DIVISION OF **FISHERIES**

1994 RESEARCH VESSEL PROGRAM

CRUISE PLAN

FRV *SOUTHERN SURVEYOR*
CRUISE SS5/94

18 AUGUST – 22 SEPTEMBER 1994

CSIRO DIVISION OF FISHERIES
MARINE LABORATORIES
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HOBART TAS 7001
AUSTRALIA

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ITINERARY

LEG 1
DEPARTURE: HOBART 0900 THURSDAY AUGUST 18
RETURN: DEVONPORT 1200 TUESDAY AUGUST 23

LEG 2
DEPARTURE: DEVONPORT 1400 TUESDAY AUGUST 23
(OFF BATEMAN'S BAY WEDNESDAY SEPTEMBER 7)
RETURN: EDEN 1400 THURSDAY SEPTEMBER 8

LEG 3
DEPARTURE: EDEN 2200 THURSDAY SEPTEMBER 8
RETURN: HOBART 1400 THURSDAY SEPTEMBER 22

AREA OF OPERATION

Tasmanian, Victorian and New South Wales coastal and offshore waters bounded by 36°S–44°S and 144°E–151°E.

RESEARCH BACKGROUND

Leg 1 will conduct investigations critical to assessing the biomass of the blue grenadier stock that spawns off western Tasmania in winter. An acoustic survey of the stock was conducted in 1992 and an egg survey is being carried out this year with a chartered vessel. The cruise will focus upon determining several parameters that are part of acoustic and egg production assessments.

The acoustic volume backscattering of the grenadier and associated species will be assessed using several frequencies, the first time that more than a single frequency has been used in a CSIRO acoustic survey. Because the resonance of organisms is a function of wavelength and frequency, it is expected that greater species discrimination can be achieved through the use of multiple frequencies.

The temperature structure of the water column will be assessed along with the vertical distribution of blue grenadier eggs. Blue grenadier eggs will be fertilized and incubated at a range of temperatures, so the development rate of the eggs can be predicted *in situ*. Trawls for the blue grenadier adults will also be carried out to assess their length frequency and distribution of maturity stages and to obtain samples to determine their fecundity.

Legs 2 and 3 will examine ecosystem structure in the South East Fishery region with an emphasis on the relationship of seafloor habitat to fisheries productivity. Sampling will be undertaken on the continental shelf in eastern Bass Strait and southern NSW in the vicinity of several important commercial fishing grounds. This is the second in a series of four cruises which provide seasonal coverage for the study.

Biological samples, information on seafloor topography and oceanographic data will be collected from the study area in two phases. The first phase, a

broad scale survey based on seven cross-shelf transects, will provide information on the primary patterns of distribution and abundance of fish and invertebrate communities. Demersal trawling, benthic and epibenthic dredging, acoustic profiling and hydrological sampling will be undertaken at six sites per transect. Phytoplankton and zooplankton will be sampled at two sites per transect. The second phase will be directed at intensive sampling on and around two reef areas to extend the information gathered in phase one to smaller scale highly diverse habitat. Samples will also be taken with the pelagic trawl.

In both phases, the physical association of fish and invertebrate assemblages will be determined in relation to the physical character of seafloor habitats and overlying water masses. Biological species and the habitat they occupy will be determined through analysis of diet, trophic position and morphological adaptation.

Subsequent to the sampling undertaken by the *Southern Surveyor*, the same reef areas will be sampled with gill nets and traps deployed from commercial fishing vessels.

A related study will examine the effects of ten years of commercial fishing on the benthic composition and associated fish community off Maria Island, eastern Tasmania. This site was first examined by CSIRO fisheries scientists in 1984 before the start of commercial trawling in the area and resampled on SS05/93. Demersal trawl and underwater camera will be used to replicate the prior surveys.

CRUISE PLAN

LEG 1

The vessel will steam from Hobart around the south of Tasmania to the west coast. CTD stations will be occupied along latitude 43°00' S at 1000, 200, and 100 m depths; CTD stations will subsequently be occupied at similar depths at latitudes 42°00' and 41°00' S. Plankton, trawl, and acoustic sampling will be carried out at several sites along the west coast of Tasmania, where the blue grenadier tend to aggregate along topographic features: off Cape Sorell, the Pieman River, and two off Sandy Cape (Fig. 1). Sampling will be contingent on the availability of fish, and a further site may be sampled based upon communication at the time with blue grenadier fishermen.

At each blue grenadier sampling site, the fish will first be sampled acoustically based upon several transects crossing the topographic feature. A CTD profile of temperature and salinity will be taken. A demersal trawl will be carried out to assess the species composition of the aggregation, the length and maturity-stage frequency of the blue grenadier, to obtain samples for fecundity analysis, and to obtain running-ripe fish for *in vitro* fertilization and incubation experiments to be carried out under temperature-controlled conditions. Replicate vertically-stratified plankton samples will be obtained with the MIDOC system to assess the depth distribution of the blue grenadier eggs and larvae as they develop. The vessel will then proceed to Devonport to exchange personnel for Leg 2.

LEG 2 & 3

Following staff transfer at Devonport, *Southern Surveyor* will steam to the first site on the western-most transect off Wilsons Promontory. Biological sampling on Leg 2 will be mainly by demersal trawl and benthic sled along 7 cross shelf transects (Fig. 2). Three of the six stations on each transect will be sampled each day. Since several of the key fish species of interest may move into the water column at night, trawling will be carried out during daylight hours only. The benthic sled will used before daybreak and at the end of each day when fish trawling is completed. Scientific work will therefore be undertaken during a staggered 12 hour daytime shift during Leg 2. For the next 14 days the vessel will move east and then north completing one transect every two days. Sampling will be at sites identified during the 1993 cruise at 25, 40, 80, 120, 200 m depths, and at an additional site at 400 m depth on each transect. At each site a 30 min fish trawl, a 30 min sled tow, 2 sediment grabs and a CTD cast will be undertaken. Plankton samples will be taken with oblique Bongo net tows and vertical ring net drops at the 80 and 200 m station on each transect.

Demersal trawl samples from each station will be sorted and the fish identified, enumerated and weighed. Commercial quota species and a range of other abundant fishes will be sub-sampled for further data collection. This will include taking length frequency and biological data, stomach contents, muscle samples for stable isotope analysis and otoliths from representative numbers

of each key species at a range of localities. Invertebrate samples will be sorted, identified to the lowest possible taxonomic level and processed for length and biological information. Water samples for salinity, oxygen and nutrients will be collected from as many of the following depths as possible: 0, 10, 25, 50, 75, 100, 200, 250, 300, 350 and 400 m. Fluorometer data from the CTD will calibrated using chlorophyll-a measurements at 0, 10, 25, 75 and 100 m from the 80 m and 200 m stations on each of 2 transects. At night, when the scientific crew are off-watch, the vessel will undertake a series of acoustic surveys for bottom topography and pelagic biomass distribution over predetermined areas before steaming to the next transect.

Following the completion of transect 7 north of Eden, *Southern Surveyor* will steam north and anchor in Batemans Bay. During the afternoon of September 7 the vessel will be open to delegates from the South East Fishery Workshop who will be ferried out from shore by local fishermen. Tours of the vessel and informal presentations of research projects will be followed by light refreshments in the mess. The transfer of some scientific crew will also occur at Batemans Bay following transport by light aircraft between Hobart and Merimbula.

Leg 3 will commence on September 8 with the vessel steaming south to Eden to refuel and reprovision. Following this, two sites in the vicinity of Gabo Reef will each be sampled for about 6–7 days. Sampling will have a diel component requiring scientists to revert to separate day and night shifts. Fish and invertebrate communities will be sampled on and off the reef using a variety of gears. Pelagic and demersal trawls will sample fish over and adjacent to the reef; the benthic sled and sediment grabs will sample invertebrates; vertically stratified plankton tows will be made with the MIDOC system and video and 35mm cameras will be deployed on mooring and fishing gears. Acoustic profiling with the EK500 will map the reefs and surrounding areas. An initial 10 CTD casts to define the overlying water mass(es) will be followed by two CTD casts per day to detect any change in water mass(es) at sites during the biological sampling periods. The collection and processing of biological and hydrological data will be same as during Leg 2.

Following this 14 day period the vessel will steam south into Tasmanian waters. A 24-hour trawling program will be undertaken at a site off Maria Island to determine the species composition of the upper-slope fish community. The Engels high rise trawl with Photosea camera will be used for seven shots spaced at four hour intervals. The benthic sled may be deployed once depending on conditions.

OBJECTIVES ARE TO:

LEG 1

1. Assess the temperature and salinity structure at spawning sites and along the shelf and upper slope along the west coast of Tasmania based upon CTD profiles at 1000, 200, and 100 m depth at 41°00', 42°00', and 43°00' S latitudes.

2. Sample the blue grenadier at known areas of concentration along the west with demersal trawl to assess their size and maturity-stage structure, to obtain samples for fecundity analysis, and to obtain running-ripe fish for *in vitro* fertilization and incubation experiments.

3. Carry out replicate vertically-stratified plankton tows using the MIDOC system in each of four areas of potential blue grenadier concentration covering the following depths: bottom-400 m; 400-300 m, 300-200 m, 200-100 m; and 100 m-surface.

4. Conduct *in vitro* incubation experiments on blue grenadier eggs, raising them from fertilization to hatch at 3 constant temperatures.

5. Obtain acoustic measurements with three frequencies (12, 38, and 120 kHz) of blue grenadier aggregations.

LEGS 2 AND 3

1. Over a broad area of the continental shelf off eastern Bass Strait and southern NSW:
a) Determine the late-winter distribution and abundance of demersal fish species by demersal trawling.
b) Determine the late-winter distribution and abundance of seafloor invertebrate species by benthic/epibenthic sled sampling.
c) Identify and determine the distribution of seafloor habitat types through photographic, acoustic and sediment sampling of bottom topography and bottom type, and their associated fish and epibenthic faunas.
d) Determine the characteristics of the primary water masses in the sampling area during the survey.

2. Obtain samples of fish, plankton and seafloor invertebrates for analysis of stable isotopes to identify their positions in the community food web.

3. Sample stomach contents from commercial and other abundant fish species to determine their immediate feeding links and to compare with stable isotope analyses of trophic structure.

4. Collect water column and benthic sediment samples for analysis of phytoplankton pigments and breakdown products.

5. Through an intensive survey of two offshore (mid-shelf) reef areas:
a) Determine the composition of the fish and invertebrate communities associated with reef habitats, adjacent flat bottom, and the overlying water mass(es) by sampling with demersal and pelagic trawls, benthic sled or trawl, cameras and acoustics.
b) Determine the characteristics of the primary water masses over the sampling areas.
c) Complete and/or repeat 2 and 3 for reef habitat.

6. Determine the species composition of the upper-slope fish community and the distribution of brittle stars off Maria Island for comparison with historical (pre-commercial fishing) catch data.

7. Collect specimens, muscle samples and take photographs of fish and invertebrates for new CSIRO project: Handbook of Australian seafood.

8. Collect biological material for collaborative studies with other Australian research institutions and stock assessment.

PERSONNEL	LEG
Dr. Tony Koslow (Cruise leader)	1
Ms. Cathy Bulman (Asst cruise leader Leg 1)	1, 2
Mr. Rudi Kloser	1, 3
Mr. Lyndsay MacDonald	1
Ms. Chong Chamchang	1
Mr. Mark Lewis	1
Mr. Aleks Terauds	1
(Mr. Jason Waring)	1
Mr. Les Drury	1
Ms. Claire Fyfe, Tasmania State Fisheries Department	1
Mr. James Pirie, Tasmania State Fisheries Department	1
Mr. Douglas Nichols, Tasmania State Fisheries Department	1
Dr Alan Williams (Cruise leader)	2, 3
Dr Nic Bax (Assistant cruise leader)	2, 3
Dr Sebastian Rainer	2
Ms Stephanie Davenport	2, 3
Mr Bruce Barker	2, 3
Mr Gordon Yearsley	2
Mr Grant West	2
Mr Alastair Graham	3
Dr Vicki Wadley	3
Mr Craig Proctor	3
Mr Mark Rayner, CSIRO Division of Oceanography	2, 3
Mr Matt Sherlock	2
Mr Jeff Cordell	3
Mr Dave Evans, CSIRO Marmion	2, 3
Mr Scott Gordon, CSIRO Cleveland	3
Dr Penny Berents, Australian Museum, Sydney	2

CONTACTS

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P.C. Young
Chief, CSIRO Division of Fisheries

August 1994

APPENDIX 1: CRUISE TIME ESTIMATES

ACTIVITY	TIME (DAYS)
1. BLUE GRENADIER SURVEY	**(5.5 DAYS)**
Steaming	2
CTD transects	1
Acoustic measurements	0.5
Demersal trawling	0.5
Vertically-stratified MIDOC zooplankton sampling	1.5
2. SEF ECOSYSTEM STUDY	**(30.5 DAYS)**
LEG 2 (BROAD SCALE SURVEY)	
Steaming	1
7 transects	14
Each sampled with:	
Demersal trawls	
Benthic/ epibenthic sled	
Camera	
CTD	
Sediment grab	
Bongo nets	
Drop net	
SEF Workshop tour of vessel	0.5
LEG 3 (HARD GROUND SURVEY)	
Steaming	1
2 intensive survey areas	13
Each sampled with:	
Pelagic trawl	
Demersal trawl	
Benthic/ epibenthic sled	
Bongo nets	
Cameras	
CTD	
Sediment grab	
Demersal trawl survey of Maria Is. site	1
Sampled with:	
Engels high rise trawl	
Cameras	
Benthic/epibenthic sled(?)	
TOTAL	**36**

FIGURE 1.

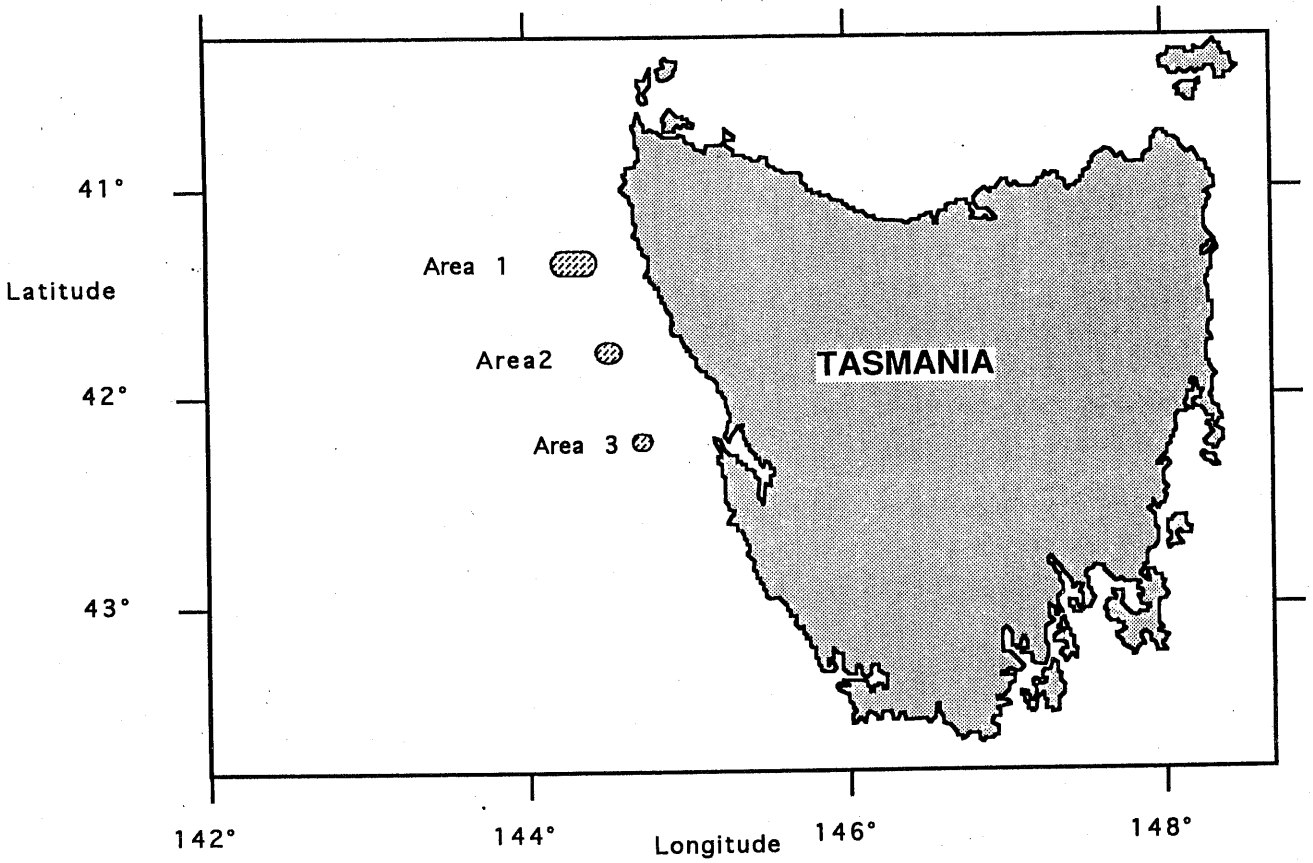
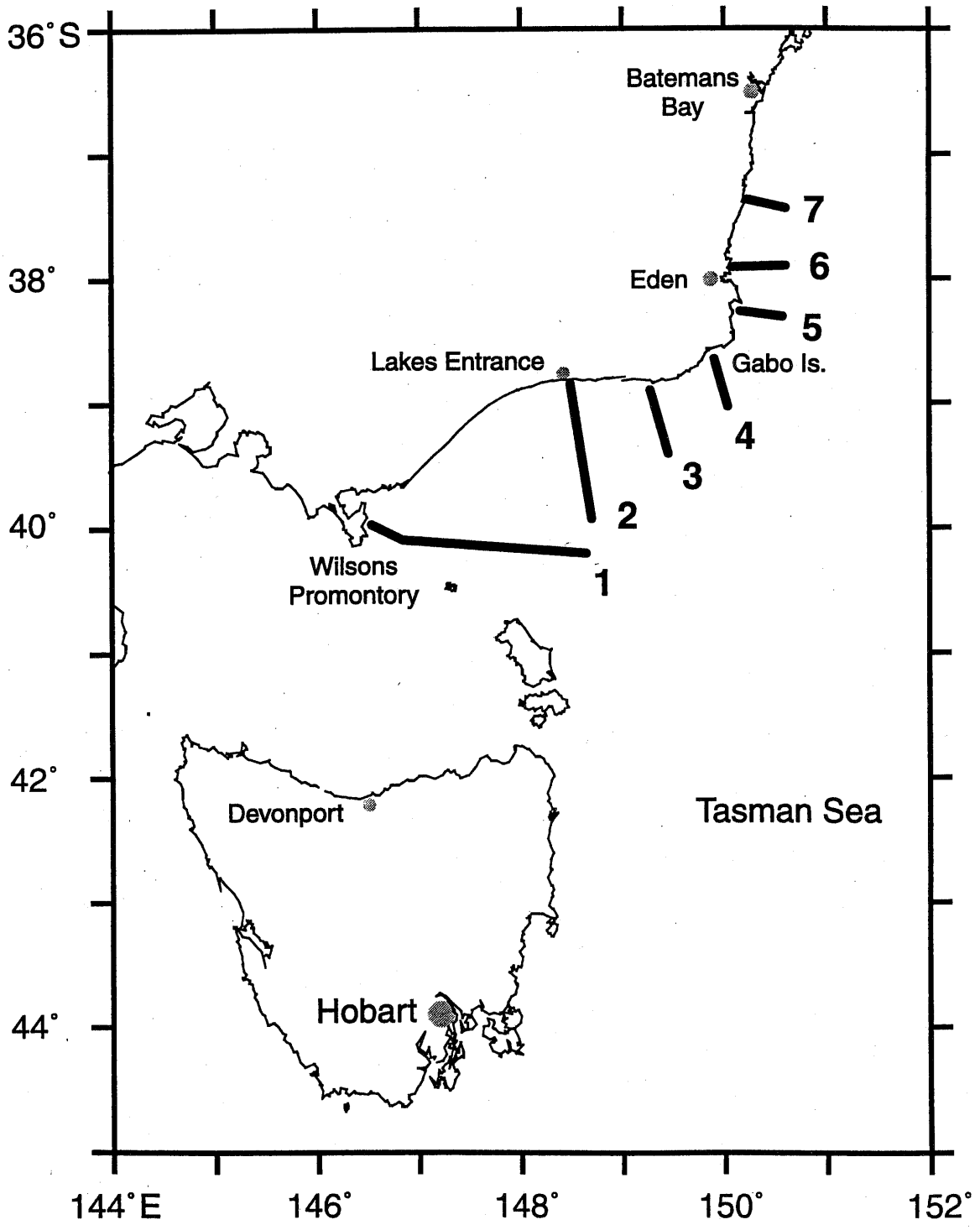

41°
Latitude
42°
43°
Area 1
Area2
Area 3
TASMANIA
142°
144°
Longitude
146°
148°

FIGURE 2.


36°S
38°
40°
42°
44°
144°E
146°
148°
150°
152°
Batemans Bay
Eden
Lakes Entrance
Gabo Is.
Wilsons Promontory
Devonport
Hobart
Tasman Sea
1
2
3
4
5
6
7