CRUISE REPORT
SS 01-1992



## Itinerary

Departed Hobart: 0830 h Tuesday, 4 February 1992 (Leg 1)
Arrived Hobart: 1600 h Thursday, 13 February 1992

Departed Hobart: 0830 h Friday, 14 February 1992 (Leg 2)
Arrived Hobart: 1230 h Tuesday, 25 February 1992

## Area of Operation

**Leg 1:**
Continental slope south of Tasmania within latitude 44°00'–44°40'S and longitude 146°00'–147°35'E (see Figure 1)

**Leg 2:**
South of Tasmania in the vicinity of Pedra Branca and on three transects orthogonal to the continental shelf (see Figure 1).

## Cruise objectives

**Leg 1:**
To carry out the first acoustic survey of orange roughy *(Hoplostethus atlanticus)* and deepwater oreos, smooth oreo *(Pseudocyttus maculatus)* and black oreo *(Allocyttus niger)*, on the major deepwater fishing ground off southern Tasmania.

This survey is CSIRO's first use of acoustics to survey a multispecies fishery and, internationally, the first such use of acoustics for deepwater fisheries. The survey depended upon the use of both the split-beam capability of the acoustic system on the *Southern Surveyor* (a Simrad EK500) and trawl sampling to estimate the species and size composition of acoustic targets. The survey will be repeated in 1993.

**Leg 2:**
To examine the productivity of the mid-slope region off southern Tasmania and the processes supporting the rich fisheries of this area. In particular, the cruise examined near-surface primary productivity and microbial productivity through the water column, the flux of material from the near-surface to deep water, the vertical migrations of organisms through the water column, advection of material into the area, and the trophic pathways leading from primary producers to commercial fishes. This summer cruise was the second in a series of four cruises that will examine these processes on a seasonal basis.

## Primary objectives in detail

**Leg 1:**

1. Conduct echo-integration acoustic surveys of the orange roughy fishing grounds off southern Tasmania (Maatsuyker, Pedra Branca area).
2. Obtain in situ target strength (TS) measurements of orange roughy and other species on these grounds.
3. Direct operations of commercial vessels to trawl on acoustic marks.
4. To calibrate the towed transducer at depth.

**Leg 2:**

1. To determine the day/night vertical distribution of zooplankton, midwater and demersal fishes at a site off Pedra Branca, southern Tasmania using replicated, day/night demersal, midwater and plankton tows.
2. To examine the diet of the dominant fish and zooplankton species at the study sites through stomach content and stable isotope analyses, as the basis for determining the general trophic structure at mid-slope depths, the vertical distribution of feeding, and resulting vertical flux of material.
3. To carry out three cross-slope CTD transects to determine water mass structure in the sampling area.
4. To measure zooplankton biomass, primary productivity and the concentration of HPLC phytoplankton pigment at the trawl site and on the cross-shelf transects.
5. To continue the study of currents at the Pedra Branca site begun during SS2/91, by redeploying two current meters retrieved by one of the commercial vessels during the first leg of the current cruise.
6. To investigate the flux of detritus through the water column by deploying moored and free-floating sediment traps.
7. To use acoustics in conjunction with net sampling to estimate the vertical biomass distribution and its daily vertical flux through the water column.

**Ancillary Projects**

1. To collect marine invertebrate fauna for the taxonomic collections of the South Australian Museum of Natural History.
2. To collect taxonomic specimens for the ISR Munro Ichthyological Collection at the CSIRO Division of Fisheries in Hobart.

## Results

**Leg 1:**
All objectives were met during the first leg of the cruise.

1. An echo-integration acoustic survey was conducted over the Maatsuyker–Pedra Branca fishing ground south of Tasmania. Around 45 hills currently fished by the industry were surveyed. *(The positions of the hills, which were obtained from the industry, are not listed to maintain confidentiality.)* Transects were also made between hills and toward the shelf to 700 m and offshore to 1500 m to examine the abundance of fish not on hills. The Pedra Branca fishing hills were surveyed three times to obtain an estimate of sampling variability and the dynamic behaviour of the fish.

2. Target strength (TS) measurements were carried out on aggregations of orange roughy and deepwater oreosomatids, the dominant species-groups in the fishery.

3. Under the direction of the *Southern Surveyor*, four fishing vessels—the *Corvina* and *Teena B* (4–8 February), and *San Rakino* and *Belinda* (9–13 February)—conducted fishing operations to sample the species and size composition of fish that had been surveyed acoustically. Altogether these fishing vessels attempted 62 trawls, although many resulted in the gear becoming hooked up on the bottom and in several cases nets were damaged. However, a considerable quantity of fish was caught (over 100 tonnes) with orange roughy being the dominant fish in most trawls. The other dominant fishes in catches were smooth dory and squalid sharks. Orange roughy were dominant in catches taken in the western sector of the fishery, whereas smooth dory appeared to dominate catches from the deeper eastern hills. Catches were retained by the commercial vessels as part of a catch-for-charter quota arrangement with the Australian Fisheries Management Authority (AFMA).

4. The transducer in the towed body was calibrated from the surface to 1000 m depth at short (0.3 m $s^{-1}$) and medium (1.0 m $s^{-1}$) pulse lengths.

**Leg 2:**
The objectives of Leg 2 were largely met.

1. To determine the day/night vertical distribution of zooplankton, and midwater and demersal fishes, a 24-hour series of sampling was carried out with the EZ opening–closing net for zooplankton, the opening–closing cod-end system attached to the International Young Gadoid Pelagic Trawl (IYGPT) for midwater nekton; and the Engels demersal trawl for demersal fishes and invertebrates.

The opening–closing plankton and midwater samples were obtained for 100-m layers from 900 m to the surface, with two complete sets being obtained for both day and night periods. Six valid demersal trawls were completed, equally divided between day and night. To obtain samples representative of day and night distributions all net sampling was suspended for two hours at both dawn and dusk. It was originally intended to do 48 hours of EZ net sampling up to 72 h stratified pelagic trawling, but this was not possible, due mainly to the reduction in ship time allocated for the cruise. However, several periods were lost due to inclement weather and ship breakdowns, and 18 h were lost in modifying the newly acquired opening–closing midwater system to make it fully operational.

2. Samples of midwater and demersal specimens were taken for dietary studies to be carried out in the laboratory. Samples for stable-isotope analysis were taken from trawls, plankton net catches and from the particulate matter from Niskin samples.

3. Two of the three cross-slope CTD transects were completed. The third transect was not completed due to circumstances beyond our control. At each station, CTD casts measured temperature, salinity and oxygen over a range of depths. These values were calibrated with reversing thermometers on selected Niskin bottles and from discrete Niskin bottle samples. Nutrients were also analyzed from the bottle samples. Light, salinity, temperature, and chlorophyll fluorescence profiles to 150 m were also obtained with a Seacat profiler. Drop net samples were taken from 0–150 m depths to assess zooplankton biomass. Primary productivity as a function of depth and light intensity was measured at selected stations. At the outermost stations, and the stations at ~1000 m depth, microbial production was assessed through the water column, using tritiated thymidine.

4. Zooplankton biomass, as measured with drop-net casts, primary productivity, and chlorophyll concentrations were measured over a 24-h period at the main sampling site as well as on the CTD transects.

5. The current meters deployed during SS 2/91 were recovered during Leg 1 and redeployed in the same area at the beginning of Leg 2.

6. A sediment trap was deployed with the current meter at the beginning of Leg 2. The free-floating sediment trap was not deployed, due to inadequate tracking equipment and lack of time to follow it over an extended period.

7. Four acoustic profiles (two in day and two at night) were obtained of the abundance and size-frequency distribution of acoustic scatterers through a 1000-m water column. Results of these profiles will be compared with the day–night vertical distribution of organisms sampled with the pelagic net.

## Cruise Narrative

**Leg 1**

*Southern Surveyor* left Hobart at 0830 h on 5 February 1992, and headed for the Maatsuyker fishing ground off southern Tasmania along with two orange roughy fishing vessels, *Teena B* and *Corvina*. Mechanical problems with the vessel led to a loss of ~10 hours on the first day. The fishing vessels were instructed to proceed ahead to investigate the first fishing area to be surveyed, known as Shark's Tooth, NW of Maatsuyker hill. After repairs to *Southern Surveyor*, the acoustic towing cable was streamed and re-spooled under tension. This was necessary because the cable had been removed and re-spooled ashore for winch repairs shortly before the cruise. Although the re-spooling was not entirely satisfactory, the vessel proceeded to the fishing ground and began surveying the first hills.

From 5–8 February, while *Teena B* and *Corvina* worked with *Southern Surveyor*, the survey of the western and central fishing hills was completed (Shark's Tooth and Maatsuyker, and Pedra Branca areas respectively). The work proceeded smoothly, and around 35 positions (most of which were hills) were surveyed. At least two orthogonal transects were made over each position with the acoustics mounted on the towed body towed at ~500 m depth. On hills with large fish marks, additional transects were made and the commercial fishing vessels trawled there to obtain fish samples. Two scientists—one from CSIRO and one from the Tasmania Department of Sea Fisheries—carried out biological analyses on the catches on board each fishing vessel. Most of the catches from these areas were dominated by orange roughy.

Approximately half the acoustic marks surveyed by *Southern Surveyor* were considered untrawlable by the fishing skippers. Additional acoustic transects were carried out on some of the larger marks to record the target strength of individual fish as a further means of estimating species composition. During the target strength tows, the towed body was only ~100–200 metres above the bottom. Additional acoustic transects were also carried out in shallower water (to 700 m) and deeper water (to 1500 m) water and between the western and central fishing areas. Only scattered, low-density fish marks were encountered on these transects, but trawl samples were taken from representative areas considered trawlable.

On the morning of 9 February, *Teena B.* and *Corvina* returned to port after transferring scientists at Recherche Bay in southern Tasmania onto the second pair of commercial vessels, the *San Rakino* and *Belinda*. During the changeover period, the towed-body transducer was calibrated with depth to 1000 m. This operation, which required 12 h to complete, involved suspending a standard copper sphere beneath the towed body and recording changes in its apparent target strength as it was lowered through the water column.

The second half of the survey concentrated on a cluster of about 15 fishing hills in the eastern sector of the fishing grounds. Most of these hills were deeper, rising from about 1300–1400 m depth to about 900 m from the surface, where catches were characterised by a dominance of smooth dory as opposed to orange roughy. However, one large catch (~15 t) was composed primarily of deepwater sharks. Many of acoustic targets were found at the top of steep hills and proved difficult to trawl. A high proportion of the attempted trawls on these hills resulted in large catches of coral or the gear becoming hooked up.

*Southern Surveyor* carried out replicate surveys of several of the hills to examine sampling variability. With the towed body directly beneath the vessel, several drifts across fish aggregations were carried out to obtain target strength distributions of the schools. This proved more successful than towing the towed body behind the vessel, presumably it was less disturbing to the fish aggregations.

On 13 February the spooling of the towed body cable became so disrupted that it posed a significant risk to the safety of the towed equipment. Consequently, the cable was streamed to the last lay and re-spooled satisfactorily, a task that took about 12 h to complete. The fishing vessels and *Southern Surveyor* returned to Hobart on the afternoon of 13 February 1992.

**Leg 2**

*Southern Surveyor* left Hobart on schedule at 0830 h on 14 February. At 1600 h, the sampling site in the area of 44°11'5" S,147.00'0"E. was reached and the current meter and sediment-trap mooring re-deployed. This mooring will be recovered in about 6 months.

Over the next 24 h, an alternative trawl site was selected to the one on the SS 02/91 cruise that had caused severe net damage. Additionally, problems with the operation of a recently purchased opening–closing cod-end system for the midwater trawl were investigated. This system was received just before the cruise and had not been tested at sea. Initial deployments were unsuccessful because of problems with depth sensors mounted on the net and the separate cod ends, which had triggered and closed properly on deck, failing to do so when deployed. Eventually the problem was traced to poor connectors in the timer unit; once soldered, they functioned without further problem.

During modification of the opening–closing codend system, the EZ net was deployed over 24 h (15–16 February) to sample the day and night distribution of the zooplankton. The EZ system performed without problem and replicate day and night samples were obtained for 100-m depth intervals.

On 16–17 February, 24 h of depth-stratified pelagic trawling was successfully carried out, interspersed with CTD/rosette casts to estimate primary productivity. On 18 February, an acoustic profile of the water column was obtained before steaming for Recherche Bay, where an exchange of some scientific personnel took place.

On 19–20 February, 24 h of demersal trawling was carried out, along with a further night-time acoustic profile of the water column, a test of the CTD system, and a final depth-stratified midwater trawl. During this final trawl, weather conditions worsened considerably and the pelagic trawl net was severely damaged—an entire panel blown out—on retrieval. Sampling was discontinued for the night.

The following day (21 February), the central CTD transect, which passes through the biological sampling site, was completed in ~24 h. While the ship was steaming to the next transect on the morning of 22 February, the weather deteriorated and winds increased to Force 8/9, at which point sampling was abandoned. At this time a member of the scientific staff reported a medical problem, which worsened rapidly, requiring onshore medical attention and transfer to hospital. The vessel returned to Recherche Bay to put the staff member ashore, and to shelter from the storm. It remained at anchor until the evening of 23 February, when it headed back out and, as conditions were suitable, completed the westernmost CTD transect by the end of 24 February. We then steamed back toward Hobart, stopping at the main sampling station to test new software for the CTD, and attempted a further towed-body calibration. The vessel arrived in Hobart at 1430 h on 25 February 1992.

## Summary

The first leg of the cruise was notable for its thorough coverage of a highly complex fishing ground, comprising a dispersed group of over 40 previously unsurveyed fishing hills, during a period of only 10 days. In addition to completing the routine survey transects, surveys of several hills were replicated and target strength (TS) data were obtained from several aggregations. Completion of the survey in the time available was attributable to the virtually flawless performance of the acoustic system, the capacity of *Southern Surveyor* and the coordinated effort with four cooperative and able commercial fishing vessels. We were further aided by mainly excellent weather conditions.

Initial examination of the TS data indicates two modes, one consistent with the TS of orange roughy and the second with the suspected TS of the deepwater oreosomatids. From these data it should be possible to estimate the biomass of orange roughy and oreosomatids within fairly broad confidence limits, the breadth being largely a

function of uncertainty about species composition. Further research should allow us to largely resolve this uncertainty and provide credible biomass estimates by major species for the south Tasmanian deepwater fishery.

The second leg of the cruise was the second in a series of four cruises designed to provide seasonal coverage of the primary productivity of the mid-slope region, the flux of material from near-surface to near-bottom waters; the daily and seasonal vertical movements of dominant organisms through the water column and their associate predator–prey relationships.

Although there was insufficient time to complete all aspects of the sampling, most was completed satisfactorily. Several items of new gear, including a deepwater rotating sediment trap and the opening–closing cod-end system for the midwater trawl, were successfully deployed.

This was the first oceanographic and ecological study of a mid-slope fish community in the Southern Hemisphere and one of the most broadly interdisciplinary studies of a deepwater fish community ever undertaken. As such it represents a major scientific undertaking with substantial implications for assessing the ecological sustainability of Australian deepwater fisheries.

## Reporting of Results

The results of the acoustic survey will be fully reported to the relevant government/resource management/industry committees and at a public meeting (the Annual Orange Roughy Workshop) in 1992. Full scientific findings will be published in the scientific literature, and in articles in fishing industry literature.

Data from the cruise are held by the CSIRO Division of Fisheries in Hobart and Cleveland. The principal contacts for information are:

Acoustic, Fisheries and Biological data (Dr Tony Koslow in Hobart)
Taxonomic data (Dr Alan Williams in Hobart)
Fisheries oceanographic and environmental data (Dr John Parslow in Hobart)
Microbial productivity data (Dr David Moriarty in Cleveland).

## Scientific Personnel

*(Note: unless indicated otherwise, all scientific personnel are staff of the CSIRO Division of Fisheries. Scientific staff on Southern Surveyor were placed on 12-hour rosters. Watches 1 and 2: start times 1230 and 0030 h. Scientific staff on commercial vessels worked as required by the research cruise program.)*

**Leg 1:**

FRV *Southern Surveyor*:

| | |
|---|---|
| Dr T. Koslow | (Cruise Leader) |
| Dr A. Williams | |
| Mr R. Kloser | |
| Mr M. Sherlock | |

Commercial fishing vessels:

| | |
|---|---|
| Mr M. Lewis | |
| Mr R. McLoughlin | |
| Dr J. Lyle | (Sea Fisheries, Tasmania Dept of Primary Industries) |
| Mr S. Riley | (SF, TDPI) |
| Mr J. Kitchener | (SF, TDPI) |
| Mr W. Ford | (SF, TDPI) |
| MsK.Gowlett-Holmes | (South Australian Museum of Natural History) |

**Leg 2:**

| | |
|---|---|
| Dr T. Koslow | (Cruise Leader, Principal Investigator) |
| Dr A. Williams | |
| Mr R. Kloser | |
| Mr J. Cordell | |
| Mr M. Lewis | |
| Ms P. Bonham | |
| Mr D. McKenzie | |
| Mr R. Plaschke | (CSIRO Division of Oceanography) |
| Mr R. Griffiths | |
| Mr B. Griffiths | (left vessel at 1200 h on 18/2 at Recherche Bay) |
| Dr G. Fenton | (Principal Investigator) (Zoology Dept. Univ. Tasmania) (left vessel at 1200 h on 18/2 at Recherche Bay) |
| Mr I. Suthers | (Univ. NSW) (left vessel at 1200 h on 18/2 at Recherche Bay) |
| Dr J. Parslow | (Principal Investigator) (joined vessel at 1200 h on 18/2 at Recherche Bay) |
| Mr M. O'Donohue | (joined vessel at 1200 h on 18/2 at Recherche Bay) |
| Ms L. Clementson | (joined vessel at 1200 h on 18/2 at Recherche Bay) |

## Acknowledgements

We gratefully acknowledge the assistance of Matt Punch, Steve Harvey, Keith Saunders and Jeff White, the skippers of *Corvina, Teena B., Belinda* and *San Rakino*, and their crews, for their effort and cooperation in making the acoustic survey successful. Thanks are also extended to Jeremy Lyle, Sean Riley, John Kitchener and Wes Ford of the Sea Fisheries Laboratories, Tasmania Dept of Primary Industries, for their assistance with coordinating trawling operations and sampling on board the commercial vessels during the acoustic survey.

Our appreciation also goes to the fishing skippers who generously provided us with the location of the south Tasmanian fishing hills. We are always pleased to acknowledge the able assistance of the Master, Jim London; the Fishing Master, Roger Pepper; Second Mate, John Boyse; and the crew of the *Southern Surveyor* in what was a busy and demanding cruise. Our needs ashore were ably met by the Vessel Operations Manager, Clive Liron.

This research cruise was funded by (i) the CSIRO Division of Fisheries (Temperate and Deepwater Fisheries Resources Program, Marine Environment Research Program and Research Support Program); (ii) a research grant from the Australia Research Council: *Food-chain structure on the mid-slope region off southeast Australia* awarded to Dr Gwen Fenton, Zoology Department, University of Tasmania and Dr Tony Koslow, CSIRO Division of Fisheries; (iii) Fishing Industry Research and Development Council grants 90/25 *Development and use of acoustic techniques for the assessment of deepwater commercial fish stocks* (Principal Investigator Dr Tony Koslow), and 91/17 *Fisheries oceanography of east Tasmania slope waters* (Principal Investigators Dr John Parslow and Dr Tony Koslow).

Fishing quota-for-charter was awarded during the survey period to cooperating fishing vessels by the Australian Fisheries Management Authority.

Tony Koslow
**Cruise Leader**
**Principal Investigator**

John Parslow

Gwen Fenton

**Principal Investigators**

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

## Contacts

**For further information about this cruise contact:**

Dr Tony Koslow
CSIRO Division of Fisheries
GPO Box 1538
Hobart, Tasmania 7001
Tel: (002) 20–6358
FAX: (002) 24–0530

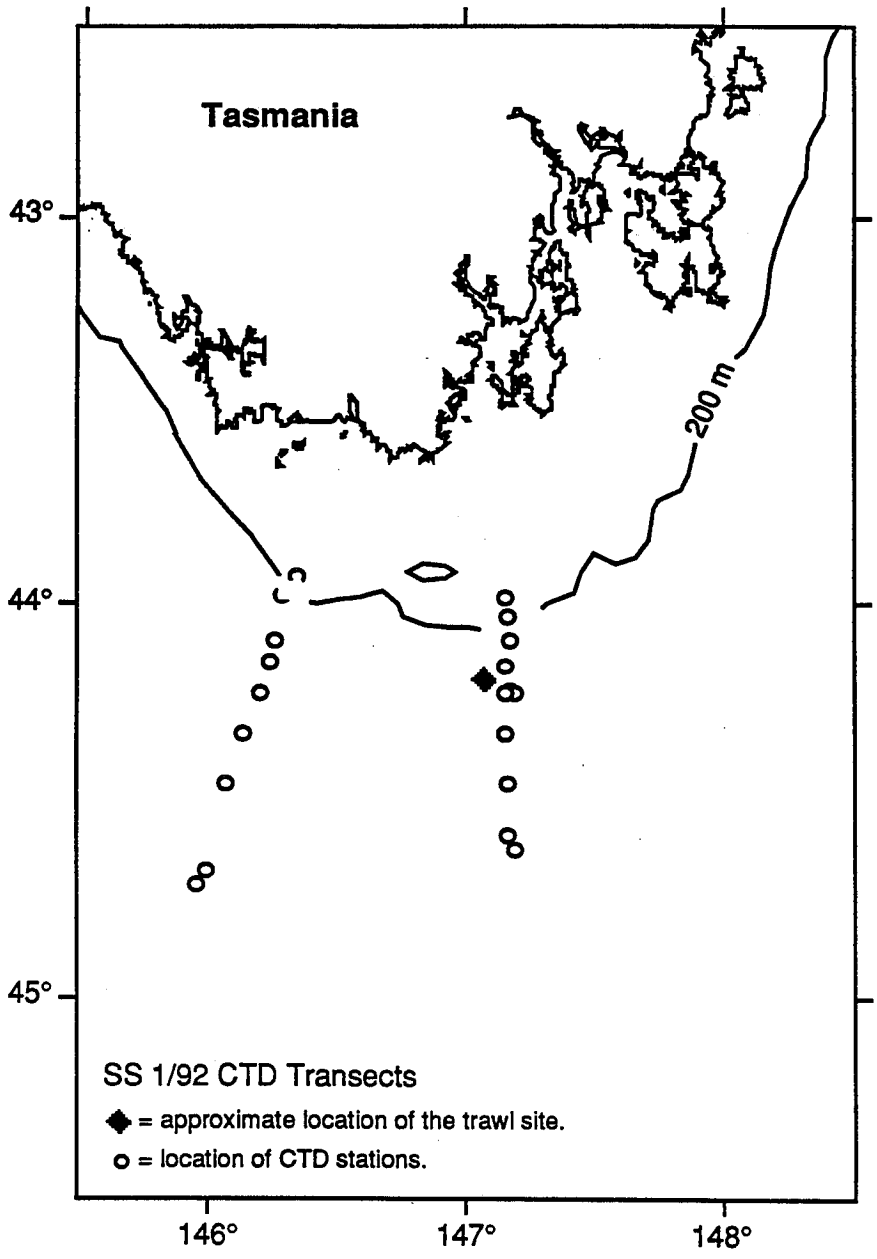
Mr Clive Liron, Vessel Operations Manager
CSIRO Division of Fisheries
GPO Box 1538
Hobart, Tasmania 7001
Tel: (002) 20–6234
FAX: (002) 24–0530



**Distribution:**

Normal distribution
Cruise participants

**Fig 1. Area of operation**



# Appendix

**Table 1. Stations occupied during SS 01/92 Leg 2.**

| Station | Date (Feb 92) | Time | Lat °S | Long °E | Activity |
|---|---|---|---|---|---|
| 3 | 15 | 0050 | 44.11.50 | 147.04.60 | Pelagic trawl 400–900 m |
| 4 | 15 | 0545 | 44.18.50 | 147.80 | CTD station |
| 5 | 15 | 0818 | 44.11.60 | 147.08.30 | Pelagic trawl 400–900 m |
| 6 | 15 | 1400 | 44.11.70 | 147.10.80 | E.Z. net |
| 7 | 15 | 2010 | 44.11.20 | 147.09.40 | Pelagic trawl |
| 8 | 15 | 2150 | 44.11.90 | 147.09.30 | E.Z. net |
| 9 | 16 | 0200 | 44.11.60 | 147.40 | E.Z. net |
| 10 | 16 | 0630 | 44.11.80 | 147.06 | Pelagic trawl |
| 11 | 16 | 0830 | 44.12.70 | 147.12.57 | E.Z. net |
| 12 | 16 | 1316 | 44.12.65 | 147.32 | CTD station |
| 13 | 16 | 1540 | 44.13.60 | 147.30 | Pelagic trawl |
| 14 | 16 | 1920 | 44.16.20 | 147.14.50 | CTD station |
| 15 | 16 | 2135 | 44.16 | 147.13 | Pelagic trawl |
| 16 | 17 | 0111 | 44.13.80 | 147.60 | CTD station |
| 17 | 17 | 0223 | 44.14.80 | 147.03.60 | Pelagic trawl 0–400 m |
| 18 | 17 | 0610 | 44.14.40 | 147.07.70 | CTD station |
| 19 | 17 | 0900 | 44.14.10 | 147.08.50 | Pelagic trawl |
| 21 | 17 | 1200 | 44.18.16 | 147.19.01 | CTD station |
| 22 | 17 | 1303 | 44.18.20 | 147.19 | Pelagic trawl |
| 23 | 17 | 1750 | 44.13 | 147.06 | CTD station |
| 24 | 17 | 2347 | 44.13.30 | 14708.70 | Pelagic trawl 900–400 m |
| 25 | 18 | 0200 | 44.13.40 | 147.18.90 | Pelagic trawl |
| 26 | 18 | 0645 | 44.13.60 | 147.08.30 | Towed body |
| 27 | 19 | 0142 | 44.11.10 | 147.04.60 | Demersal trawl |
| 28 | 19 | 0630 | 44.11.40 | 147.08.50 | Demersal trawl |
| 29 | 19 | 0940 | 44.11.30 | 147.06.60 | Demersal trawl |
| 30 | 19 | 1245 | 44.11.30 | 147.05.50 | Demersal trawl |
| 31 | 19 | 1627 | 44.11.50 | 147.07.90 | Demersal trawl |
| 32 | 19 | 1858 | 44.11.50 | 147.10.10 | CTD station |
| 33 | 19 | 2121 | 44.11.70 | 147.07.10 | Demersal trawl |
| 34 | 20 | 0110 | 44.11.80 | 147.10.40 | Towed body |
| 35 | 20 | 0515 | 44.11.40 | 147.06.80 | Demersal trawl |
| 36 | 20 | 0824 | 44.11.50 | 147.02.80 | CTD station |
| 37 | 20 | 1050 | 44.10.20 | 147.01.10 | CTD station |
| 38 | 20 | 1301 | 44.12.70 | 147.04.70 | Pelagic trawl |

| Station | Date (Feb 92) | Time | Lat °S | Long °E | Activity |
|---|---|---|---|---|---|
| 39 | 21 | 0818 | 44.59.10 | 147.09.60 | CTD station |
| 40 | 21 | 1013 | 44.01.60 | 14710.20 | CTD station |
| 41 | 21 | 1230 | 44.05.30 | 147.10.30 | CTD station |
| 42 | 21 | 1400 | 44.09.60 | 147.09.50 | CTD station |
| 43 | 21 | 1630 | 44.13.30 | 147.09.90 | CTD station |
| 44 | 21 | 1905 | 44.13.50 | 147.11.80 | CTD station |
| 45 | 21 | 2140 | 44.19.80 | 147.09.60 | CTD station |
| 46 | 22 | 0030 | 44.27.20 | 147.09.70 | CTD station |
| 47 | 22 | 0320 | 44.35.20 | 147.09.80 | CTD station |
| 48 | 22 | 0615 | 44.37.50 | 147.10.90 | CTD station |
| 49 | 23 | 2330 | 43.52.50 | 146.20.30 | CTD station |
| 50 | 24 | 0110 | 43.58.80 | 146.19.50 | CTD station |
| 51 | 24 | 0235 | 43.58.80 | 146.17 | CTD station |
| 52 | 24 | 0415 | 44.05.60 | 146.15 | CTD station |
| 53 | 24 | 0610 | 44.08.80 | 146.13.90 | CTD station |
| 54 | 24 | 0800 | 44.13.70 | 146.11.60 | CTD station |
| 55 | 24 | 1115 | 44.19.80 | 146.07.60 | CTD station |
| 56 | 24 | 1515 | 44.27.40 | 146.03.80 | CTD station |
| 57 | 24 | 1840 | 44.42.90 | 145.57.80 | CTD station |
| 58 | 24 | 2030 | 44.40.80 | 146.30 | CTD station |
| 59 | 25 | 0435 | 44.13.90 | 147.09 | Towed body aborted |
| 60 | 25 | 0500 | 44.13.70 | 147.09.40 | CTD station |