

MARINE
NATIONAL FACILITY

2008

RV Southern Surveyor
program



voyagesummary **SS**Transit**03/2008**

SSTransit03/2008

Evaluation of changes in phytoplankton and larval communities when crossing the East Australian Current in temperate coastal waters of New South Wales

Itinerary

Depart: 12/08/2008

PORT OF DEPARTURE: Gladstone, Queensland, Australia

Return to port: 16/08/2008

PORT OF RETURN: White Bay, Sydney Harbour, New South Wales, Australia

RESPONSIBLE LABORATORY

University of Technology, Sydney

PO Box 123, Broadway, NSW, 2007

Australia

CHIEF SCIENTIST(S)

Dr Ross Hill

Aquatic Photosynthesis Group

University of Technology, Sydney

OBJECTIVES AND BRIEF NARRATIVE OF VOYAGE

Scientific Objectives

- a) To expose students to the challenges of research voyages, by using the basic equipment of the vessel and occasional tutorials by the scientific crew and the officers; to appreciate the importance of communication, mutual respect, lines of authority and safety “toolboxes” for each operation;
- b) To operate and interpret the EM300 swath mapper, as well as the CTD rosette, plankton nets, ADCP and underway data; to take nutrient samples and chlorophyll calibration samples;
- c) To investigate oceanographic features such as fronts and eddies identified from MODIS images and BlueLink on the voyage south;
- d) To trial new gear with seawater collected from the underway flow.

Voyage Objectives

- i) To make targeted swath mapping around the 400 m isobath from Gladstone to Sydney (to be guided by GA and EM300 scientist on board);
- ii) To make CTD casts for nutrients and take Rectangular Midwater Trawls (RMT) and surface neuston net hauls inside and outside eddies that are encountered on the voyage south (to be guided by MODIS images and BlueLink forecasts during the week before departure); most plankton samples will be preserved in formalin;
- iii) To make standard 1 hour counts of seabirds and any marine mammals at dawn, midday and dusk from the bridge, and separate, particular counts in areas leading up to and within any particular oceanographic feature (e.g. an eddy or front);
- iv) To monitor the ADCP and underway data (T, S and fluorescence at 4 m intake) as the vessel crosses eddies and other oceanographic features;
- v) To collect seawater samples and trial new instrumentation in the Fish Lab

Results

- i) Swath mapping was completed from Gladstone to Sydney along the 400 m isobath. Students were given a detailed explanation on how the instrument works by Tony Veness and were involved in monitoring its progress during the voyage.
- ii) MODIS images indicated that prior to and during the voyage, there were no eddies occurring in the EAC from Gladstone to Sydney. Although this was disappointing, we were able to make two transects perpendicular from the coast at 29°53'S and then at 31°57'S. We sampled at 3 stations: 1) the inshore water, 2) in the centre of the EAC and 3) the water body east of the EAC. This was completed successfully for the first transect, however due to large swell, the water body east of the EAC was not sampled in the second transect. CTD casts, 10 min RMTs at 40 m depth and 5 min neuston nets at the surface were deployed by the students and marine crew at each station. Three replicate RMTs and three replicate neuston nets were performed at each station. Samples were preserved for later analysis in the laboratory at UNSW.
- iii) Bird and marine mammal observations were completed over three days at dawn and midday. Due to the deployment of nets in the afternoon and that all hands were required on deck, the dusk measurements were missed. Following is a summary of the data collected:

13 August 2008

Time	06:00 to 07:00	Time	10:10 to 11:10
Lat/Long start	25°30.200'S 153°52.68'E	Lat/Long start	26°12.031'S 153°56.693'E
Lat/Long finish	25°45.40'S 153°55.391'E	Lat/Long finish	-
Bearing	170-150	Bearing	209
Oceanographic feature	Fraser island to the west	Oceanographic feature	-

Species:	Number observed:	Species:	Number observed:
Blue beak garnet	5	Terns	20
Crested turn	1		
Terns	3		
Albatross	1		
White belly brown back	8		

14 August 2008

Time	08:12 to 09:12	Time	13:40 to 14:40
Lat/Long start	29:45.1395S 153:43.393E	Lat/Long start	29:52.848S 153:39.240E
Lat/Long finish	29:50.5635S 153:32.401E	Lat/Long finish	-
Bearing	242-244	Bearing	270
Oceanographic feature	Turning back to shore	Oceanographic feature	Sanded shelf to east

Species:	Number observed:	Species:	Number observed:
Gull	3	Full black gull	3
Crested tern	9	Black trim gull	1
Albatross	3	Silver gull	3
		Brown bird	10
		Light belly dark back small	1

15 August 2008

Time	07:30-08:30	Time	14.02-15.02
Lat/Long start	31:53.906S 153:12.036E	Lat/Long start	31:55.252S 152:51.354E
Lat/Long finish	31:54.432S 153:12.342E	Lat/Long finish	31:58.765S 152:55.406E
Bearing	73	Bearing	160
Oceanographic feature	Turning closer to shore	Oceanographic feature	6.8 km from Crowdy Head

Species:	Number observed:	Species:	Number observed:
Gull	15	Gull	37
Albatross	10	Black Albatross	41
Gannet	4	White Albatross	4
Tern	8	Petrel	3
Kestrel	2	Tern	2
		Whale	2

iv) The ADCP and underway data were monitored by the students.

Increases in temperature were noted when entering the EAC.

v) At each of the stations, the inline seawater was passed through the newly developed size fractionation system. This setup separated phytoplankton into two size classes: 1) >200 µm and 2) <200 µm > 20 µm. On each population the photosynthetic efficiency was determined using a Water-PAM fluorometer. Smaller algae were hypothesised to respond to changes in nutrient conditions, while larger algae remain unaffected. The maximum quantum yield values obtained illustrated size-dependent differences in phytoplankton health as seen in the table below:

Transect 1

	Station 1 - inshore	Station 2 - EAC	Station 3 - offshore
	29°53'S 153°30'E	29°52'S 153°37'E	29°54'S 153°46'E
>200 µm	0.368 ± 0.067	0.484 ± 0.023	0.249 ± 0.027
<200 µm > 20 µm	0.598 ± 0.031	0.450 ± 0.016	0.256 ± 0.011

Transect 2

	Station 4 - inshore	Station 5 - EAC	Station 6 - offshore
	31°55'S 152°53'E	31°58'S 153°04'E	Unable to complete
>200 µm	0.560 ± 0.086	0.549 ± 0.028	
<200 µm > 20 µm	0.600 ± 0.101	0.672 ± 0.011	

Voyage Narrative

12 August 2008:

Departed Gladstone at 1000 and headed East towards the 400 m contour. A muster was performed at 1300. We passed south of Lady Elliot Island and reached the edge of the continental shelf around 2000. An XBT was launched at this time in 500-600 m deep water. Conditions have been fairly smooth with a swell at about 1-2 m. All equipment (size fractionation and nets) have been set up. The size fractionation system has been tested and data will be collected from 0600 tomorrow. The nets and CTD will be tested tomorrow at 1000. Some whales, dolphins and birds have been spotted and formal observations will begin tomorrow, along with monitoring of the swath mapper.

13 August 2008:

The ship is heading south along the 400 m contour with the swell increasing to 2 m. The size fractionation system has been running since 6 am and is processing approximately 90 L of seawater per hour. The water is very low in algae so concentrating samples to adequate density for measurements on the Water-PAM is proving a little difficult. Bird and marine mammal observations are underway with 4 sets of 1 hour readings being measured from dawn to dusk. Swath mapping monitoring is being undertaken in shifts throughout the day. A practice CTD, side net and RMT (rectangular mid-water trawl) were performed and went fairly smoothly. The depth sensor on the RMT did not communicate with the bridge, so sonar will be trialled tomorrow. Students are sorting and identifying biota from the nets. Nutrient, oxygen and salinity measurements are being performed on the CTD samples.

14 August 2008:

At 0800 the ship steered west and reached about 20 nautical miles offshore about 0920. Three replicate RMT and side nets were performed and samples preserved in formaldehyde. A CTD was dropped in 90 m water and 4 samples taken through the water column. The size fractionation system was also run during this time and the photochemical efficiency of two different size classes of phytoplankton was determined on the Water-PAM. This procedure was repeated at the second station in the centre of the EAC (east Australian current) and again further east beyond the EAC. At the last station, the CTD was dropped to 1200 m and Styrofoam cups (covered in artistic patterns by the students) were attached to the frame to demonstrate the extreme pressure at such depth. The day's sampling was completed by 1700 and data entry was completed during the evening. Bird and marine mammal observations were performed at dawn, midday and dusk.

15 August 2008:

A repeat of yesterday's measurements was completed along a transect further south, although the seas were too rough to perform nets and CTDs at the outer-most station. However, a sediment grab was undertaken at the second station to identify the benthic composition of the region. The scientific sampling and analyses were finished by 1700 and the ship is headed for Sydney.

16 August 2008:

We made good progress over night and we reached Sydney at 1300. The morning was spent packing up the labs, cleaning cabins and entering all data into a single spreadsheet. The ship docked at White Bay, Balmain (Sydney Harbour) at 1500.

Summary

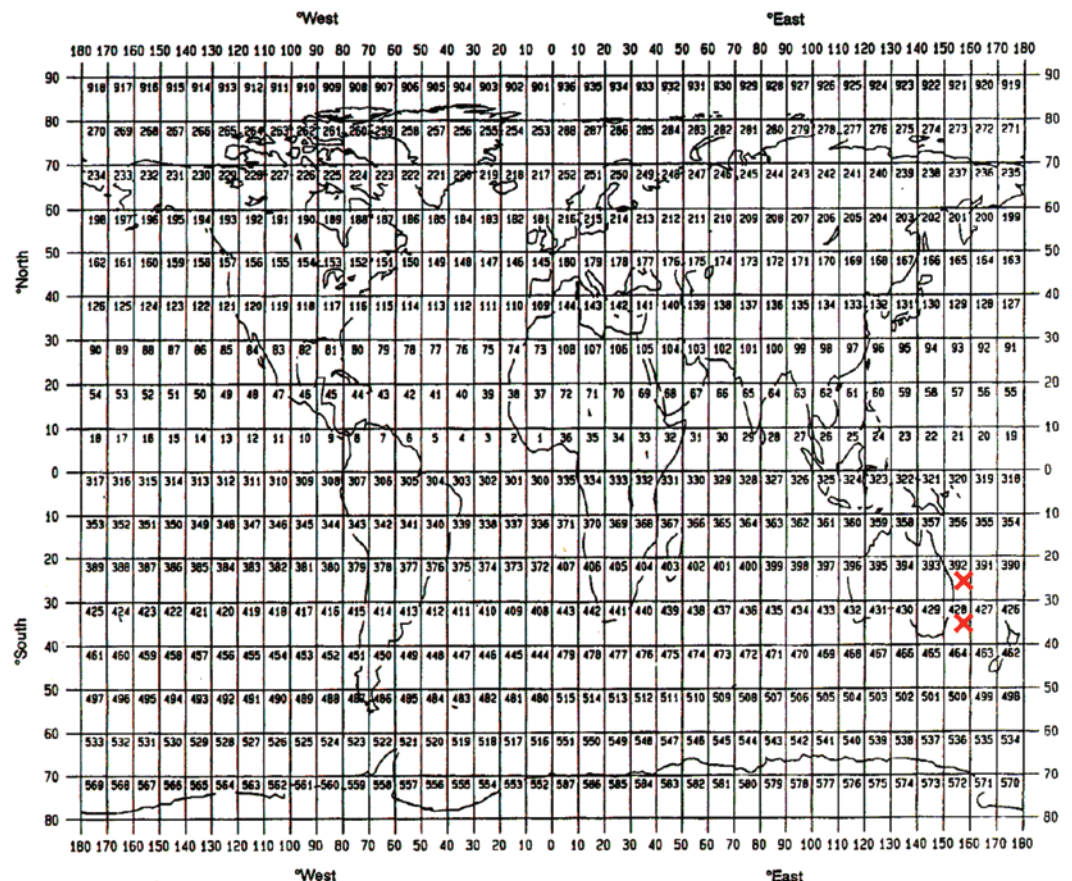
Overall, the objectives of the voyage were met and in many cases, exceeded. The swath mapping was completed along the 400 m isobath and additional mapping of the sea floor was completed over sea floor pinnacles of interest to the Navy. The net trawls and CTD were deployed at a number of sights along two transects from the Australian east coast and the samples were preserved for later analysis. The new size fractionation system was tested onboard and worked quite successfully, although a number of design improvements were identified in preparation for future cruises. The students worked very hard each day and battled through the traumas of seasickness. From their reviews of the voyage (see Appendix 2), they found the experience highly enjoyable, insightful and reinforced their aspirations for working in the marine science discipline. A major driving force behind the Next Wave initiative is the education of university students at sea about oceanography – this was clearly achieved in this voyage.

Principal investigators

- A. Dr Ross Hill
- B. Dr Jason Everett

MARSDEN SQUARES

GEOGRAPHIC COVERAGE X Data collected



Summary of measurements and samples taken

Item No.	PI see page	NO see above	UNITS see above	DATA TYPE Enter code(s) from list on last page	DESCRIPTION
1	A	30	Stations	B02 B08	Water-PAM measurements of maximum quantum on two size classes of phytoplankton collected through the ships online seawater system.
2	A	6	Stations	B25 B26	1 hour surveys of birds and marine mammals at dawn and midday on three consecutive days
3	A	5	Stations	H10	CTD casts performed at 5 stations and samples collected at a number of bepths
4	B	15	Stations	B10	Neuston nets deployed on the surface for 5 mins at each site
5	B	15	Stations	B90	Rectangular mid-water trawls (RMTs) deployed at 40 m depth for 10 mins at each site

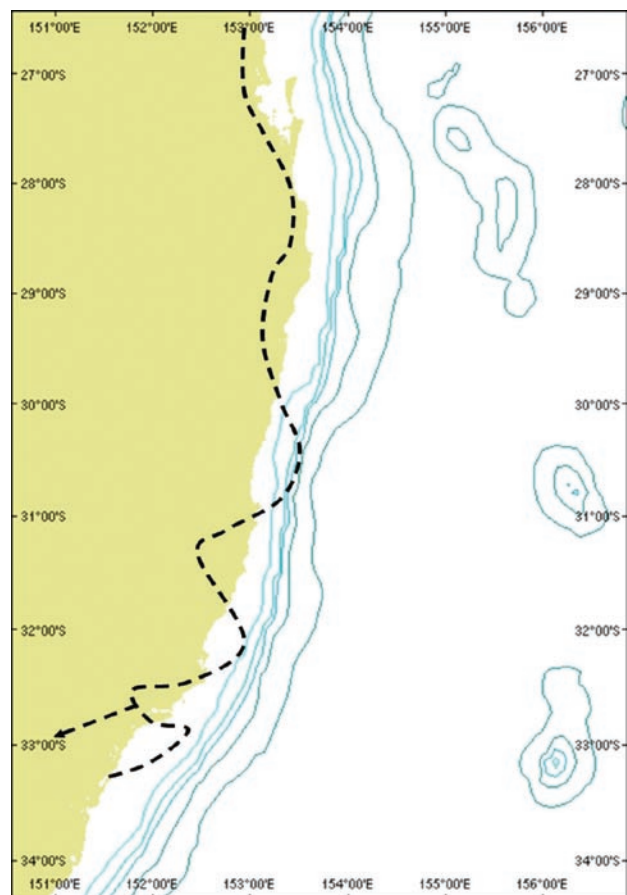
Curation report

Item No.	Description
4, 5	Samples from Neuston nets and RMTs preserved and transported to the University of New South Wales for analysis

General Ocean Area(s):

Coral sea, Tasman sea, Pacific Ocean

Track chart



PERSONNEL LIST

Scientific Participants

Name	Affiliation	Role
Ross Hill	UTS	Chief Scientist
Jason Everett	UNSW	Alternate Chief Scientist
Ben Harris	UNSW	Student
Halley Durrant	UNSW	Student
Adrienne Gatt	UNSW	Student
Jennifer Clarke	UTS	Student
Sam Avery	UTS	Student
Hayden Quinn	UTS	Student
Madeleine D'Arcy	U.Syd	Student
David Terhell	CMAR	MNF Hydrochemistry support
Tony Veness	CMAR	MNF Swath Mapping support
Bob Beattie	CMAR	MNF Voyage Manager/computing support

Marine Crew

Name	Role	Name	Role
Marcus Defina	Master	John Howard	IR
John Boyes	Mate	Kel Lewis	IR
Darren Lack	2nd Mate	Gareth Gunn	IR
Graham McDougall	Bosun (Chief IR)	Ashleigh Pollock	Chief Steward
John Morton	Chief Engineer	Paul Brown	Chief Cook
David Jonkers	2nd Engineer	Kevin Shanahan	2nd Cook
Matt Barrett	IR		

Acknowledgements

Many thanks to the crew of the *Southern Surveyor* (both science and marine) for your tireless help in ensuring the science was completed successfully. The voyage would certainly not have been as productive without your expertise and help. The students thoroughly enjoyed their time onboard and it was great to see their interaction with the crew. A big thank you to Lisa Woodward for your constant support – both logistically and on-site – prior to, during and following the voyage. Thanks are also extended to Professor Iain Suthers and Associate Professor Peter Ralph who were integral to initiating this Next Wave voyage and in the organisation of the trip. This expedition was generously supported by CSIRO-MAR, MNF, ARCNESS and NSW DPI, whose contributions to this trip enabled seven university students to be involved in a truly unique experience.

Dr Ross Hill

Chief Scientist

Appendix 1 – Student Reports

1. Madeleine D’Arcy – The University of Sydney

Over the past five days I have been part of the ‘New Wave Expedition’ on the *Southern Surveyor* transit between Gladstone and Sydney. When I applied to take part in the voyage, I wrote that I was not yet sure what direction I wished to pursue in further research, but the trip has given me insight. I have learnt that I am rather susceptible to sea sickness, which is not necessarily the best characteristic for a would-be marine biologist, but this was not all.

I was the lone Sydney University representative and worked with students from UTS and UNSW. We visited 5 sites where we used Neuston, RMT (rectangular midwater trawl) and plankton nets to collect organisms in different size classes from the surface and deeper down. We also deployed CTD’s (Conductivity, Temperature and Depth sensors) to investigate how the ocean changed with increasing depth. To confirm our ideas about depth and pressure we sacrificed a few Styrofoam cups, shrinking them with the pressure of 1200m of water. Ross and Jason told us lots about what we were doing and why as we collected the data.

We used a water-PAM to examine the quantum yield of phytoplankton that we separated into two size classes using a new size fractionating system. Students took turns surveying the birds and marine mammals visible from the ship. CSIRO scientists on board showed us how to use XBT’s to track temperature and depth with the need to stop the vessel, and explained the process of swath mapping to us.

Taking part in the trip was an amazing opportunity. I am grateful for the chance to see marine biology in action, learnt a lot and am keen to pursue the field further. I would jump at the chance to go on another voyage, regardless of seasickness.

2. Jennifer Clark – University of Technology, Sydney

Today is the last working day on CSIRO *Southern Surveyor* Ship. What a blast it has been!! Not only am I grateful for being apart of this expedition I also felt I have learned heaps from being here. I definitely have a feel for what it would be like to conduct research out in the big blue sea.

Dr. Ross Hill taught us about florescence found in algae and how to determine whether the cell can recover from being pulled up from different depths of the ocean. After learning some background information on photosynthesis and thylakoid membranes, photosynthesis I and photosynthesis II, we were able to conduct a water-PAM on the water samples collected both by size fractionation where the samples were separated into 20 µm and 200 µm and from the water samples collected in the CTD (Conductivity, Temperature and Depth). The students and I took shifts in doing bird and whale surveys, recording the fluorometer levels and watching the swath mapper as it surveyed the bottom of the ocean. We did end up getting some really good samples of algae by the size fractionation but unfortunately did not find an eddy to use to see whether there was a difference in plankton and fluorescence. We also collected plankton from Neuston nets (which by the way the girls did all by themselves) as well as from the RMT (Rectangular Mid-water Trawl)

and plankton nets. It was amazing to observe just how many types of plankton and larval fish were found just on the surface and mid-water in the water column.

Drew, Tony, Bob and Dave (CSIRO), taught us how to use the XBT to find out the depth and temperature of the ocean as well as how to collect samples to find out the dissolved oxygen, salinity and nutrient content from the CTD. The swath mapper was interesting as the scientists from CSIRO can have an exact idea of what the bottom of the ocean looks like. All this research can give us a better idea of how the ocean works.

All in all, the time spent aboard the *Southern Surveyor* was amazing. I feel so fortunate to be involved with this expedition. There was one thing that I thought was fun to learn was what happens to a Styrofoam cup when you take it down to depths of 1200 m! I also learnt that I did not get my sea legs on this trip and that it will take many more opportunities for me to gain them...hint hint. Thanks again for this amazing opportunity and I look forward to the next voyage.

3. Hayden Quinn – University of Technology, Sydney

My voyage on board the RV *Southern Surveyor* was one which is going to be the highlight of my undergraduate studies. This trip has taught me what it is like to be a real research scientist working and collaborating with other scientists from numerous other fields and intuitions.

This voyage allowed me to put to work much of the theory which I have been studying in my course work for the past 3 years, gaining very hands on approach to science. Throughout my studies I have found that being out in the field, experiencing the many things which I have been studying has allowed me to greatly increase my level of understanding and knowledge, and this trip aboard the *Southern Surveyor* has been no exception. One of the most astounding things which I have taken from this experience is the sheer size and scale of such projects. From the sampling, through organisation, all the way through to the man power required. The crew on board were more than helpful and gave extremely sound and valued advice when and where needed. Dr Ross Hill and Jason Everett led a very enthusiastic and committed team of young scientists with great professionalism, being ever helpful and knowledgeable in their areas of expertise. Without their organisation and those at CSIRO this trip would not have been possible and all those involved greatly appreciate this support.

Getting to use the vast array of technical sampling equipment on board the *Southern Surveyor* was immensely rewarding especially when we were so hands on with all the sampling. Also the use of the flow-through cell size fractionation filters (as developed by UTS:APG) was very exciting as it is hoped that through this voyage new improvements can be made and the apparatus can be then used effectively in future voyages.

It has been a thrilling experience to be involved with a team of professional scientists, working on board a real scientific boat performing real science.

4. Sam Avery – University of Technology, Sydney

My experiences on board the RV *Southern Surveyor* have been overwhelmingly positive and I have learned a great deal through my short stay on board. I have acquired valuable knowledge towards the operation and function of a range of oceanographic equipment. I have also developed a thorough understanding towards the values needed to work in a professional environment and work long hours with teams of scientists in close confines.

I am grateful to the crew both scientific and operational, who have embraced our stay and included us in all of the duties they perform. Without such a friendly and outgoing crew I feel I would not have learned so much. Dr Ross Hill our chief scientist has been encouraging and helpful from the beginning. He has led our crew in a professional manner and has contributed greatly to my personal enjoyment of this trip. Jason Everett also contributed greatly towards the smooth running and enjoyment of the trip and specifically aided the safe deployment of the various instruments used.

It saddens me to hear that the *Southern Surveyor* is soon to be decommissioned. I fear that without this vessel, future students will not have the chance to be exposed to such a fantastic opportunity. I feel it is necessary to continue these learning voyages for enthusiastic students in order to foster future specialists in the field.

It has been a thrilling experience to be involved with a team of professional scientists, working on board a real scientific boat performing real science!

5. Adrienne Gatt – University of New South Wales

During my degree I've been on many field trips, everywhere from Fowler's Gap to Smith's Lake, which have been critical to my studies and have been great experiences, but this trip has been something far more beneficial. It has allowed us to network and talk to all the people involved, not just the scientists and other students but also the crew, about being at sea.

There is only so much that we can learn at a university without actually being a part of research itself, which is what this voyage has provided us with. Apart from the few bouts of sea sickness it's been a great opportunity to get into the pace of things out at sea and see what it's all about. With my Honours project (looking at larval lobster biology and rocky reef assemblage ecology) sometimes it's difficult to see past this year, but going on this voyage only reaffirmed my passion for marine science and it was a reminder that the career opportunities are quite diverse in this field.

This trip has overall provided us with a taste of the real marine research, something that we could not have achieved on the same level at university alone. It's been a great insight into life at sea and marine research and I'm extremely grateful for the opportunity.

6. Halley Durrant – University of New South Wales

The *Southern Surveyor* next wave voyage has been an eye opening experience. As I am in the final session of my marine biology degree, this trip has certainly opened my eyes and allowed me to gain some insight into the proceedings of a scientific voyage. One of the first lessons that were learnt is that not everything goes to plan; weather can be unfavourable and thus does not permit for surveying conditions. In this case it is imperative that you have made replicates of previous data points.

It was great to work with the two contrasting plankton tow nets, the Neuston (a small scale net) and the RMK (a large scale net). The effort that goes into deploying these nets is amazing, as the crew have to help man the machinery that lowers the RMK into the water.

It was a remarkable experience being shown the operations room, which is the heart of all the computer and data retrieval equipment of the ship. We were introduced to the swath map and shown which path it is surveying and how the bridge corrects the ships course to survey these areas.

I would highly recommend this voyage to anyone interested or undertaking any education in the marine biology area. I am very grateful to have had this opportunity and am pleased with the knowledge of all the various equipment apparatuses we had a chance to use. Adding to the educational side of this voyage, the crew were very accommodating and helpful. The food was great and the views from the *Southern Surveyor* were magical.

My final thoughts of this trip are that I have never had the experience that this trip provided from any university field camp. You meet great people and learn how to use important marine surveying equipment and get a feel for the lifestyle that a marine scientist could have.

7. Ben Harris – University of New South Wales

The experiences that I have been exposed to upon the *Southern Surveyor* are an astounding part of my student life that will stay with me forever. It was an invaluable insight into scientific research in fisheries and marine health that can not be experienced in a class. The hands on approach which is encouraged by the scientific crew as well as their passion to teach you of the fields is remarkable and makes learning new concepts a much easier experience.

The interaction with students from other institutions is an amazing insight into how different techniques are used and specialties pursued by the various universities represented upon the vessel. The meeting of peers in similar positions is also giving great networking capabilities, broadening the people known in the industry but with differing specialties is sure to be useful in later years and research work. I don't believe this would be possible without opportunities like this, and its importance can not be disregarded.

The trip was also an enjoyable experience with seeing great sights like the passing of whales, the ship being surrounded 360° by ocean and the great numbers of other sea life. The ships crew were amazingly open to all the students aboard showing interest as well as trying to be as helpful as possible, but also interacting on a social level. The *Southern Surveyor* was a great experience one not to be forgotten and to reaffirm a passion into my marine studies.