

## Itinerary

- Leg 1: Depart Hobart: 0830 h Wednesday, 15 July 1992  
Arrive Hobart: 1700 h Friday, 24 July 1992
- Leg 2: Depart Hobart: 0830 h Saturday, 25 July 1992  
Arrive Hobart: 1700 h Thursday, 13 August 1992

## Area of operation

- Leg 1: The orange roughy spawning hill off St. Helens, NE Tasmania, 41°13.9'S 148°45.5'E.
- Leg 2: The blue grenadier spawning ground off western Tasmania and surrounding area from Lower Rocky Pt. (43°00' S 145°17'E) to SW of King Island (40°20'S 143°30'E).

## Research Background

Leg 1 of the cruise will carry out the third in a series of annual acoustic surveys of the biomass of orange roughy (*Hoplostethus atlanticus*) on their major spawning ground off northeastern Tasmania. As well as providing an estimate of roughy biomass in 1992, this survey will focus on assessing the target strength of the orange roughy and the proportion of orange roughy in the acoustic plumes found around the spawning hill. The survey will depend primarily upon use of the split-beam capability of the acoustic system (a Simrad EK500) to achieve these objectives, because trawls cannot adequately sample orange roughy in midwater. This is the final year of a FIRDC grant in support of this work, and if these objectives are achieved, the survey will not be repeated in 1993. A chartered commercial vessel will be used to carry out an egg survey of the orange roughy at this time, as a separate exercise to assess the stock's spawning biomass.

Leg 2 of the cruise will make an initial acoustic survey of the blue grenadier (*Macruronus novaezelandiae*) stock that spawns from June–August off western Tasmania. This portion of the survey will be conducted in conjunction with two chartered fishing vessels, which will fish on acoustic marks to determine the size and species composition of fish within them. The results of trawling will be compared with results from the split-beam echo sounder. Egg sampling carried out from the commercial vessels will be used to assess the feasibility of using egg surveys to estimate blue grenadier stock biomass. Plankton samples collected this year will be used by Ms C. Chang (University of Tasmania) to examine the growth of blue grenadier larvae in relation to food availability and competitors. It is likely that the acoustic survey will need to be repeated in 1993 and possibly 1994 to obtain a reliable estimate of biomass.

## Cruise Objectives

### **Leg 1:**

1. To conduct two echo-integration acoustic surveys of orange roughy on their spawning ground off northeastern Tasmania (St Helens area), with repeat transects to quantify sampling variance.
2. To obtain *in situ* target strength measurements of orange roughy on these grounds.
3. To assess the proportion of orange roughy and other fishes in acoustic marks on the spawning ground from target strength measurements.
4. To calibrate the hull-mounted and towed transducers at the surface and to calibrate the towed transducer at depth.
5. To sample acoustic marks with the Engels demersal trawl to assess the size and species composition of fish in the area and to sample fishes that can be captured in the water column with the pelagic trawl.
6. To incubate orange roughy eggs at three temperatures at sea-level pressure and at one temperature at mid-water pressure to determine development rate.
7. To establish the dead zone height and density of fish within the dead zone by comparing hull-mounted and towed transducer returns.
8. To examine the feasibility of tagging orange roughy with the Deepwater Automated Fish Tagging device.
9. To obtain flesh and liver samples of orange roughy at reproductive Stage IV to examine the relationship of body condition to fecundity.
10. To determine the buoyancy of orange roughy eggs through use of a graded density series of Ficoll solutions (C. Crossley, University of Sydney).
11. To determine the vertical distribution of orange roughy eggs from 0–900 m through use of the EZ opening/closing plankton net.
12. To obtain water column profiles of temperature and salinity with the CTD to determine sound velocity and absorption profiles.
13. Over a 48-hour period, to determine the day/night vertical distribution of midwater fishes off Pedra Branca, southern Tasmania using replicated, midwater tows with the midwater opening/closing (MIDOC) net.
14. To collect orange roughy eye lens for analysis of crystalline proteins for HPLC ageing studies (C. Crossley, Sydney University).

**Leg 2:**

1. To carry out an echo integration acoustic survey of blue grenadier off the west coast of Tasmania between the shelf break and 700 m, replicating transects day and night to assess diurnal variability.
2. To obtain day/night *in situ* target strength measurements of blue grenadier.
3. To assess the proportion of blue grenadier in acoustic marks off western Tasmania as a function of depth between the shelf break and 700 m using *in situ* TS sampling.
4. To direct the sampling of two chartered, commercial fishing vessels to assess the size and species composition and swimbladder type of fish in acoustic targets both on the bottom and in midwater.
5. To incubate blue grenadier eggs at three temperatures at sea level pressure to determine development rate.
6. To collect ichthyoplankton and microzooplankton samples from the chartered commercial vessel offshore, at the shelf break, and on the shelf on 5-10 transects to assess the distribution of blue grenadier eggs and larvae, and to obtain samples of blue grenadier larvae and microzooplankton to examine the feeding and growth of the larvae in relation to larval density and food availability (C. Chang, University of Tasmania).
7. To collect samples of orange roughy and other major species for heavy metal analysis on an opportunistic basis.
8. To obtain water column profiles of temperature and salinity with the CTD to determine sound velocity and absorption profiles.
9. To determine the vertical distribution of blue grenadier eggs from the 0-600 m above bottom with the EZ O/C plankton net.

**Cruise Plan****Leg 1:**

The vessel will leave Hobart and proceed to the orange roughy spawning ground off St Helens. Over the spawning hill, an acoustic echo-integration survey will be carried out initially and once more in ~5-d time. Surveys will consist of 12-14 transects, each 2.5 nm in length and arranged in a rectangular grid, 6 E-W, 6 N-S with two replicates of a transect in an area of high fish density. Surveys will be carried out with the towed body, which will be towed at ~5 kt. Expected time for completion of each survey: 12 hours.

Examination of the target strength (TS) distribution of the acoustic marks will follow the echo-integration surveys. The ship will drift across the major plumes of fish with the transducer 150–200 m above the plume. The towed body and transducer will be lowered in successive passes over the plume to assess the TS distribution of fish at successively lower levels. This TS sampling will enable us to determine the TS of orange roughy and to assess the frequency composition of species-groups at different TS levels within the main acoustic plume.

Trawling will be carried out to assess the size, species, and sex composition of fish within the acoustic marks and to obtain reproductively ripe-and-running individuals to carry out egg incubation and egg density experiments. The tagging device will be tested during trawl operations.

A TS will be obtained, and the EZ net will be deployed east of the spawning ground to assess the vertical distribution of orange roughy eggs, and hence the temperature at which they develop.

The towed transducer will be calibrated at depth when weather conditions permit.

If time is available at the end of Leg 1, replicated, depth-stratified midwater tows will be made over a 48-hour period with the midwater opening/closing (MIDOC) net to determine the day/night vertical distribution of midwater fishes at a site off Pedra Branca, southern Tasmania. Otherwise the tows will be made at the end of Leg 2.

### **Leg 2:**

A two-stage survey design is planned, consisting of a broad-scale survey followed by more intensive sampling of areas of high grenadier density. The two-phase survey will be repeated at 10-day intervals if time (i.e. weather) allows.

*Southern Surveyor* will proceed from Hobart to the outer edge of the shelf (170 m) off Lower Rocky Point, where it will rendezvous with a chartered fishing vessel and begin the first broad-scale acoustic survey, which will cover the area from Lower Rocky Point to SW of King Island. The survey will consist of a series of parallel transects at 5' of latitude intervals from 43°00' to 40°20' S (33 transects in all). The start and end points of the transects will be the 170 and 700 m contours, and it is estimated that the transects will be ~5–10 nm in length. The chartered vessel will be directed to sample significant acoustic targets, and at the end of each transect, *Southern Surveyor* will return along the track to take TS measurements from selected acoustic targets. Total steaming time for the broad-scale survey will be ~3 days, assuming a speed of 6 kt along the transects (total distance ~250 nm; steaming time ~42 hr); and a speed of 8 kt between transects (total distance 170 nm; steaming time ~21 hr). Upon completion of the broad-scale survey, *Southern Surveyor* will return to area(s) of high fish density to conduct a more intensive survey based upon parallel transects spaced at 1 nm intervals, although this may vary depending upon time available and the area to be covered.

Ichthyoplankton and microzooplankton samples will be obtained on every fourth acoustic transect during the broad-scale survey. On each such transect, plankton sampling will be conducted at 700, 400, 170, and 75 m depth contours.

A trawl sample of blue grenadier will be obtained in an area of spawning activity to obtain fish in spawning condition to carry out an incubation experiment with blue grenadier eggs. If possible, the fish will be transferred from the commercial vessel; otherwise *Southern Surveyor* will carry out the trawl operation.

At the end of the cruise, the *Southern Surveyor* will anchor for ~12 hr in calm water off Port Arthur to calibrate the echo sounders.

## Personnel

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

### **Leg 1:**

FRV *Southern Surveyor*.

T. Koslow (Cruise Leader)

A. Williams

R. Kloser

M. Sherlock

C. Bulman

Acoustic technician

Acoustic programmer/data analyst

C. Crossley (University of Sydney)

### **Leg 2:**

FRV *Southern Surveyor*.

T. Koslow (Cruise Leader)

R. Kloser

J. Cordell

C. Bulman

Acoustic technician

Acoustic programmer/data analyst

Commercial fishing vessel:

1:

A. Williams

C. Chang (University of Tasmania)

2:

D. Evans

Biological technician

## Contacts

For further information about this cruise please contact:

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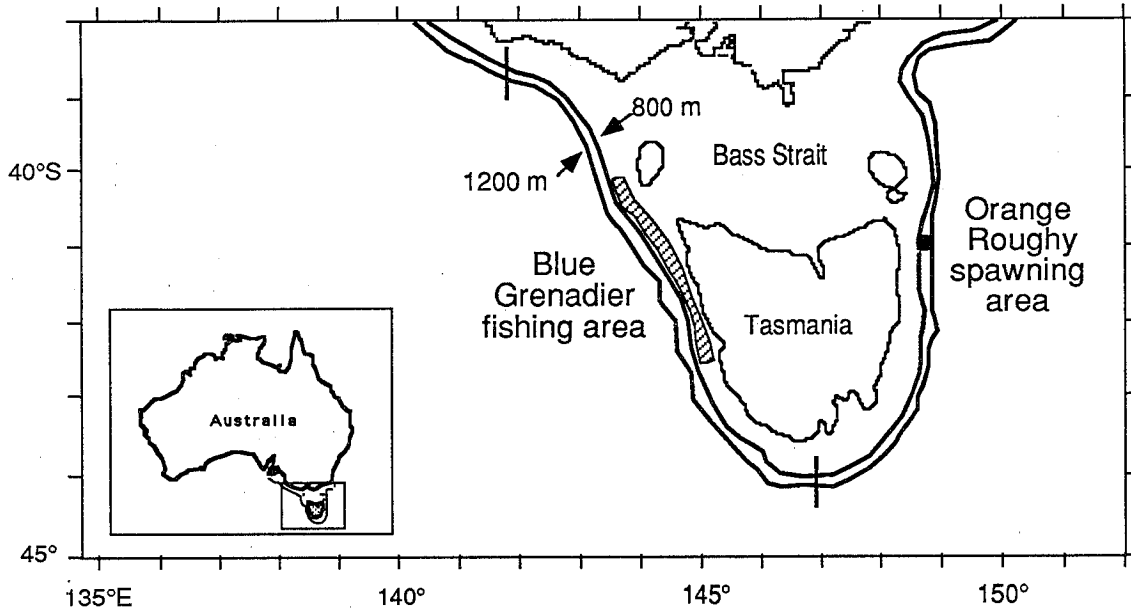
**P. C. Young**  
**Chief, CSIRO Division of Fisheries**      **Date**

**Distribution:**

Normal distribution

Cruise participants

J. Lyle (Tasmanian Sea Fisheries Laboratory, Tarooma)



**Figure 1. Area of operation**

**FRV Southern Surveyor 1992/94 Research Schedule**

Cruise	From	To	Chief Scientist	Project Title and Institute
SS3/92	Hobart We 15 Jul	Hobart Th 13 Aug	Koslow	Orange Roughy Blue Grenadier CSIRO
SS4/92	Hobart Tu 3 Nov	Hobart Tu 8 Dec	Koslow Parslow	Trawl Survey Trophodynamics CSIRO
SS1/93	Cairns We 13 Jan Darwin Fr 19 Mar	Darwin Fr 12 Feb Townsville Fr 26 Mar	Blaber Boyle Boyle	Trawl Fish Resources Current meter CSIRO/DSTO
SS2/93	Darwin Tu 2 Mar	Darwin Th 18 Mar	Miller	SAR Imaging DSTO
SS3/93	Hobart Th 1 Apr	Hobart Th 15 Apr	Parslow	Trophodynamics CSIRO
SS4/93	Hobart Tu 1 Jun	Hobart Th 24	Sainsbury	Tuna CSIRO
SS5/93	Hobart We 14 Jul	Hobart Fr 27 Aug	Thresher	Trawl/Ichthyoplankton CSIRO
SS6/93	Pt Hedland Tu 5 Oct	Darwin Sa 30 oct		SAR/Acoustics DSTO
SS7/93	Darwin Mo 1 Nov	Cairns Su 28 Nov	Blaber	Trawl Fish Resources CSIRO
SS1/94	Hobart Tu 22 Feb	Hobart Tu 8 Mar	Parslow	Trophodynamics CSIRO
SS2/94	Hobart We 9 Mar	Hobart Fr 8 Apr		TESPEX DSTO

DSTO Defence Science and Technology Organisation

6th July 1992