15 km out from Cape Sorrell to midshelf. Of interest, from the point of view of satellite remote sensing, the plume had no temperature signature.

The Southeast Cape temperature and salinity sections show a salty wedge at and above the thermocline intruding shoreward across the shelf and apparently sinking beneath the fresher waters there. This wedge probably contains some water from the East Australian Current that has made its summer excursion to southern Tasmania.

Bass Strait

No CTD stations were occupied in Bass Strait. The ADCP and other underway instruments were operated, and Aquashuttle was towed for 5 hours eastward from the centreline of the strait (theAquashuttle test is discussed later). The currents measured northward from the Marawah transect seem too strong to be other than an ebb tide. Once in the strait the eastward flow there suggests a flood tide, since the strait floods from both the east and the west. There was a westward flood tide in Banks Strait that was over 1.5 knots.

Eastern and southeastern Tasmania
(St Helens to Bruny Island sections)

All four sections (Figures 4a,b)showed evidence for East Australian Current water, which we identify as being >16°C and >35.2. The current speeds, however, were quite small and not southward as we would have expected, except at the outer end of the

Bruny transect (Figure 2). The northward currents from Schouten to Cape Pillar may have been due to forcing from a fresh southerly wind overnight 24/25 March.

Salinities on the inner shelf on the Bruny transect were low (<34.8) and these waters appeared to extend northward to the Cape Pillar transect, where they were subsurface.

Discussion

In comparing the western and eastern sections we note that the thermocline was stronger and shallower in the west (the depth of the 12°C isotherm is a good indicator of this). Whether or not this was a factor in the higher abundance of sea life and seabirds in the west may be an interesting question.

The post-cruise interpretation of the data will be assisted by satellite infrared images and a careful examination of the subsurface currents measured with the ADCP, as well as by calculating the geostrophic currents.

The Aquashuttle tests

Lindsay Pender gave this device three tests, one for an hour at the outer end of the Marawah transect; one for 5 hours eastward from the centreline of Bass Strait; and one out from Storm Bay. Lindsay has prepared a full report and operating instuctions, but these will not be included here. A one-hour sample record from Bass Strait is shown in Figure 5. Aquashuttle cycled from 3-38 m every 100 seconds and easily detected a warm salty region between the 4000 and 6000 second time marks — equivalent to about 5 miles.

First impressions from the plankton hauls (Russell Bradford)

In a general sense, plankton hauls from the west coast of Tasmania contained large amounts of salps, increasing in density at the Marawah transect. Along the east coast, salps made up a smaller proportion of the samples; instead, jellyfish and pyrosomes clogged the surface net. Jellyfish were more numerous along the northern transects; pyrosomes becoming more important at the more southerly Tasman Island transect.

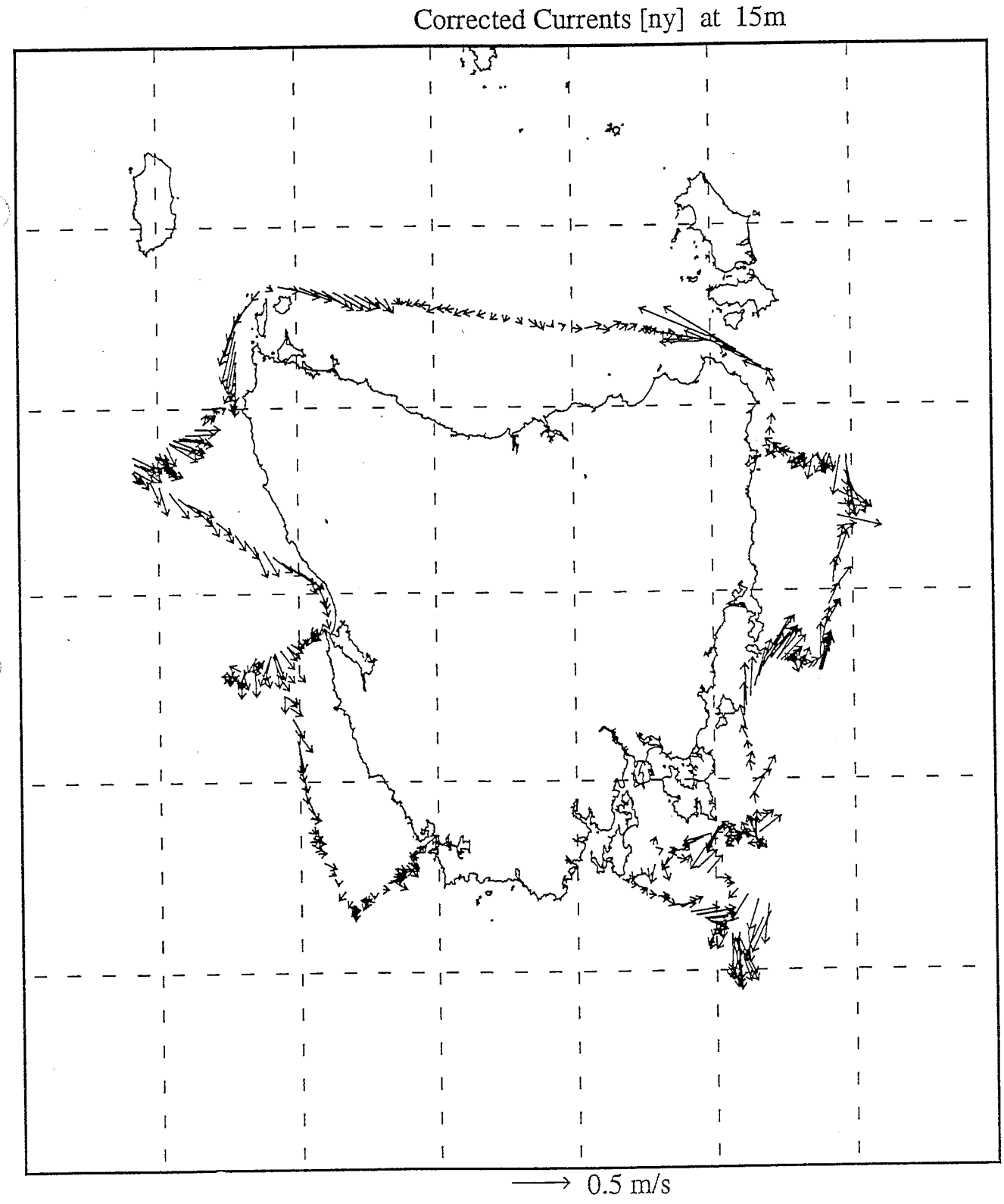
Krill, normally abundant at this time year, were almost absent from the east coast transects. This has important ramifications for the jack mackerel fishery. A similar absence of adult krill along the east coast in 1989 resulted in the failure of the jack mackerel fishery that year (Young et al. 1993). However, off the southeast of Tasmania the larger adult krill were abundant in the offshore samples; with juveniles present inshore. Several jack mackerel fishers were working in the area.

The most striking change in species composition came from samples collected from the Cape Sorrell transect. These samples were dominated by a single species of amphipod except at the outermost station (20). Between stations 19 and 20 the sample size decreased markedly and the species composition changed from the almost monoculture of amphipods to a handful of krill with only 1/2 dozen amphipods. The ADCP figure (Fig. 2) indicates that the predominantly southerly currents changed to westerly between the two stations.

The primary aim of the zooplankton collections was to collect phyllosoma (lobster larvae). Southern rock lobster (SRL) larvae were abundant in the collections from the offshore stations of the Port Davey transect - 28 larvae were collected between stations 15&18. Two SRL were collected from the outermost station of the Southeast Cape transect. Collections from the east coast had nine phyllosoma; only one of which was a southern rock lobster collected at the outermost station of the Schouten Island transect.

Young JW, Jordan AR, Bobbi C, Johannes RE, Haskard K, Pullen G (1993) Seasonal and interannual variability in krill (Nyctiphanes australis) stocks and their relationship to the fishery for jack mackerel (Trachurus declivis) off eastern Tasmania, Australia. Marine Biology 116: 9-18

Figure 2 The current vectors at 15 m depth from the ADCP.



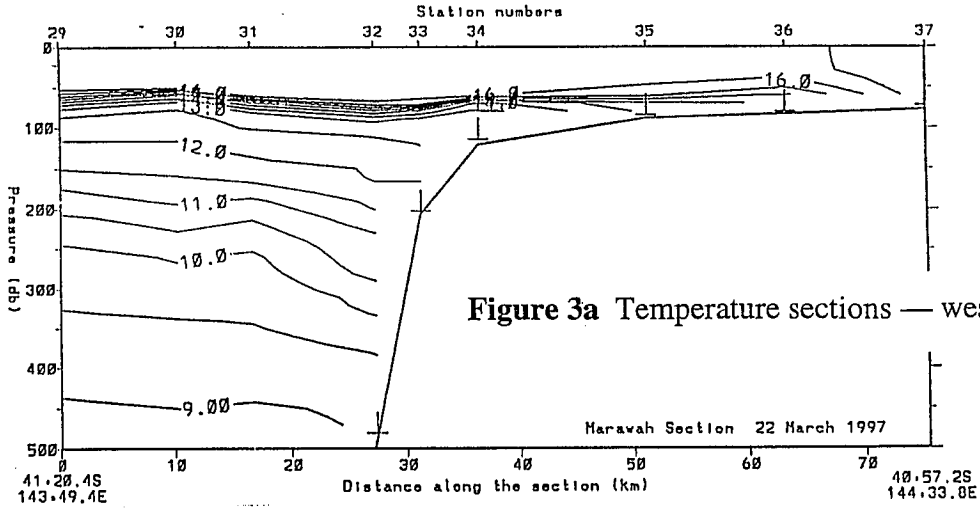
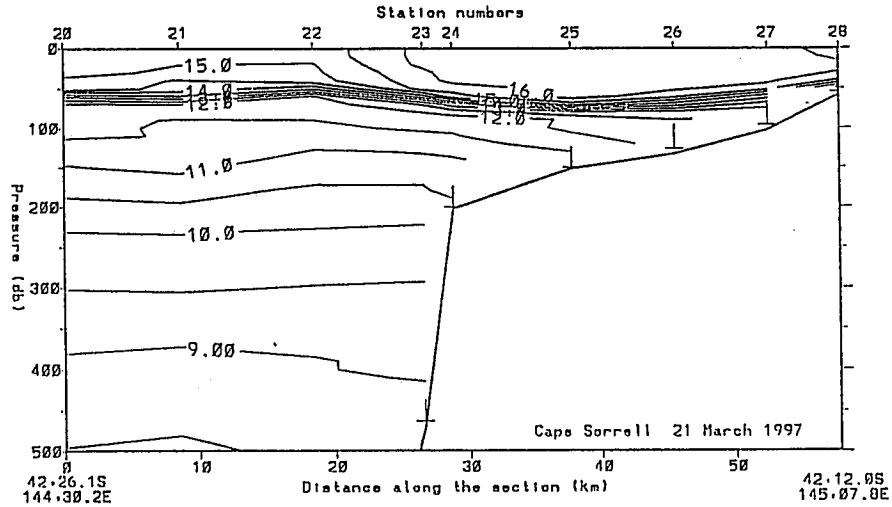
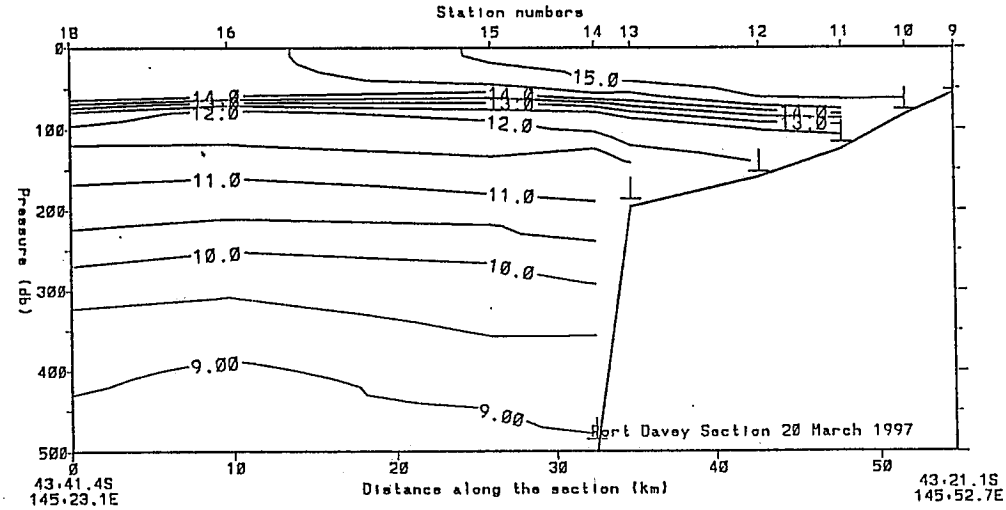
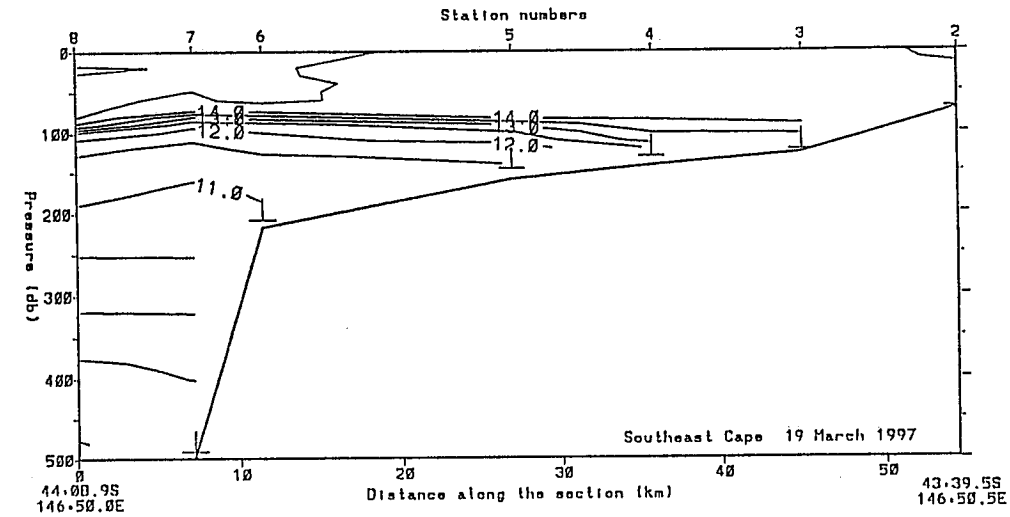


Figure 3a Temperature sections — west and south.







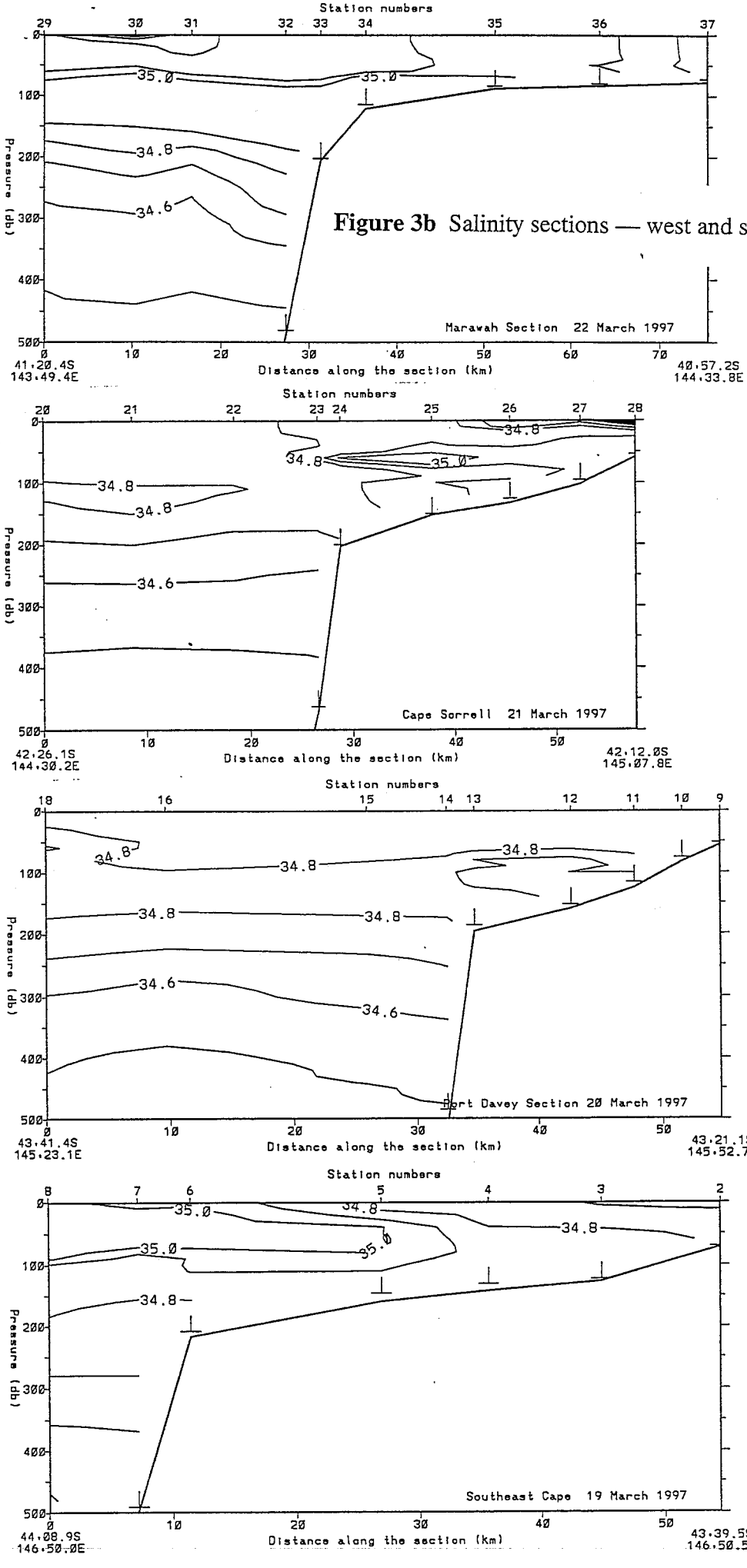
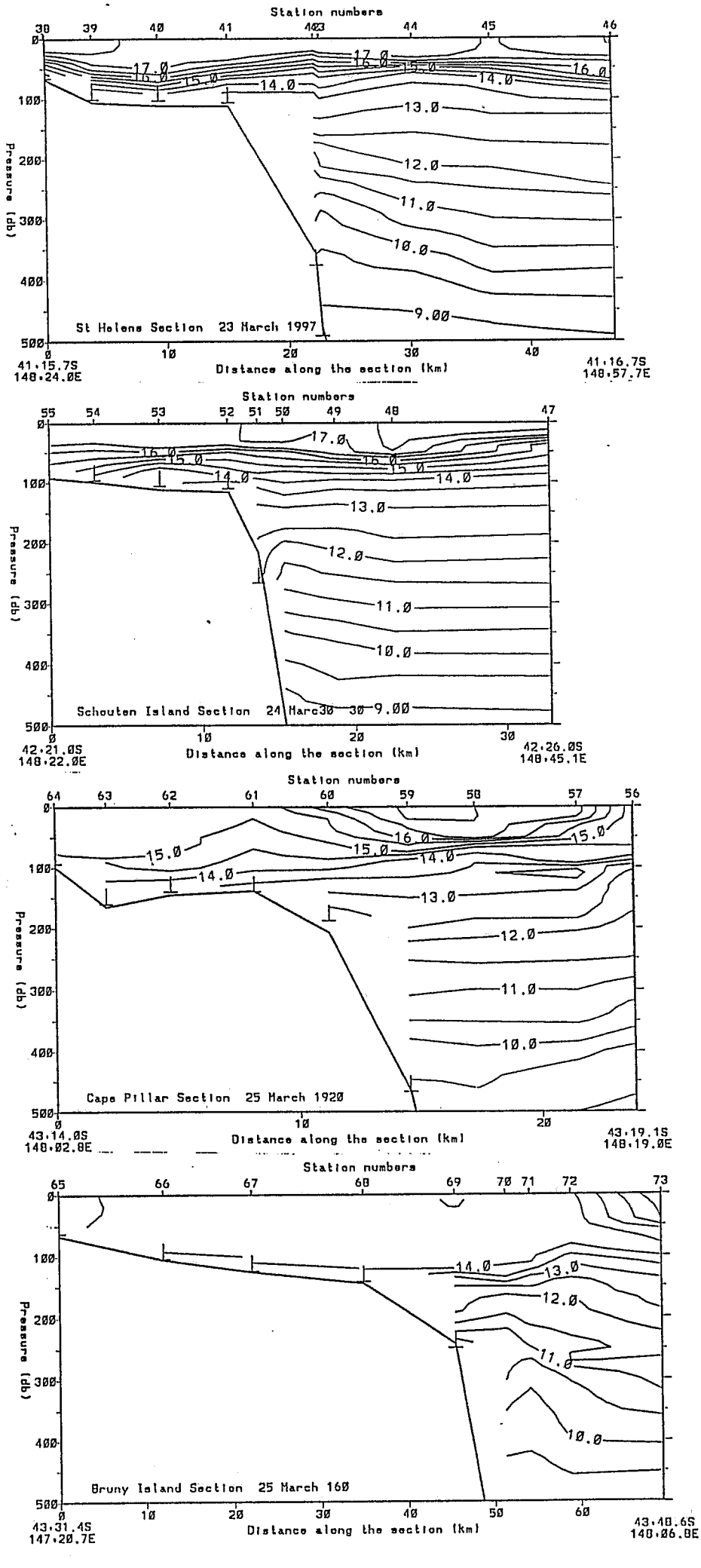


Figure 3b Salinity sections — west and south.

Figure 4a Temperature sections — east and southeast.



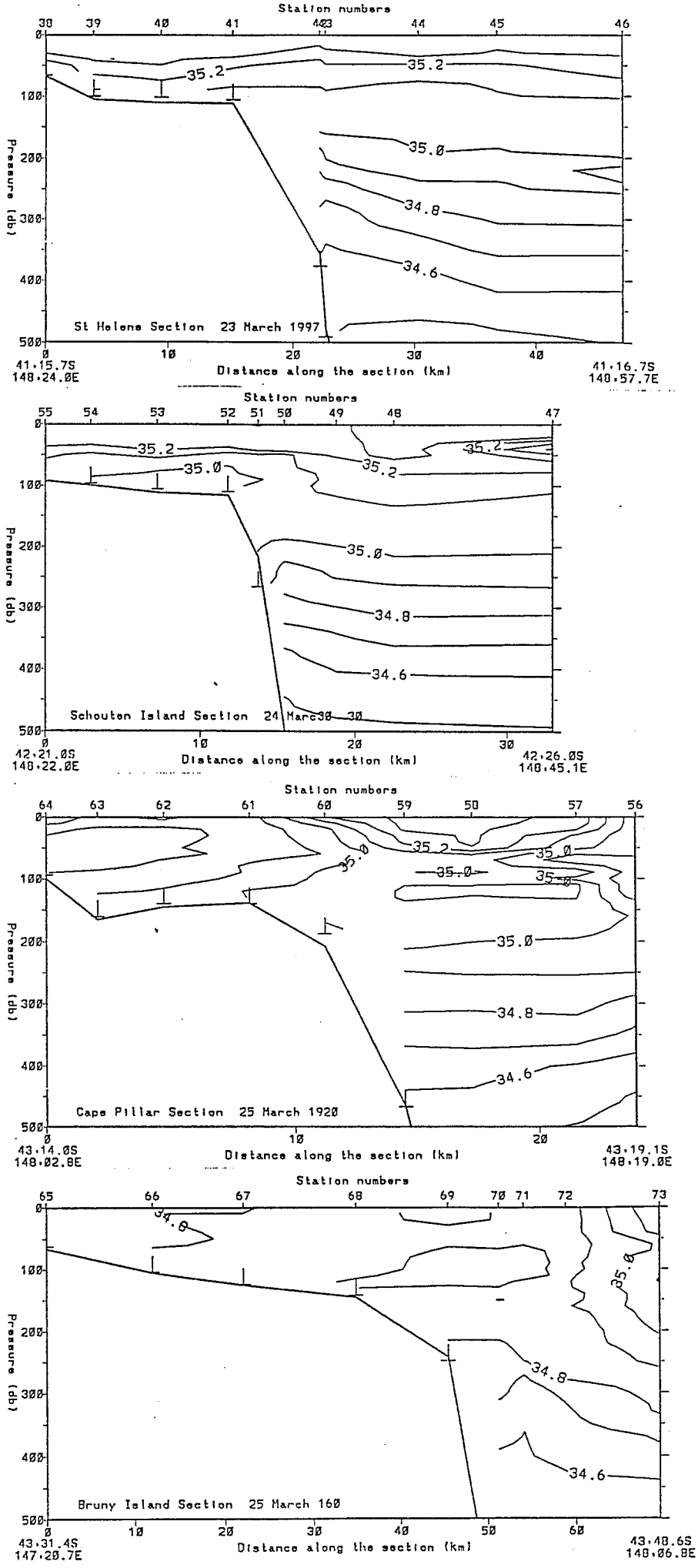


Figure 4b Salinity sections — east and southeast.

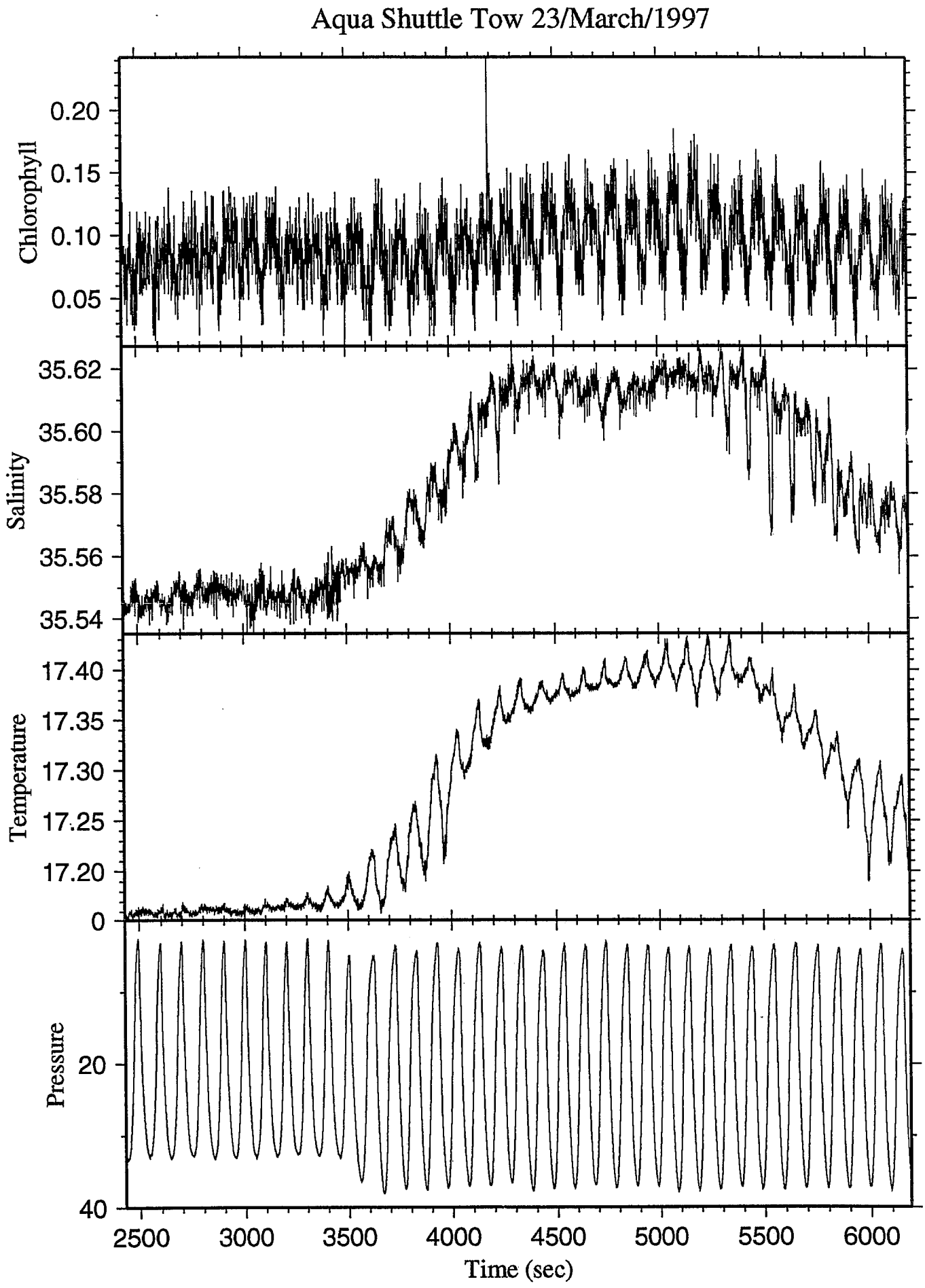


Figure 5 Aquashuttle in Bass Strait.

Figure 2 The current vectors at 15 m depth from the ADCP.