# *FRANKLIN*

## National Facility
## Oceanographic Research Vessel

**RESEARCH SUMMARY**

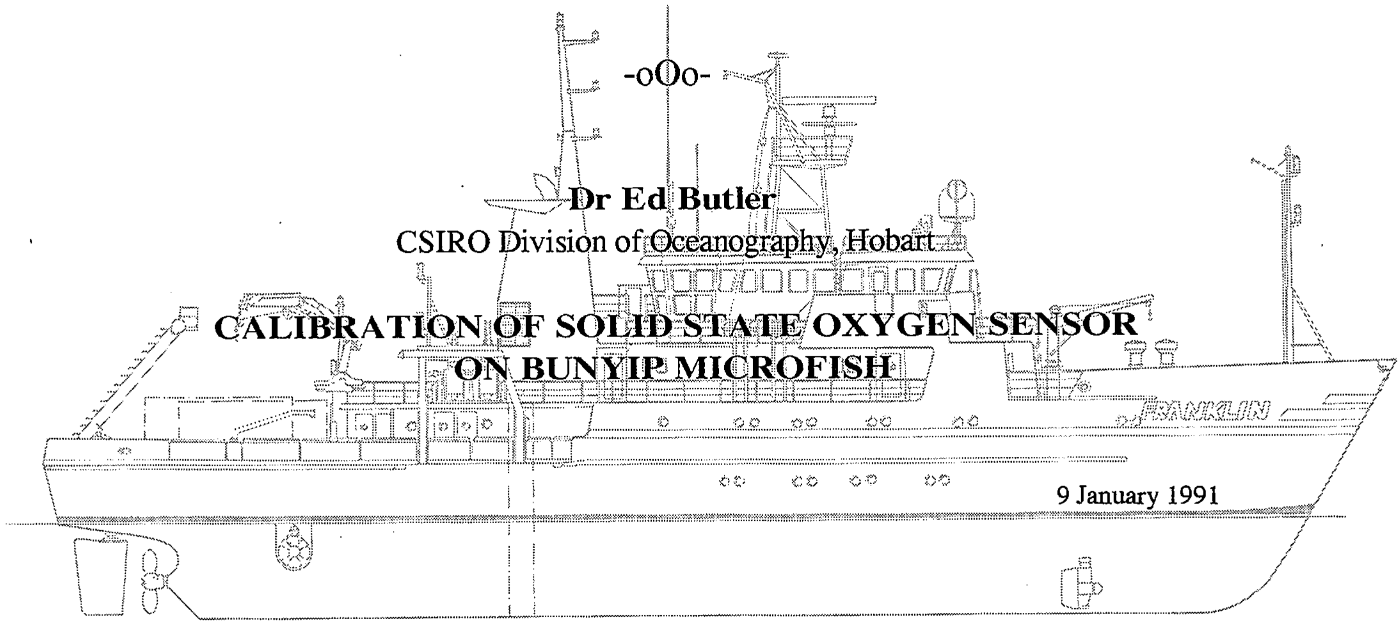
**CRUISE FR 10/90**

Sailed Sydney 0700 Tuesday 27 November 1990
Arrived Hobart 1400 Friday 14 December 1990

**Principal Investigators**

**Dr Trevor McDougall**
CSIRO Division of Oceanography, Hobart

**MIXING AND SUBDUCTION**

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**Dr Ed Butler**
CSIRO Division of Oceanography, Hobart

**CALIBRATION OF SOLID STATE OXYGEN SENSOR ON BUNYIP MICROFISH**

9 January 1991

For further information contact:

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# RV Franklin
# National Facility
# Oceanographic Research Vessel

## Research Summary
## Cruise FR10/90

**Itinerary**

| | | | |
|---|---|---|---|
| Sailed | Sydney | 0700 | Tue 27 November 1990 |
| Arrived | Hobart | 1400 | Fri 14 December 1990 |

**Principal Investigators**


**Mixing and Subduction**
Dr Trevor J McDougall,
CSIRO Division of Oceanography, Hobart Tasmania

**Field Calibration of Solid-State Dissolved Oxygen Sensor Mounted on Bunyip Micro-fish.**(piggy-back proposal)
Dr Ed Butler,
CSIRO Divsion of Oceanography, Hobart Tasmania


**Cruise Objectives**

**(1) Low Richardson numbers and upwelling filaments**

To locate vertically-extensive patches of low Richardson number in frontal regions near the New South Wales Coast, and then to (i), examine the mixing intensity in these regions, and (ii), to map the three-dimensional fields of salinity and potential vorticity.

**(2) Preliminary Subduction Experiment**

During the Spring restratification, to map the three-dimensional fields of salinity and potential vorticity just below the mixed layer in the central Tasman Sea.

**(3) Mixing in the thermocline**

During the transit between the central Tasman Sea and the NSW coast, to deploy Bunyip to at least 800 m and to collect microstructure data.

**(4) Field Calibration of Solid-State Dissolved Oxygen Sensor Mounted on Bunyip Micro-fish.**

To calibrate the solid-state dissolved oxygen sensor on the Bunyip micro-fish against the conventional dissolved oxygen micro-electrode mounted on the same vehicle. To further relate data from these devices to dissolved oxygen measurements made by the conventional electrode mounted on the CTD, and ultimately to the primary discrete determinations of dissolved oxygen by the Winkler titration.

## Personnel

### Ship's Crew

| | |
|---|---|
| Master | Neil Cheshire |
| Mate | Chris Sharp |
| 2nd Mate | Mike McAuley |
| Chief Engineer | Ron Parrot |
| 2nd Engineer | Ron Munro |
| Elec. Engineer | Lynton Spry |
| Bosun | Jannick Hansen |
| AB | Bluey Hughes |
| AB | Kris Hallen |
| AB | Ian Phillips |
| Greaser | Colin Lawrence |
| Chief Steward | Ray Clarke |
| Chief Cook | Gary Hall |
| 2nd Cook | Bob Clayton |

### Scientific Party

| | |
|---|---|
| Trevor McDougall | CSIRO Division of Oceanography (Cruise Leader) |
| Lindsay Pender | CSIRO Division of Oceanography (Cruise Manager) |
| Ian Helmond | CSIRO Division of Oceanography |
| Alex Papij | CSIRO Division of Oceanography |
| Stuart Swan | CSIRO Division of Oceanography |
| Leigh Carter | CSIRO Division of Oceanography |
| Erik Madsen | CSIRO Division of Oceanography (& ORV) |
| Bob Griffiths | CSIRO Division of Fisheries Research |
| Michael Long | CSIRO Division of Oceanography |
| Phillip Organ | CSIRO Division of Oceanography |

## Cruise Narrative

Guided by the most recent satellite pictures of sea surface temperature, we headed south from Sydney along the 200 m isobath and crossed the EAC just 40 nm south of Sydney. Following a 12-bottle CTD station in 1000 m of water to test for leaking hydro bottles, we deployed Bunyip for the first time, towing in a northeastward direction across the EAC just after it had separated from the shelf. This tow lasted only 3.5 hours when we lost communication. Reseating the cpu card in the microfish cured the problem, so that dirty contacts on the connector of this card were implicated. (See the attached table for a summary of the Bunyip deployments on this cruise). This transcet was continued with a CTD line (CTD stations 2–8, station spacing 10 nm) in the same direction (northeastwards) across the front.

The second Bunyip (beginning at 1400 Local Time Wednesday 28 November) was directed SSW across the same separated front of the EAC. This deployment lasted for 7.5 hours and was terminated when electrical continuity was broken. The culprit was the two-pin connector at the mainfish which had broken on previous cruises and would cause further trouble later in this cruise. In any case, there is no microstructure data from this tow because the sensors were inadvertently placed in the wrong positions on the probe sting.

A second CTD transect was made across the front (CTD stations 9–14) proceeding southwestward with station spacing of 10 nm. After this CTD section, we steamed northward ready for another Bunyip transect (beginning at 0315 Local Time Friday 30 November) across the separated front of the EAC. This third Bunyip deployment lasted for ten hours and was again halted by the breaking of the new connector at the mainfish bulkhead. Fast running out of spare connectors, and disappointed at the frequency with which they break, we decided to terminate the tow cable in a different fashion, putting the connector inside the seasoar vehicle rather than being fixed to the bulkhead. The microconductivity signal, mCond1, worked well on this tow, but the dual shear probe and mCond2 were not giving real signals.

These crossings of the EAC were disappointing in that although the SST front was not very sharp, the subsurface gradients were rather weak with consequently only a medium amount of shear in the water column. In essence, the EAC was a broad feature with a rather smooth front. We had not caught this feature at its most active: perhaps we were a few days late, because on the TECSAS cruise last year, we found high shears and large turbulent activity in just such a separation region.

After these three Bunyip deployments and and two CTD sections in the EAC separation region, we headed south to engage a mature eddy that the Nowra Oceanographic Analysis group had placed at about 36° 30´S. This eddy does not now have a very distinct signature in sea surface temperature, but is evident in the temperature at 250 m depth, $T_{250}$, with values up to 17°C. From 36°S 152°E we steamed southwestward taking CTD stations every 11 nm (CTD stations 16–25). Then Bunyip was launched for the fifth time and a section through the eddy was completed, running northeastwards. This was a 12-hour tow and it showed an unusual structure at about 330 m depth where there were two patches of very low vertical stability evenly spaced either side of eddy centre. Unfortunately, the main microconductivity sensor pierced a fish at the beginning of the tow and the turbulence data of the entire tow was useless.

Determined to have another cut through this eddy, we began a Bunyip transect from the northwest part of the eddy, but after three and a half hours, the microfish detected a leak and the system was recovered for washing and drying. This transect was successfully completed with a further ten-hour tow on deployment 6, where the microconductivity sensor showed the region to contain many highly turbulent layers.

On this transect we found but one region of low vertical stability and, in contrast to tow 5, this was located near the eddy centre. This completed our work off the New South Wales coast, and we set a course for the subtropical convergence region. On the way, the ship lost control of the pitch of its main screw and we were stationary for seven and a half hours. Immediately thereafter a power supply of the bow thruster died and we were without the use of the bow thruster for several days.

Despite the lack of a bow thruster, we began the oxygen calibration work for Ed Butler by doing four CTDs to 200 m depth and then deployed Bunyip to trace along the same path as the CTDs. The weather was however deteriorating rapidly, and towing into the sea caused the Bunyip tow cable to go slack intermittently. This course was then abandoned and instead we towed towards the south with the seas behind us for several hours. The wind had been at 30 knots for several hours when we recovered the vehicles and we used a ship speed of 8 knots to recover the microfish in order to avoid it landing on the deck by itself! The main tow cable suffered some damage when we had landed the mainfish and the cable was slack in the main sheave.

Then followed a long hunt for the STC. We sailed south along 155°E down as far as 45°S but an XBT transect showed that we were still in a southward disturbance of the STC. We changed our heading to the southwest and eventually found a strong STC front at about 46°S and 153°E. We had spent an extra day looking for the STC and were very likely in an eddy-like southward extension of the STC but decided to deploy Bunyip here (deployment #8). However, we found that the density of the STC frontal water ($s_q = 26.42$) appeared only very high in the water column (less than 40 m deep) throughout the entire length of this tow, and we altered course to the west, while still towing Bunyip. The STC was not found on this westward tow and so we turned south and then eventually found the STC again. The conclusion is that we were in a very large southward excursion of the STC. Whether it is an eddy- like excursion that is near pinch-off or whether it is a more gentle but larger-scale wave-like feature, we cannot yet say. On this tow the microconductivity sensors periodically speared fish and were no good for an hour or so at a time.

While Bunyip was out of the water this time, the gain of the mainfish speed sensor filter was increased, resulting in a marked improvement. We steamed westward in between Bunyip tows, and in deployment #9 we towed northward on what was to become a part of a box of several northward and southward tows. Tow #9 ended when a short occurred in the splice on the towing arm of the mainfish. After several hours, we redeployed in the same location and continued the second leg of the box southward into a heavy sea. We could only make 6 knots for most of the evening and consequently did not measure as high in the water column as we would have liked. Tow #10 lasted 22 hours and we recovered Bunyip simply to clean fish remains off the microconductivity sensors. Tow #11 lasted for 25 hours and was also terminated to clean the microconductivity sensors. Tow #12 was to the north, on the seventh leg of the box and we had only done half of this leg when we lost communication with the mainfish (the microfish was OK) and we recovered the vehicles. We would have redeployed the system but the seas had deteriorated and after several hours hoving to, we decided we would have to head for home. That night we endured awful conditions, winds gusting to 50 knots and steady at 40 knots for hours at a time. We could make only about 4 knots into these seas. This was to be the end of our work on the cruise as the weather kept up and it was all we could do to make an average speed of 5 knots for the next 24 hours. We battled continuously against the 40 - 55 knot winds and large seas for almost 48 hours to arrive in Hobart right on schedule.

Attached are (i) tables of the Bunyip deployments, reports on (ii) computing, (iii) electronics, and (iv) mechanical problems with Bunyip that need fixing before the next cruise.

## Acknowledgements

As always,the entire FRANKLIN crew provided excellent support and cooperation throughout the cruise. Some marathon demonstrations of the limits of human endurance were provided by Lindsay Pender:- how many hours sleep per week does a computer jock need anyway?

## Computing Report - Lindsay Pender

At the beginning of the cruise, the tricycle (for monitoring cable tension and wire out) was connected via RS232 to TT11 on MICRO6. Software was installed to make the tricycle data available over the network. This system worked well for all the Bunyip deep tows when it was used. Note that the tricycle cannot be used with Bunyip if all of the faired cable (400 m) is not out. Even though not attached to the cable later in the cruise, the tricycle remained connected to MICRO6 until near the end when it started producing erroneously high tension values (see electronics report).

All the computing systems worked without fault during the cruise, with everything being logged. Exabyte copies were made of all tapes by the EXABACK utility. It should be noted that the saveset names for tapes labelled D90101 & F109010 were interchanged by mistake.

On the VAX, the utility area CRUISUTIL had been cleared before the cruise and so no cruise track plotting etc. could be done.

Something needs to be done so that the Sun computer can easily plot graphs on the laser-printer.

## Bunyip mechanical problems following Fr10/90:- Ian Helmond

### 1. Winch

The main drum bearing at the faired cable end of the winch was running dry and could not be lubricated through the grease nipple. The bearing should be removed and replaced if necessary and the lubrication fixed.

The bush on the bare cable diamond lead screw should be checked and the key replaced. The key on the leadscrew for the faired cable should also be replaced. New spare keys to be made.

The end float limiting roller, added for this cruise, should be strengthened.

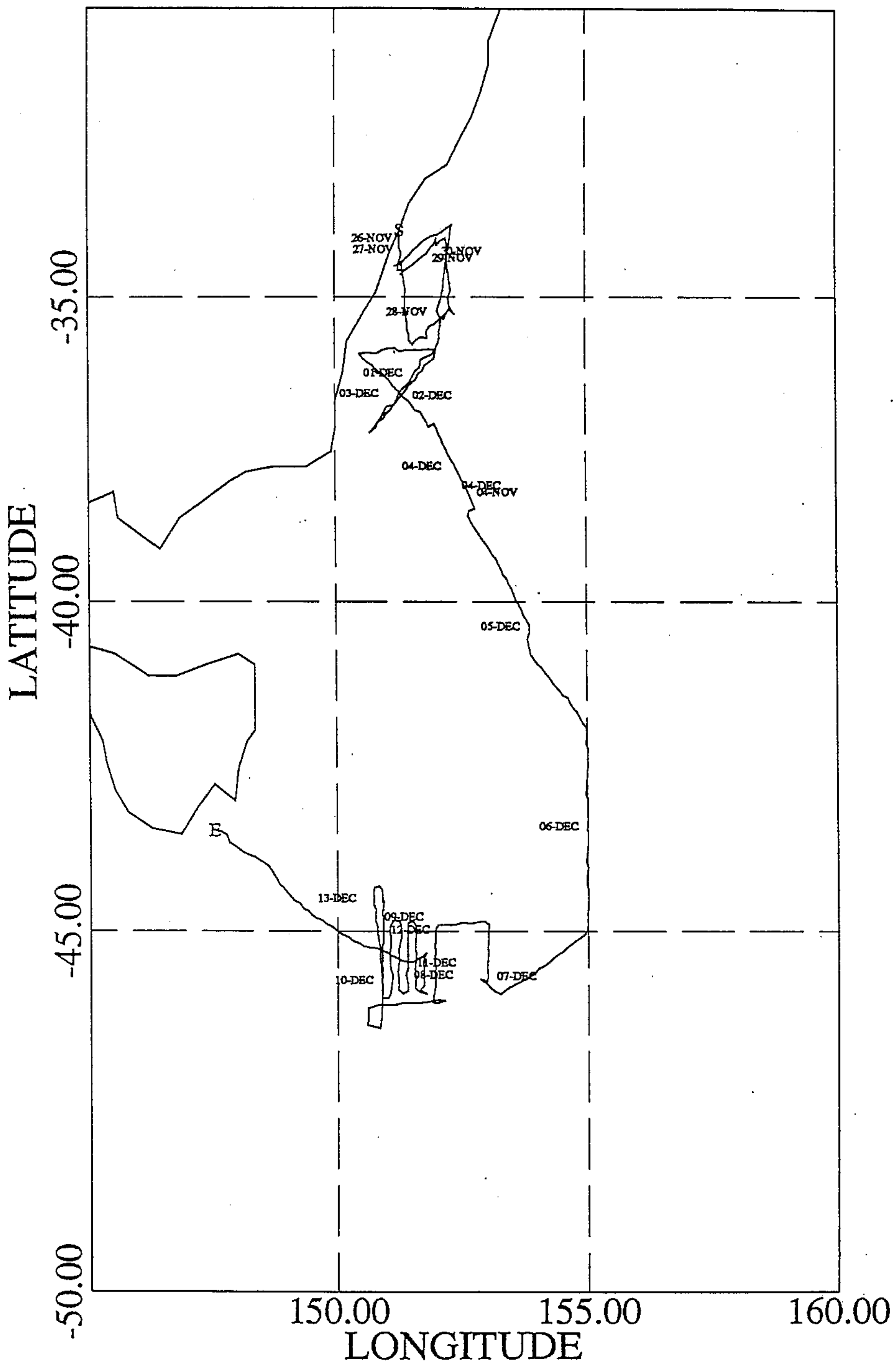
Check slip rings.

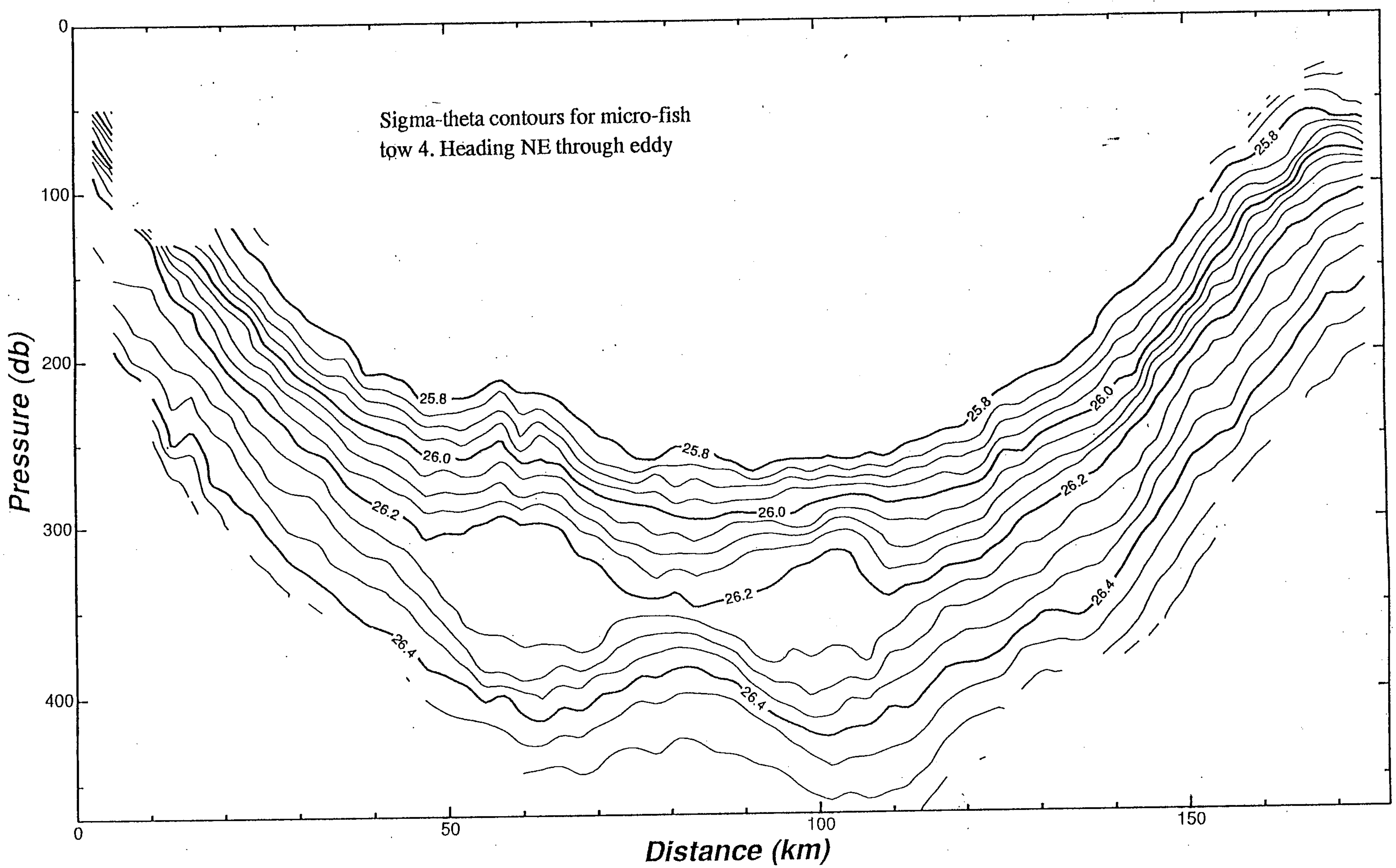
### 2. Mainfish

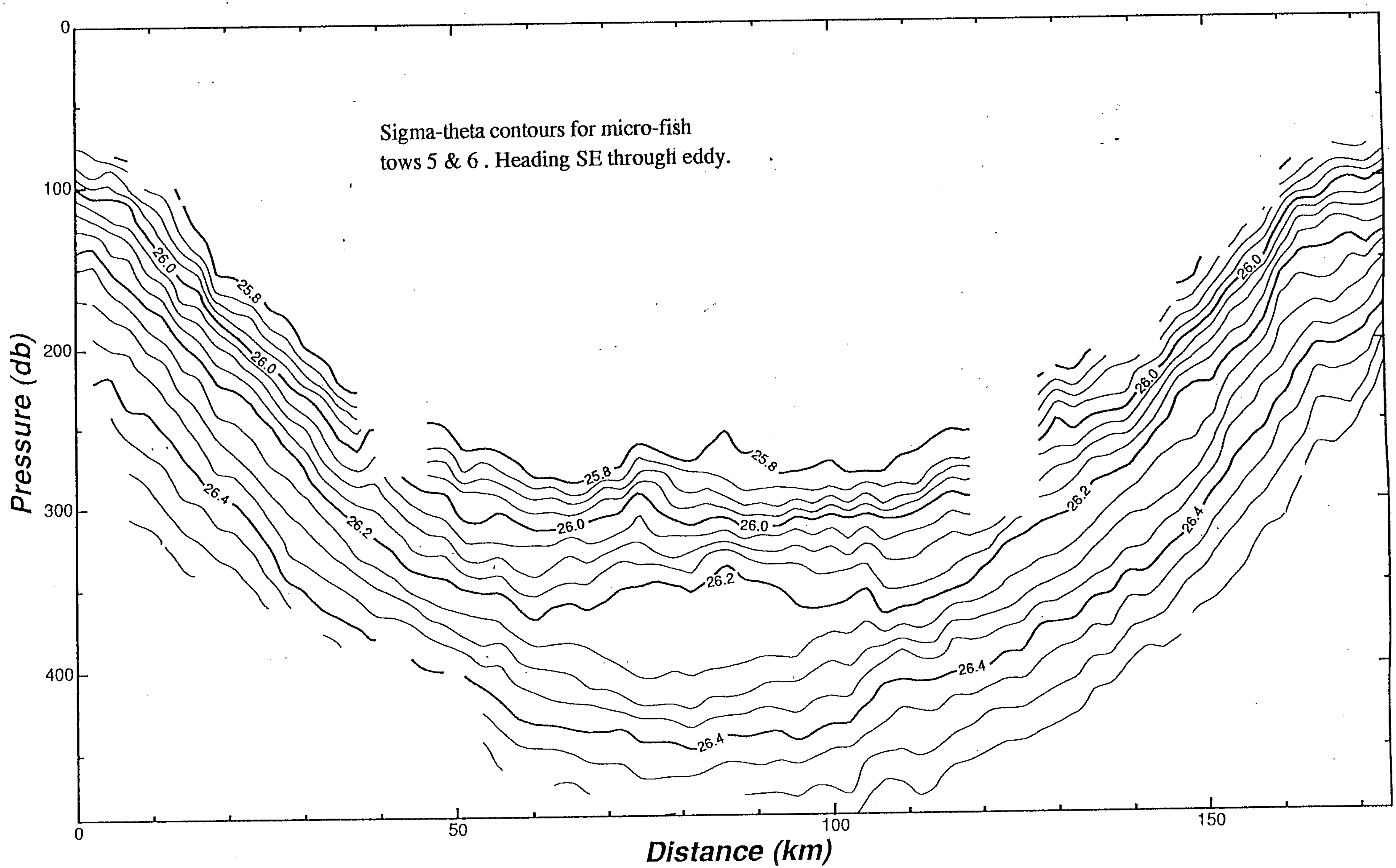
A new arrangement is required for the electrical termination of the sea cable. As this will probably require a mechanical retermination of the cable, a spare retermination kit needs to be ordered.

The hydraulic unit needs to be opened up and inspected.

# CRUISE TRACK




Sigma-theta contours for micro-fish
tow 4. Heading NE through eddy
Pressure (db)
0
100
200
300
400
Distance (km)
0
50
100
150
25.8
26.0
26.2
26.4


Sigma-theta contours for micro-fish
tows 5 & 6 . Heading SE through eddy.
Pressure (db)
Distance (km)
0
100
200
300
400
0
50
100
150
25.8
26.0
26.2
26.4

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**ADDENDUM TO**

**RESEARCH SUMMARY**

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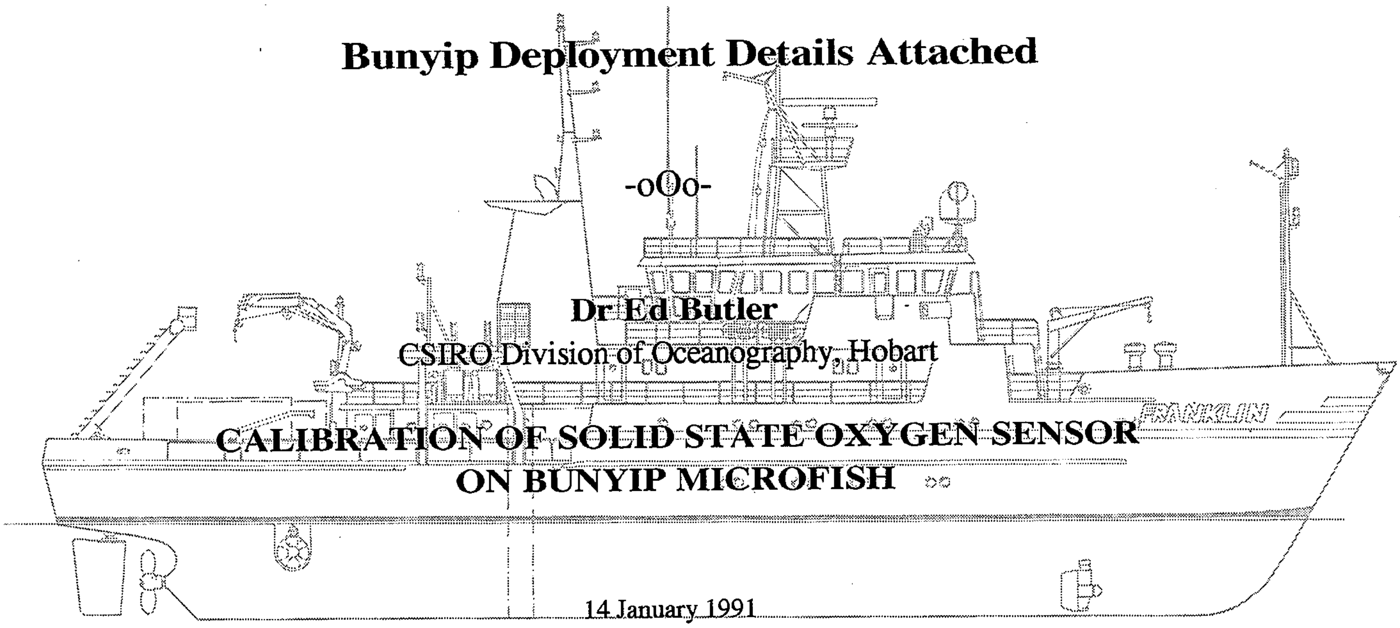
**Principal Investigators**

**Dr Trevor McDougall**
CSIRO Division of Oceanography, Hobart

**MIXING AND SUBDUCTION**

**Bunyip Deployment Details Attached**

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**Dr Ed Butler**
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**CALIBRATION OF SOLID STATE OXYGEN SENSOR ON BUNYIP MICROFISH**

14 January 1991

For further information contact:

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# Table of Bunyip Deployments, Fr10/90

| # | Time In | Position In | Time Out | Position Out | Sensors | Comments |
|---|---|---|---|---|---|---|
| 1 | *Tues 27 Nov 0300 UTC* —— Tues 27 Nov 1400 LT | | *Tues 27 Nov 0630 UTC* —— Tues 27 Nov 1730 LT | | Acc<br>DSP3<br>µCond1<br>µCond2 | Pre-Bunyip CTD cast was CTD #01. Northward (NE) crossing of the separated EAC. Retrieved because of lack of communication. This is thought to be a connector problem on one of the digital cards. Also, pitting on the O-ring seats of the O'Brien connectors let in a tablespoon of water. Also, DSP3 contained a little water after this tow. What did DSP (in the early part of the tow) and µCond2 (and µCond1) show on this tow? Files fr1090001 – fr1090003. |
| 2 | *Wed 28 Nov 0300 UTC* —— Wed 28 Nov 1400 LT | 34° 07.5´S 152° 14.0´E | *Wed 28 Nov 1030 UTC* —— Wed 28 Nov 2130 LT | 35° 21.6´S 152° 08.1´E | Acc<br>~~Clay~~<br>~~µCond1~~<br>~~µCond2~~<br>+ Titron | Pre-Bunyip CTD cast was CTD #08. Southward (SSW) crossing of the separated EAC. Shear probe circuit #1 had a high open circuit noise level prior to deployment but was fine with Clay. Maybe this is OK. Recovered because of intermittent loss of signal and power. It was the 2-pin connector at the sea-soar again. All the µstructure sensors except for Acc were in the wrong positions on this deployment. Titron is uncalibrated. Files fr1090004 – fr1090007. |
| 3 | *Thurs 29 Nov 1615 UTC* —— Fri 30 Nov 0315 LT | 34° 27.5´S 151° 17.7´E | *Fri 30 Nov 0210 UTC* —— Fri 30 Nov 1310 LT | 33° 48.3´S 152° 17.9´E | Acc<br>DSP4<br>µCond1<br>µCond2<br>+ Titron | Pre-Bunyip CTD cast was CTD #15. Northeastward crossing of the EAC front, just as it leaves the coast near Wollongong, starting at a depth of 280m. The rms µCond2 is far too high (and drifted down during the tow), as is the DSP. Deployment ended because of the same old cable connector at the mainfish dying. The exit tube from pump to seabird conductivity #1 was crimped on this deployment. The impedance of both beams of the DSP indicated water leakage that must have gone through the epoxy holes. How did DSP4 behave on the first part of this tow, before any water leaked into it? The Titron probe was filled with KCl prior to deployment. Files fr1090008 – fr1090012. |
| 4 | *Sat 01 Dec 1600 UTC* —— Sun 02 Dec 0300 LT | 37° 14.3´S 150° 45.2´E | *Sun 02 Dec 0415 UTC* —— Sun 02 Dec 1515 LT | 35° 53.4´S 151° 59.2´E | Acc<br>DSP5<br>µCond1<br>µCond3<br>+ Titron | Pre-Bunyip CTD cast was CTD #25. Northeastward tow across the eddy off the coast from Nowra. DSP5 was deployed with new epoxy on small holes through which Ian suspected water to have leaked on the previous deployment. Since last tow, the cables to the two microconductivity circuits inside the microfish were shortened. During this tow the y-acceleration Sunstrand was off-scale and the roll was a steady -28°. This was due to a broken wire on a connector. Upon recovery, we found the remains of a fish on µCond1 and a piece of jelly fish on one (seabird–Cond1?) of the seabird temperature probes. The shear probe DSP5 must have also suffered from the same collision because it was mechanically broken at the end of the deployment. This long tow found a strange apparently toroidal shape of very low vertical stability at 330 m centreed on the ring centre. The long tow gave a beautiful cross-section through the eddy and the contours of potential density worked well. Damn the fish– this would have been a great tow otherwise! As on tow 3, the mainfish speed sensor did not work straight away. The noise level on µCond3 in circuit#2 was still unacceptably high. This is a major mystery. Files fr1090013 – fr1090016, plus a short test tow of the microfish on fr1090017. |
| 5 | *Sun 02 Dec 1450 UTC* —— Mon 03 Dec 0150 LT | 36° 00.3´S 150° 30.3´E | *Sun 02 Dec 1825 UTC* —— Mon 03 Dec 0525 LT | 36° 14.5´S 150° 49.2´E | Acc<br>Clay<br>µCond1<br>µCond3<br>+ Titron | Pre-Bunyip CTD cast was CTD #26. Southeastward tow through the eddy. The microconductivity sensors were much improved on this tow with the noise levels being $2x10^{-11}$ $K^2$ $s^{-1}$ for µCond1 and $2x10^{-10}$ $K^2$ $s^{-1}$ for µCond3 in circuit #2. The tow was ended because of a serious leak in the microfish through the central D.G. O'Brien connector. Files fr1090018 – fr1090019. Note that file fr1090020 does not exist. |

Key
Acc = Accelerometer Shear Probe. OSP = Osborn Shear Probe. DSP = Dual Shear Probe. µCond = Microconductivity Probe. Clay = Clayton's Shear Probe.
Titron = Titron oxygen sensor. OxyTE = Three-electrode Oxygen sensor.

# Table of Bunyip Deployments, Fr10/90 (Continued)

| # | Time In | Position In | Time Out | Position Out | Sensors | Comments |
|---|---|---|---|---|---|---|
| 6 | *Mon 03 Dec 0917 UTC* <br> —— <br> Mon 03 Dec 2017 LT | 36° 15.3´S 150° 46.0´E | *Mon 03 Dec 1950 UTC* <br> —— <br> Tues 04 Dec 0650 LT | 37° 04.4´S 151° 56.9´E | OSP407 <br> Clay <br> µCond1 <br> µCond3 <br> + Titron | Pre-Bunyip CTD cast was CTD #27. Continuation of the southeastward tow through the eddy that began with the previous deployment. The microconductivity sensors were much the same on this tow as on tow #5, perhaps with a little higher noise floor at the beginning and a little better at the end. The tow was ended because of an electrical short in the tow cable at the connector inside the mainfish. Together with tow #5, and this one, #6, the whole eddy was crossed with microconductivity probes. On this tow, we found only one region of low vertical stability, and this seemed to be at ring centre. The Titron sensor was refilled with KCl before this tow. This tow was the most active microstructure tow we have ever done. Files fr1090021 – fr1090023. Note that file fr1090020 does not exist. |
| 7 | *Wed 05 Dec 0235 UTC* <br> —— <br> Wed 05 Dec 1335 LT | 40° 33.0´S 153° 48.3´E | *Wed 05 Dec 0545 UTC* <br> —— <br> Wed 05 Dec 1645 LT | 40° 48.2´S 153° 51.9´E | OSP407 <br> Clay <br> µCond1 <br> µCond3 <br> + Titron <br> + OxyTE | Pre-Bunyip CTD cast was CTD #31. This tow was for Ed Butler's piggy-back proposal for the calibration of the three-electrode and Titron dissolved oxygen sensors. We towed at a variety of speeds at a constant depth, and also at a constant speed in the see-saw mode. The Titron sensor was refilled with KCl before this tow. There was lots of activity in the microconductivity probes on this tow in layers near the top of the triangular flight path, and this activity was reproduced consistently on every up and down cast. The conditions were quite rough for this tow and the microfish almost surfed onto the deck by itself: it was recovered at 8 knots. Because of the rough conditions and the tow cable going slack with the large swell, we were forced to tow to the south rather than the north so that the tow did not go over the four CTD stations. Also, we could do no CTD on recovery because of the lack of a bow thruster. The main tow cable suffered damage by sliding off the big sheave. File is fr1090024. |
| 8 | *Thurs 06 Dec 2245 UTC* <br> —— <br> Fri 07 Dec 0945 LT | 45° 43.3´S 152° 57.1´E | *Fri 07 Dec 2130 UTC* <br> —— <br> Sat 08 Dec 0830 LT | 45° 48.0´S 152° 07.5´E | OSP407 <br> DSP6 <br> µCond1 <br> µCond3 <br> + Titron <br> + OxyTE | Pre-Bunyip CTD was CTD #32. This is the first deployment in the STC region. The microconductivity sensors had noise levels of (base of 1 to) $2\times10^{-11}$ K$^2$ s$^{-1}$ for µCond1 and $2\times10^{-10}$ K$^2$ s$^{-1}$ for µCond3 in circuit #2. The surface water masses on either side of the STC front had T=13.55°C, S=35.19psu, σ=26.43, and T=11.64°C, S=34.68psu, σ=26.41. The Titron sensor was refilled with KCl before this tow and a new membrane was installed, although there was no visible damage to the first membrane. There are huge variations in N$^2$ along isopycnals in this tow; perhaps this is typical of newly-formed fronts that are not recirculating eddies. We headed north until 1645 LT (at 44° 53.5´S, 153° 00.0´E) and then turned to the west as the isopycnals from the surface expression of the STC had not subducted at any more than a slope of 1:2000, indicating that we were running parallel to the STC by doing a northward course. After running westward for some time we headed south in an effort to find the STC again, and eventually we did find it, then decided to recover Bunyip as the weather was getting fierce. During the tow µCond1 went very high (~$7\times10^{-8}$ K$^2$ s$^{-1}$), first noticed at 1720 LT Fri 07 Dec, while µCond3 in circuit #2 was its normal self. Later on (about 1930 LT) µCond1 came good and µCond3 drifted high. This showed that the maximum level of χ that can arise from these µCond circuits is about $3\times10^{-7}$ K$^2$ s$^{-1}$. Later, both µCond sensors came good. Then µCond1 was high on recovery. This all was consistent with seeing the remains of sea-snot on µCond1 on recovery. In future we will take the little guard off the µCond1 probe. On the whole tow, the isopycnal of the STC (σ=26.42) did not come below about 40 m! The mainfish speed sensor was temperamental on this whole tow but the sensor itself checked out alright on the rear deck. Files fr1090025 – fr1090035. |

Key
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Titron = Titron oxygen sensor. OxyTE = Three-electrode Oxygen sensor.

# Table of Bunyip Deployments, Fr10/90 (Continued)

| # | Time In | Position In | Time Out | Position Out | Sensors | Comments |
|---|---|---|---|---|---|---|
| 9 | *Sat 08 Dec 1200 UTC* — Sat 08 Dec 2300 LT | 46° 21.6′S 150° 50.9′E | *Sun 09 Dec 0520 UTC* — Sun 09 Dec 1620 LT | 44° 30.4′S 150° 54.0′E | OSP407 DSP6 µCond1 µCond3 + Titron + OxyTE | Pre-Bunyip CTD was CTD #33. This is the second deployment in the STC region, and it is far over to the west, towards Hobart! The mainfish speed sensor had been worked on (increased gain on the circuit) since the last deployment. The Titron sensor was filled with KCl solution prior to deployment, and the OxyTE probe was sand-papered. Both the µCond1 and µCond3 probes were deployed without guards this time. Following deployment, it took forever to find the STC front proper, but we eventually crossed it at 0720 LT Sun 09 Dec:- T went from 11.92°C to 13.60°C, and S went from 34.76 psu to 35.19psu. At 1420 LT Sun 09 Dec, we changed course to the east and then to the south, 10 minutes further east, going south along 150° 54.0′E. At 1620 LT Sun 09 Dec we suddenly found we had an open circuit on the tow cable, and brought the fish on board. Files fr1090036 – fr1090043. |
| 10 | *Sun 09 Dec 1250 UTC* — Sun 09 Dec 2350 LT | 44° 32.7′S 150° 53.2′E | *Mon 10 Dec 1030 UTC* — Mon 10 Dec 2130 LT | 44° 52.0′S 151° 04.0′E | OSP407 DSP6 µCond1 µCond3 + Titron + OxyTE | There was no pre-Bunyip CTD for this deployment. Heading south again to complete the second leg of our box pattern. For much of this tow we could not make the upper depth limit of 30 m as the seas were rough and we were going against the sea. At about 1230 LT Mon 10 Dec we turned to the east and then to the north, 10 minutes further east along 151° 04.0′E, for the next northward-going leg. µCond1 went very high at about 1720 Mon 10 Dec and didn't really recover on this deployment. Recovered Bunyip to take fish remains off the µCond1 and µCond3 probes. Files fr1090044 – fr1090052. |
| 11 | *Mon 10 Dec 1200 UTC* — Mon 10 Dec 2300 LT | 44° 52.0′S 151° 14.0′E | *Tues 11 Dec 1315 UTC* — Wed 12 Dec 0015 LT | 45° 52.0′S 151° 34.0′E | OSP407 DSP6 µCond1 µCond3 + Titron + OxyTE | There was no pre-Bunyip CTD for this deployment. This tow began with the fourth leg of the box pattern and is to the south. Then we moved 10 minutes of longitude to the east and did the fifth (northward) leg along 151° 24.0′E. There are regular warning bells about not detecting dither that occur for a few minutes continuously, and then disappear for half an hour. Turn to the east at 1515 LT Tues 11 Dec at end of 5th leg of box. On the sixth (southward) leg, µCond1 was contaminated the whole way. At the end of the 6th leg we recovered Bunyip to clean the sensors and to do a CTD station. Files fr1090052 – fr1090064. |
| 12 | *Tues 11 Dec 1620 UTC* — Wed 12 Dec 0320 LT | 45° 52.0′S 151° 44.0′E | *Tues 11 Dec 2115 UTC* — Wed 12 Dec 0815 LT | 45° 22.6′S 151° 44.0′E | OSP407 DSP6 µCond1 µCond3 + Titron + OxyTE | Pre-Bunyip CTD was CTD #34. This is the beginning of the 7th leg, going north. µCond1 was OK to start with on this tow, but became contaminated later on. Lost communication with the mainfish only at 0815 LT Wed 12 Dec and retrieved both vehicles. On deck, the problem was replicated in both dual fish and in mainfish mode, but on opening up the mainfish electronics, nothing wrong could be found. But for the weather, we would have redeployed the system. Between tows #9 to this one, #12, we have six and a half north-south transects at a longitudinal spacing of 10′. Files fr1090064 – fr1090066. |

Key
Acc = Accelerometer Shear Probe. OSP = Osborn Shear Probe. DSP = Dual Shear Probe. µCond = Microconductivity Probe. Clay = Clayton's Shear Probe.
Titron = Titron oxygen sensor. OxyTE = Three-electrode Oxygen sensor.