1993 RESEARCH VESSEL PROGRAM

FRV *SOUTHERN SURVEYOR*

July 14 – August 27 1993

CRUISE PLAN SS 5/93

CSIRO
AUSTRALIA

DIVISION OF FISHERIES

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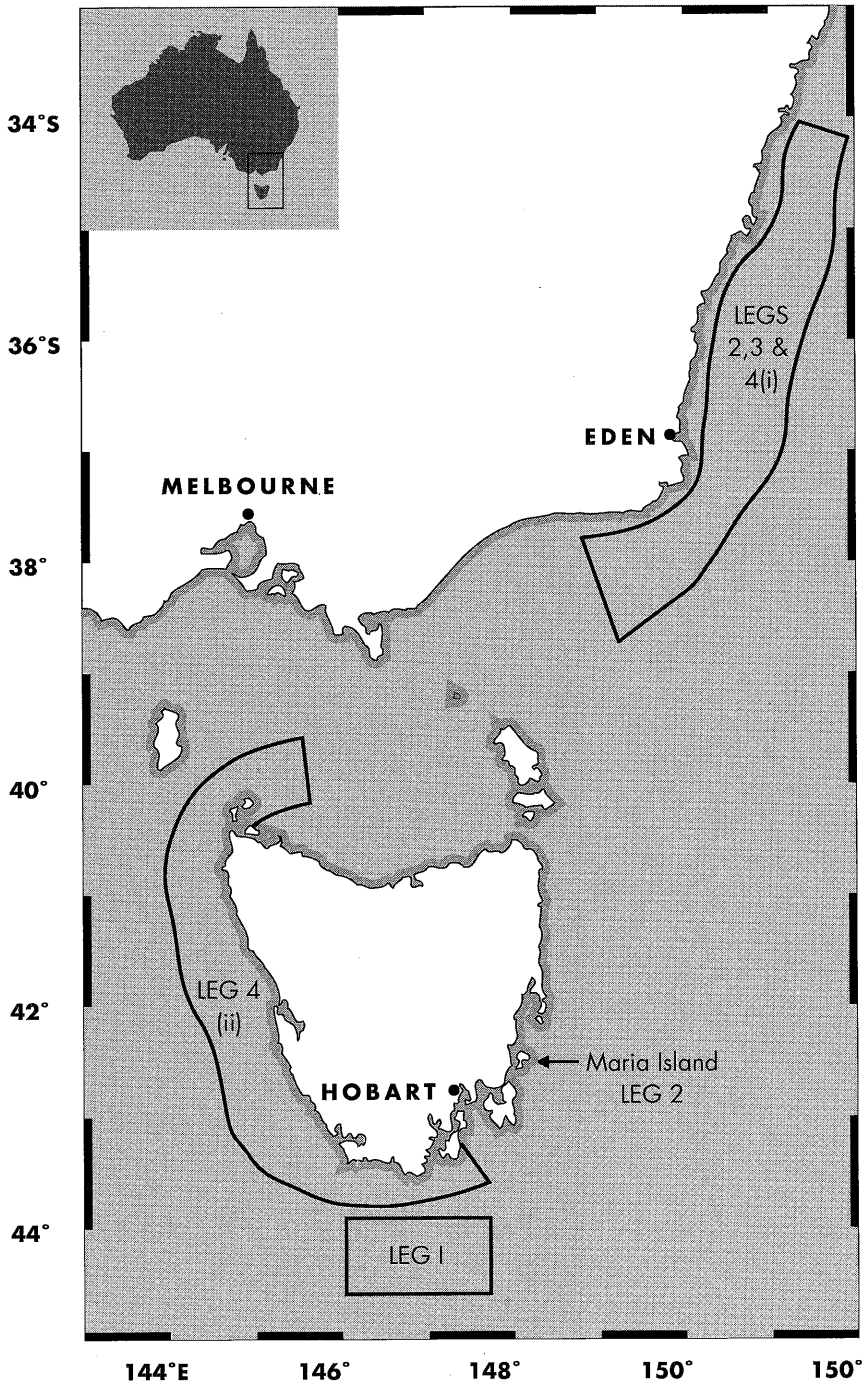

Figure 1: Main study areas on Cruise SS 5/93, Legs 1, 2, 3 and 4

PRELIMINARY

A Temperate and Deepwater Fisheries Resources program cruise is scheduled with four Legs in the waters of the South East Fishery (SEF), within latitudes 33°35'– 44°40'S and longitudes 146°00'–150°30'E (see Fig. 1). The cruise is divided into three parts, with a total of four legs. The first part (Leg 1) will continue investigations of ecological processes begun in 1992 in the mid-slope region south of Tasmania. This is the site of major orange roughy and oreo dory fisheries. The second part (Legs 2 and 3) will initiate a study of the shelf ecosystem of the SEF, where a mixed-species trawl and seine fishery is carried out. The third part (Leg 4) will provide data on the distribution and abundance of ichthyoplankton in the continental shelf waters off south-eastern Australia and Tasmania.

LEG 1

Departure: Hobart 0830, Thursday, July 14, 1993.
Return: Hobart 1700, Thursday, July 22, 1993, a total time of nine days.

Leg 1 will examine several aspects of the ecology of the mid-slope region off southern Tasmania, which is the major site of the orange roughy fishery during the non-spawning season. Firstly, specimens from stands of deepwater coral on some of the relatively unfished areas will be photographed and collected to assess coral density, coral community composition and associations with other fauna such as fish. This habitat appears to be severely affected by trawling and yet its ecological role is unknown. The samples will be used to examine the age and growth of the corals; the relative width of growth rings will be used in a study of deepwater environmental variability. Second, the vertical distribution of zooplankton and nekton through the water column at 1000 m depth will be examined with opening/closing nets. Finally, if time permits, there will be a preliminary examination of the fine-scale physical and biological spatial structure around Pedra Branca to assess the possible influence of a Taylor column (gyre) established by the physical circulation across the pinnacle.

LEGS 2 & 3

Departure: Hobart 0830, Friday, July 23, 1993.
Arrival: Eden 1400, Wednesday, August 4, 1993, for bunkering and crew change.
Departure: Eden 2200, Wednesday, August 4, 1993.
Staff Transfer: Eden 1500, Monday, August 16, 1993.

Legs 2 and 3 of the cruise will examine aspects of the demersal communities in the SEF. The abundance, species composition and productivity of the SEF commercial fish populations are influenced by many factors including bottom topography, the structure and pattern of benthic communities and their possible modification through trawling, large scale and local oceanographic features, directed commercial fishing, indirect commercial fishing through bycatch and discarding, and multispecies interactions. Scientific advice to mangers on the current status and expected future status of the SEF commercial fisheries needs to be given in the context of possible causes and future ramifications. The CSIRO Division of Fisheries is therefore undertaking a series of cruises in the SEF to

obtain data on the above factors and to determine their relative importance in the fisheries of the SEF. Legs 2 and 3 of SS5/93, the first of this series, will trial equipment for the quantitative sampling of seafloor communities; will obtain initial data on the scale of spatial variability in the structure of the seafloor and the major demersal fish and invertebrate communities; will compare initial trophic descriptions of the SEF ecosystem using several methods, and will measure standard oceanographic features of the area. In addition, possible effects of nine years of commercial fishing on the benthic composition and associated fish community will be examined by retrawling and rephotographing an area off Maria Island, eastern Tasmania, first examined by CSIRO fisheries scientists in 1984 before the start of commercial trawling in the area.

LEG 4

Departure: Eden 1600, Monday, August 16, 1993.
Arrival: Hobart 1500, Friday, August 27, 1993.

Leg 4 will operate in coastal waters between Bermagui (36°25'S) and Pt Hicks (37°50'S), then proceed through Bass Strait and return to Hobart via Tasmania's west coast.

Leg 4 forms an integral part of an FR&DC funded study analysing the spawning distribution and stock structure of temperate Australian fin fishes. The region between Bermagui and Pt Hicks represents both an important area of the SEF and a dynamic region oceanographically yet little is known regarding the distribution of spawning activity or early life history stages within the area. The leg will firstly examine the broadscale distribution of ichthyoplankton with respect to oceanographic properties within this area and examine, in detail, the vertical distribution of larval fish at both on shelf and off shelf localities in the vicinity of Eden. The second portion of the leg will assess the effectiveness of surface sampling in the identification of spawning grounds of SEF species within Tasmanian waters.

OBJECTIVES ARE TO:

Leg 1

1. Photograph and dredge for deepwater corals on relatively unfished hills in the Southern Zone fishing area.

2. Determine the day/night vertical distribution of zooplankton and midwater fishes at a site off Pedra Branca, southern Tasmania, using replicated day/night midwater and plankton tows and acoustics.

3. Examine the subsampling variability of zooplankton samples using the Folsom splitter.

4. Obtain CTD profiles at a station on the shelf, shelf break, and at 1000 m.

5. Examine the fine-scale physical and biological structure around Pedra Branca with CTD, acoustic

and MIDOC sampling. If time is available, the fine-scale spatial structure of the zooplankton will also be examined.

6. Calibrate the towed-body 38 kHz and hull-mounted 38 and 120 kHz transducers.

Legs 2 & 3

1. Trial a demersal sampler designed to provide video records of benthic topography and epibenthic fauna, and epibenthic and infaunal samples and then calibrate it against a Woods Hole epibenthic sled and a 0.1 m^2 Smith-McIntyre grab.

2. Carry out replicated demersal trawling and benthic sampling to determine the appropriate intensity and spatial scale for surveys in the SEF.

3. Provide acoustic data from the Roxanne imaging system and the EK500 echo sounder to compare their ability to differentiate benthic habitats on the basis of bottom topography and hardness.

4. Obtain sediment samples with a Smith-McIntyre grab for correlation with faunal composition and for the calibration of the Roxanne and EK500.

5. Determine the winter distribution and abundance of the main seafloor invertebrate species on the continental shelf in the SEF, using benthic samplers and underwater video photography.

6. Determine the winter distribution and abundance of the main demersal fish species on the continental shelf in the SEF, using demersal trawls and the EK500.

7. Obtain preliminary data on the quantity, species and size composition of fish and invertebrates, particularly the juveniles of South East Fishery quota species, that are taken as bycatch from a commercial trawl on an area of the inner continental shelf in the SEF.

8. Sample stomach contents from commercial and other abundant fish species, to indicate their immediate feeding links and sampling strategies required for further delineation.

9. Obtain samples of fish, plankton and seafloor invertebrates for stable isotope analysis, to provide preliminary data on their trophic position in the SEF community, and to direct application of this technique in future SEF studies.

10. Obtain otoliths from and age fish selected for biological samples.

11. Compare the status of the benthic community and seafloor off Maria Island with that sampled in 1984, using demersal trawl and underwater photography.

12. Collect ichthyoplankton samples with bongo nets, along the east coast of Tasmania.

Leg 4

1. Investigate the broad scale cross-shelf and offshore distribution of ichthyoplankton in southern NSW and eastern Victorian waters.

2. Compare the diel vertical distribution of larval fish in shelf and slope waters in the vicinity of Eden.

3. Describe the physical oceanography and in particular to describe the level of vertical mixing in both sampling localities (Eden and the Tasmanian west coast).

4. Compare surface and oblique samples and their respective effectiveness in locating spawning grounds.

5. Collect specimens for the larval fish reference collection as well as samples for otolith micro-probe and genetic work.

CRUISE PLAN

Leg 1 will carry out the following activities:

1. A photographic survey of the benthic fauna of the deep hills and the collection of specimens of deepwater corals.

2. Sampling of the vertical distribution of zooplankton and small midwater fishes with the opening-closing EZ net (350 mm mesh). The tows will sample nine depth strata (at 100 m depth intervals between the surface and 900 m). The tows will be carried out during hours of full daylight (0800–1600 h) and darkness (2000–0400 h); periods of dawn (0400–0800 h) and dusk (1600–2000 h) will be avoided as far as possible.

3. Sampling of the depth distribution of midwater fishes. An IYGPT trawl with the MIDOC opening/closing (O/C) cod end system will be used to sample 125 m depth strata from the near-surface to 900 m. The MIDOC system will be deployed twice during each day and night period. The O/C system can sample four strata per cast. Samples will be retained for calorimetry analysis as well as for dietary analyses. Vertical profiles of target strength distributions will be obtained with the EK500 acoustic system during the day and night.

4. A CTD cast will be carried out at a station on the shelf, shelf break, and at 1000 m.

5. Closely spaced CTD profiles will be obtained in E–W and N–S transects across Pedra Branca.

6. The plankton, nekton and sound scatterers will be sampled during one day and one night period at 800 m depth in an E–W transect across Pedra Branca with the EZ net, MIDOC system and towed body acoustics.

7. The towed-body 38 kHz transducer will be calibrated with depth and hull-mounted 38 and 120 kHz transducers.

Leg 2 will carry out the following activities:

1. A 24 hour sampling using the Engel's High Rise trawl with Photosea 2000 underwater camera mounted on the headrope will be undertaken at 'Darcy's Patch' (also known as the Paddock) located 12 nautical miles east of Maria Island between the 420 and 550 m depth contours. There will be one 30 min trawl every four hours providing a total of seven trawl samples. All fish will be identified, counted, and (subsamples) measured. Up to 20 specimens per tow of *Mediaster australiensis* will be measured to determine the mean radius of a circle inscribed through their arms, used in estimating the area of each photograph. Stomach contents will be taken from 25 specimens per tow of the three species previously identified as feeding on *Ophiacantha fidelis*: *Centriscops humerosus, Coelorinchus* sp., and *Helicolenus percoides*. Stomach contents of *Mediaster australiensis* will also be examined for arms of *Ophiacantha fidelis*.

2. Three stations on the east coast of Tasmania will be sampled for ichthyoplankton. Each station will consist of one oblique tow and three consecutive 15 min surface tows. All samples will be collected using bongo nets and will be preserved in both formalin and alcohol as described for Leg 4. It is expected that each station will require three hours.

3. One day will be spent in gear testing of the new demersal sled in a shallow area (25 to 50 m depth) off Eastern Bass Strait. Calibration of the demersal sled will occur in Leg 3.

4. The remaining seven days of Leg 2 (three days have been provided for steaming and the ichthyoplankton tows), will be used in sampling cross shelf transects in the SEF in the vicinity of Eden. Four cross-shelf transects are planned with stations at 25, 50, 75, 100, 150, and 200 m depth. The exact number of transects and stations will depend on the time required for processing the catches and the weather conditions. A commercial trawl and the epibenthic sled will be deployed at each station for 30 min tows. Tow durations may be reduced if the sampling capacity of the gear is exceeded. The EK500 and Roxanne will be running at each station for calibration and between stations to determine large scale patterns in fish distribution and benthic habitat.

5. Demersal trawl samples from each station will be sorted and the fish identified, enumerated, and weighed. Subsamples will be measured and individual weights taken. Stomach samples, muscle samples for stable isotope analysis, and otoliths will be taken from selected species.

6. A CTD profile will be taken at each station.

7. Benthic samples from the epibenthic sled will be sorted to a coarse taxonomic level and weighed. Samples of the material will be retained for subsequent identification. Sediment samples will be retained for subsequent analysis. Videos will be retained for each station.

Leg 3 will carry out the following activities:

1. The first six days of Leg 3 will be spent continuing the transect sampling started in Leg 2. Three additional cross-shelf transects are planned, the exact number to depend on processing capabilities and weather. Details are as for Leg 2.

2. The final five days of Leg 3 will be spent in an intensive sampling of two small areas. These samples will provide an indication of the small scale variability of the benthic and demersal fish communities (and sampling variability), diel variability in the demersal fish communities (and diel sampling variability) as well as providing the opportunity to calibrate the epibenthic sled against other benthic samplers including Roxanne. The areas will be nested within the cross-shelf transect design to facilitate comparison of sampling variability at different spatial scales.

3. In each area a buoy will be set at the beginning and end of a long-shore transect. Over the course of two days the area between these two buoys will be repetitively sampled with demesal trawl, epibenthic sled, Smith-McIntyre grab, Woods Hole epibenthic sled, and acoustics. The repeated trawling in a small area will also provide an idea of the types of bottom disturbance caused by trawling.

4. Repeated CTD profiles will be taken to examine water column changes in this area over a two day period

Leg 4 will carry out the following activities:

1. Broad Scale Sampling (NSW/VIC)

The cruise will proceed from Eden to Bermagui to commence sampling of the first of five cross shelf transects approximately evenly spaced between Bermagui (NSW) and Pt Hicks (in the vicinity of the 'Horseshoe', Victoria). Transects consist of four stations located at innershelf (50 m), midshelf (120 m), slope (400–500 m) and offshore (>1000 m). At each station a CTD cast followed by concurrent surface and oblique tows (the latter to within 10 m of the bottom or to a maximum depth of 200 m) with bongo nets will be undertaken to map the broad scale distribution of ichthyoplankton and water mass properties within the region. Stations will be occupied regardless of time of day. Time allocated is three days.

2. Vertical Distribution

After completion of transect two (Eden/Merimbula) the diel vertical distribution of larval fish will be investigated at the midshelf and slope stations with the opening/closing bongo system. Replicate samples will be taken in each strata at each station over a day and night period. Strata to be sampled will include: surface, 0–30 m, 30–60 m, 60–90 m, 90–150 m and 150–400 m (the latter two strata at the slope station only). The EZ net will be retained as a back up sampler if problems develop with the bongo system. Sampling will avoid dawn and dusk transition periods. A CTD cast will be undertaken during each dawn and dusk period to assess the variability of water mass properties during the diel study period. Time allocated is two days.

3. Surface/Oblique Assessment
After completion of Transect 5 (Horseshoe) the FRV *Southern Surveyor* will steam southwest through Bass Strait and via the west coast of Tasmania back to Hobart. Sampling will be undertaken at the midshelf stations along six of the transects used in the 1984/85 blue grenadier survey in order to assess the effectiveness of surface verses oblique tows in identifing spawning activity of commercial species. A CTD cast will be undertaken at each station followed by three replicate oblique and surface bongo hauls. Stations will be occupied on arrival regardless of time of day. Time allocated is four days.

PERSONNEL

All personnel are staff of the CSIRO Division of Fisheries unless otherwise indicated:

Leg 1

Dr Tony Koslow (Cruise Leader, Leg 1)
Dr Alan Williams
Mr A. Tabor (Antarctic Division)
Mr A. Terauds (Uni. Tasmania)
Mr Q. Van Nguyen
Ms Cathy Bulman
Mr Rudi Kloser
Mr Mark Lewis

Leg 2

Dr Sebastian Rainer (Cruise Leader, Leg 2)
Dr Alan Williams (Assistant Cruise Leader)
Dr Nic Bax
Dr Peter Last
Dr Vicki Wadley
Mr Bruce Barker
Mr Jeff Cordell
Ms Stephanie Davenport
Mr David Evans
Mr Rudi Kloser
Mr Mark Lewis
Mr Richard McLoughlin

Leg 3

Dr Sebastian Rainer (Cruise Leader, Leg 3)
Dr Nic Bax (Assistant Cruise Leader)
Dr Barry Bruce
Mr Bruce Barker
Ms Cathy Bulman
Mr Alistair Graham
Mr Jeff Cordell
Ms Stephanie Davenport
Mr Lyndsay MacDonald
Mr Craig Proctor
Mr Gordon Yearsley
Mr Grant West

Leg 4

Mr Barry Bruce (Cruise Leader, Leg 4)
Mr Matt Sherlock
Mr Ron Plaschke
Mr Mark Lewis
Ms Caroline Sutton
Ms Cathy Bulman
Mr Lindsay MacDonald
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DISTRIBUTION

Normal distribution and cruise participants
Russell Reichelt, BRS
Peter Cassells, AFMA

APPENDIX 1: CRUISE TIME ESTIMATES

ACTIVITY	TIME (HOURS)
Leg 1	
– Steaming to and from study area	24
– Photographic survey of the deep hills and collecting deepwater corals	36
– Sampling of zooplankton and small midwater fishes:	
EZ tows 8 x 4 h	
steaming time 16 h	
Total for EZ sampling	48
– Sampling depth distribution of midwater fish	
IYGPT tows 30–45 min	
MIDOC tows 12 x 4 h	
EK500 acoustic profiles	
Steaming time	
Total for IYGPT and MIDOC sampling	72

ACTIVITY	TIME (HOURS)
– CTD casts (included)	
– Sampling plankton, nekton and sound scatterers (included)	
TOTAL	**180 (7.5 days)**
Bad weather allowance	36 (1.5 days)
Leg 2	
– Steaming to and from study area 10 + 33 + 10 h	53
– Maria Island retrawling	24
– Demersal sampler, deployment and testing	24
– Demersal trawl transects	
4 transects , 4 x 36 h	
steaming time between transects 4 h	
Total for demersal trawl sampling	160
– Ichthyoplankton tows 3 x 3 h	9
- Bunkering in Eden	16
TOTAL	**286 (12 days)**
Bad weather allowance	26 (1 day)
Leg 3	
– Steaming to and from study area	10
– Demersal trawl transects	
3 transects 3 x 36 h	
Steaming time between transects 4 h	
Total for demersal trawl sampling	120
– Gear trials	
daytime trawls 10 x 2 h	
night trawls 10 x 2 h	
daytime sled tows 10 x 2 h	
night sled tows 10 x 2 h	
daytime grabs, 20 x 15 min	
night grabs 20 x 15 min	
steaming time 6 h	
Total for gear trials	96
— Steaming between sites	12
– Transfer in Eden 15 h	15
TOTAL	**253 (10.5 days)**
Bad weather allowance	35 (1.5 days)

ACTIVITY	TIME (HOURS)
Leg 4	
1. Broad scale survey (NSW/VIC)	
– Five individual transect times:	
steaming 3 h	
bongo 4 h	
CTD 4 h	
Total five transects	55
– Steaming times between transects	21
TOTAL 1.	76 (3.2 days)
2. Vertical distribution (including 4 CTD casts)	48 (2 days)
3. Surface/oblique assessment	
– Six individual station times:	
bongo 2 h	
CTD 1 h	
– Total six transects	18
– Steaming time: Horseshoe to Hobart	63
TOTAL 3.	81 (3.4 days)
Bad weather/technical difficulty allowance	48 (2 days)
TOTAL LEG 4	**253 (10.5 days)**

P.C.Young
Chief, Division of Fisheries

Date: 5/7/93