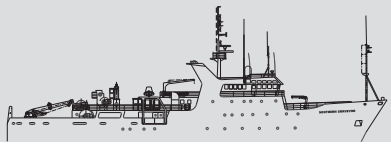


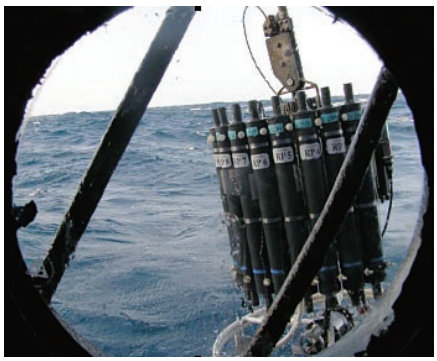
MARINE
NATIONAL FACILITY

RV *Southern Surveyor*

2009 program

CSIRO

voyage summary SS01/2009-TRANSIT



SS01/2009 – TRANSIT

Sydney to Wellington

Voyage period
25/01/2009 to 1/02/2009
Port of departure: Sydney, Australia
Port of return: Wellington, New Zealand

Responsible laboratory
Sydney Institute of Marine Science
22 Chowder Bay Road, Mosman NSW 2008 Australia

Chief Scientist
Iain Suthers, Sydney Institute of Marine Science

Scientific Objectives

"Next Wave" is a new programme of the National Facility Research Vessel *Southern Surveyor* to encourage young scientists to try research at sea. Next Wave provides the additional crew as well

as a full scientific staff (electronics, hydro, computing etc) on their transit voyages between ports. The 10 students and 1 leader worked 12 h shifts between 07:00-23:00 to operate the CTD rosette, neuston, N70 and RMT nets, XBT casts, deploy 2 ARGO floats, a well as underway TSG, fluorometer etc..

Our scientific aims on the voyage are :

a) To expose students to the challenges of research voyages, by using the basic equipment of the vessel and occasional lectures or 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 CTD rosette, plankton nets (RMT, surface neuston, and N70 vertical haul), the ADCP and underway data; to take nutrient samples and chlorophyll calibration samples;

c) To opportunistically investigate oceanographic features of the East Australian Current such as fronts and eddies identified from MODIS images and BlueLink;

d) To determine spatial (negative) correlation between salps and crustacean zooplankton (copepods and krill) across the Tasman Sea.

Voyage Objectives

Our voyage objectives are :

i) Conduct daytime tool boxes of all gear, and occasional lectures;

ii) To determine the trans-Tasman gradient in nutrients, phytoplankton and zooplankton (particularly salps and krill) – except within 200 nm of NZ – as well as counting seabirds and whales. CTD casts and plankton tows will occur during each evening, and will be aligned with any oceanographic features;

iii) To compare an Eco-triplet sensor (UTS supplied) with bottle samples

iv) If possible, to compare the nutrients and plankton net hauls inside and outside eddies that are encountered on the voyage (to be guided by MODIS images and BlueLink forecasts during the week before departure);

v) To monitor the ADCP and underway data (T, S and fluorescence at 4 m intake) as the vessel crosses eddies and other oceanographic features;

vi) To deploy XBTs and 2 ARGO floats.

Results

i) Conduct daytime tool boxes of all gear, and occasional lectures;

Four pieces of gear were regularly deployed during the voyage: the CTD to 500 m with T, S, DO, N, P; an N70 vertical haul net (70 cm diameter, 0.4 to 0.2 mm mesh); a 1.5 x 0.75 rectangular midwater trawl (RMT) with 1 mm mesh; a 0.75 m2 surface (neuston) net with 0.5 mm mesh; a Smith McIntyre grab.

On every day a 1 hour lecture was given on topics ranging from water density and oceanography, IMOS to the XBT depth equation, and careers in marine science by Stephen Thomas and the captain.

ii) To determine the trans-Tasman gradient in nutrients, phytoplankton and zooplankton (particularly salps and krill) – except within 200 nm of NZ – as well as counting seabirds and whales. CTD casts and plankton tows will occur during each evening, and will be aligned with any oceanographic features;

CTDs and plankton tows were conducted i) at the shelf break off Sydney and ii) around Gascoyne Seamount (280 nautical miles off Eden) and iii) a CTD transect across the Challenger Plateau. Spectacular abundances of a large salp, Salpa vagina of both life stages were found in near-surface waters around Gascoyne (we hope to correlate these abundances with the logged acoustic data with Rudy Kloser).

No whales were documented and a strict seabird counting watch was not maintained.

iii) To compare an Eco-triplet sensor (UTS supplied) with bottle samples

The Eco-triplet was not delivered in time.

iv) If possible, to compare the nutrients and plankton net hauls inside and outside eddies that are encountered on the voyage (to be guided by MODIS images and BlueLink forecasts during the week before departure);

There were no useful eddies at the time, but more importantly, the student crew were not prepared for sampling such features and not on a 24 h watch. One of the difficulties of the voyage was beginning the voyage in Australian waters where there were many opportunities but with an inexperienced student day-crew, whereas by the time we reached NZ waters with a more experienced crew and firm estimates of remaining time available, there were too few opportunities for sampling in NZ waters. In the future, a voyage from a foreign port to a domestic one would be easier to undertake.

v) To monitor the ADCP and underway data (T, S and fluorescence at 4 m intake) as the vessel crosses eddies and other oceanographic features;

Gascoyne Seamount was conveniently located mid voyage but near Australian waters for the students to be gainfully employed. Gascoyne is far from shore, with no regular exposure to consistent currents and has received no formal investigation. It does however lie in a difficult area for oceanographic modelling of SE Australia.

vi) To deploy XBTs and 2 ARGO floats.

Over 24 XBTs were deployed across the Tasman Sea, and a number were deployed synoptically with CTD casts (for the depth equation calibration) and 5 more downstream of a sea mount.

Voyage Narrative

All times reported below are local EDST, until another hour at 02000 on Sat. 31st.

Saturday 24 January Vessel induction took place at 1 pm, and fire drill occurred the following day at 10:30 am.

Sunday 25 January 4 pm Departed Sydney Harbour.

The dramatic filament of enriched water evident in the MODIS images (Fig. 2) was initially targeted but we would arrive at the site near midnight. Instead we completed CTD1 and 2 (including 2 N70 nets each) off Sydney (at 150 and 784 m isobaths) before steaming to Gascoyne Seamount.

Monday 26 January Survey of Gascoyne Seamount Mon 26 Jan09

9pm

Stn A 36 42’ 155 45 (arriving around 8:30 pm EDST)
About 15 n.mile west from 100 m isobath
RMT+ surface net tow
CTD3 to 1,000 m plus 2 XBTs
Bottles at 500 m, 150 m, 75 m, 25 m, 0 m

Stn B 36 42’ 155 59’

About 5 n.mile west from 100 m isobath
RMT + surface net tow
CTD4 to 500 m
Bottles at 500 m, 150 m, 75 m, 25 m, 0 m

Tuesday 27th January

1 am, Commenced ADCP and swath mapping of the seamount (Fig. 4, Fig. 6)

Transect	Waypoint	Latitude	Longitude
1	1	36 30'	156 0'
	2	37 0'	156 0'
2	3	37 0'	156 10'
	4	36 30'	156 10'
3	5	36 30'	156 20'
	6	37 0'	156 20'
4	7	37 0'	156 30'
	8	36 30'	156 30'
5	9	36 30'	156 40'
	10	36 50'	156 40'

On Transect 4 (from S to N), we made 5 XBT casts (#16 to #20), which revealed a significant deepening of the mixed layer from 40 to 60 m.

8:30pm
Stn E 36 42′ 156 36 (about 15 n.mile east from 100 m isobath) RMT + surface net tow
CTD5 to 500 m
N70 vertical haul net
Bottles at 500 m, 150 m, 75 m, 25 m, 0 m

Stn D 36 42′ 156 25
About 5 n.mile east from 100 m isobath
RMT+ surface net tow
CTD6 to 500 m
N70 vertical haul net
Bottles at 500 m, 150 m, 75 m, 25 m, 0 m

Steaming from Stn D towards C at 156 17.17 the bathymetry changed from 2,300 to 160 m (156 17.17 is a third into the chart's depiction of Gascoyne as an ellipse).

Stn C 36 42′ 156 15′
On cap of seamount,
RMT to 100 m + surface net tow
CTD7 to 500 m, Bottles at 75, 25 m, 0 m
Conducted two Smith-McIntyre grabs to 125 m. Both successful revealing crushed coral and brozoan skeletons. Nothing living, other than a small, live fish (Coris?).

Currents were weak and variable but predominantly from the east (Fig. 4). The OceanMaps forecast also indicated complex flows but a general w to E flow (Fig. 5). There was evidence of a slight island mass effect with elevation of isopycnals of 50-100 m and elevated fluorescence on the western ("downstream") end of the seamount (Fig. 7).

The swath mapper enhanced the view of an old volcano with the eastern side greatly eroded (Fig. 6).

Wednesday 28th
Steamed towards NZ.
Conducted CTD8, 9 including XBTs
Continued XBTs. Deployed 1 ARGO float

Thurs 29th
Conducted CTD 10 including XBTs
Deployed 1 ARGO float

Friday 30th 8am
Began the Challenger Plateau CTD transect (#12-17), every 3 hours

There was evidence of uplifting of water over the plateau (Fig. 8). Saturday 31st Made a N to S ADCP transect from Cape Egmont to the South Island, from 39 50′ 174 00′ to 40 38′ 174 00′ (N-S across Cook Strait)

Run to 40 38′ 175 00′ (E-W across Cook Strait to Kapiti Is)

ADCP transects along W coast of Kapiti Island, then Southward to look at oceanographic conditions between Kapiti Island and Wellington (Student scientist Malcolm Lindsay, for Steve Swearer, Dept Head of Zoology Department, University of Melbourne, sswearer@unimelb.edu.au).

Transect Waypoints:

1. 40 48.683′ 174 54.466′
2. 40 48.567′ 174 51.270′
3. 40 51.196′ 174 52.069′
4. 40 51.485′ 174 49.102′
5. 40 58.007′ 174 52.602′
6. 40 55.498′ 174 46.248′
7. 41 01.235′ 174 48.607′
8. 41 00.313′ 174 43.053′
9. 41 04.892′ 174 45.069′

Sunday 1 February
Met pilot 7:30 am, docked around 9 am.

Summary

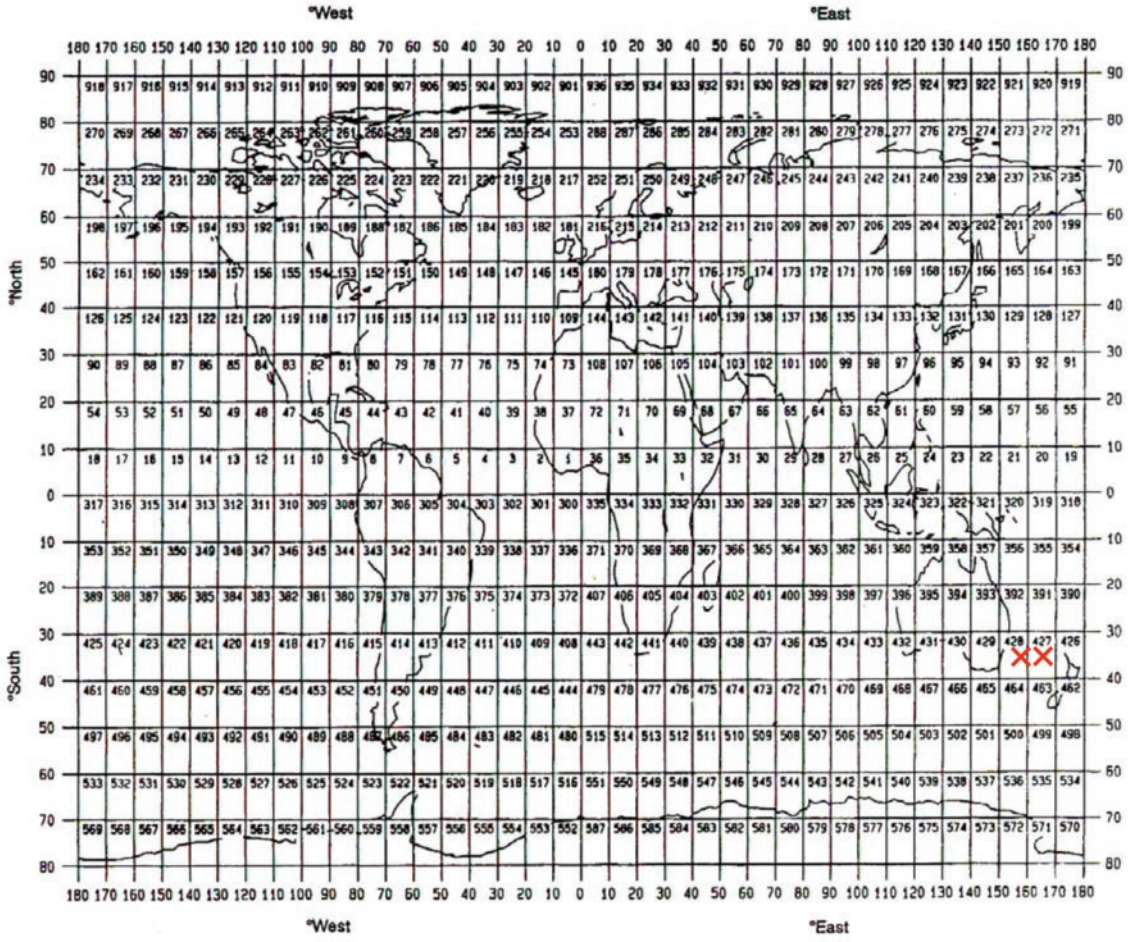
We had a safe and very successful voyage across the Tasman Sea. The major scientific achievement was a brief multidisciplinary study of the biological oceanography around Gascoyne Seamount. This pilot study revealed uplifting of thermocline downstream and a possible increase in primary production. The abundance of large salps was remarkable (although not unusual for the region). Gascoyne Seamount lies in a highly variable region off southeastern Australia and should be targeted for either instrumentation or detailed oceanographic modelling. The other major achievement was to inspire an intelligent and potentially influential group about the MNF.

Principal Investigators

A. Iain Suthers (SIMS)
B. Stephen Thomas (CMAR)

MARSDEN SQUARES

GEOGRAPHIC COVERAGE - INSERT 'X' IN EACH SQUARE IN WHICH DATA WERE COLLECTED



MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS									
Item No	**PI** See page above.	**APPROXIMATE POSITION**						**DATA TYPE** enter code(s) from list on last page.	**Description**
		LATITUDE			**LONGITUDE**				
		deg	min	N/S	deg	min	E/W		
1	B								Argo float
2	A								Argo float

SUMMARY OF MEASUREMENTS AND SAMPLES TAKEN					
Item No.	**PI** see page above	**NO** see above	**UNITS** see above	**DATA TYPE** Enter code(s) from list on last page	**Description**
i)	B		XBT	H13	Temperate and depth to 800 m using Bluewater XBTs. At two stations simultaneous CTD and XTB casts were made around the thermocline and 700 m to assess the Depth Equation
ii)	A	17	CTD	H23, H24, H25, H26	CTD
iii)		5	RMT	B09, B10, B11	Rectangular midwater trawl, 1.5 x 0.75 m, 1 mm mesh and a neuston net 0.75 m2, 0.5 mm mesh
iv)		17	N70	B09, B10, B11	N70 vertical haul plankton net, 0.7 m diameter, 0.4-0.2 mm mesh
v)		7	days		ADCP
vi)		7	days	G73	Echo sounder

CURATION REPORT	
Item No.	**Description**
i)	CMAR Marlin
ii)	CMAR Marlin
iii)	UNSW
iv)	UNSW
v)	CMAR Marlin
vi)	CMAR Marlin

Voyage track

See Figure 3 (attached)

General ocean area(s)

Tasman Sea

Specific areas

Gascoyne Seamount, and Challenger Plateau

Personnel list

Scientific Participants

Stephen Thomas	CSIRO MNF	Electronics, voyage manager
Bob Beattie	CSIRO MNF	Computing
Alicia Navidad	CSIRO MNF	Hydrochemistry
Iain Suthers	SIMS-UNSW	Chief Scientist
Jessica Essex	U. Tas	Student
Peter Hughes	CSIRO MNF	Hydrochemistry
Malcolm Lindsay	U. Melb	Alternate watch leader
Nicholas Summons	U. Melb	Student
Damon Bolton	UNSW	Student
Matt O'Sullivan	Southern Cross Univ.	Student
Matthew Eager	UoWollongong	Student
Melanie Sun	UNSW	Student
Natalie Miller	Murdoch U	Student
Jo Randall	U. Tas	Student
Sylvia Buchanan	La Trobe U	Student

Marine Crew

Master	Ian Taylor
2nd Officer	John Barr
Chief Engineer	Roger Thomas
1st Engineer	Rob Cave
2nd Engineer	Aminul Haque
Bosun	Graham McDougall
IR	John Howard
IR	Gareth Gunn
IR	Kel Lewis
IR	Paul O'Neill
Chief Steward	Katrina Beams
Chief Cook	John Fabrics
2nd Cook	Luke Riley

Acknowledgements

ARCNESS, ARC Network for Earth System Science;
Sydney Institute of Marine Science (SIMS);
DPI-Fisheries
Marine National Facility
University of New South Wales

Iain Suthers
Chief Scientist

Figures

Fig. 1: The students of SS Transit 01-2009 (from left): Nicholas Summons, Natalie Miller, Malcolm Lindsay, Jessica Essex, Matt O'Sullivan, Damon Bolton, Iain Suthers, Jo Randall, Matthew Eager, Melanie Sun, Sylvia Buchanan.

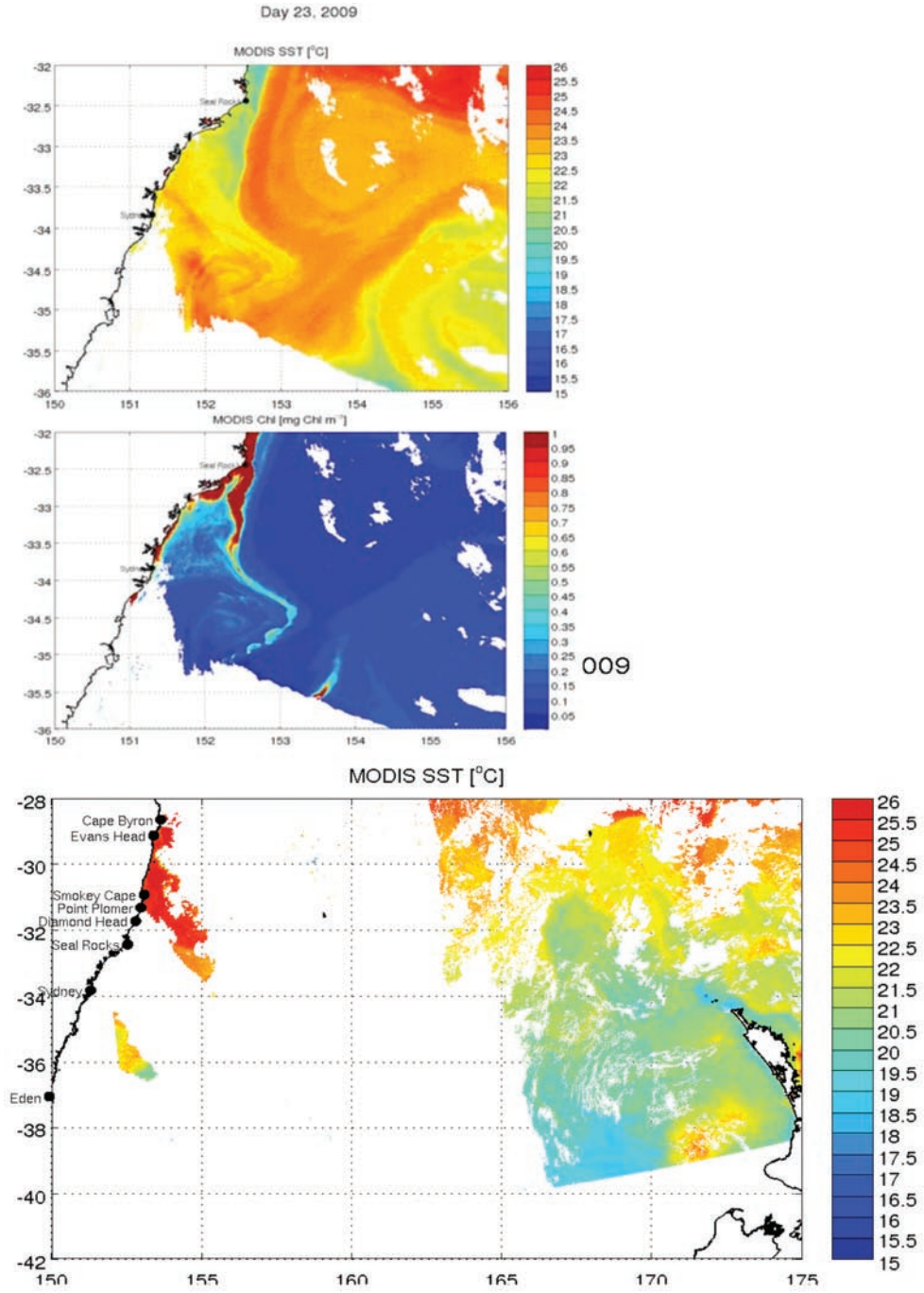


Fig. 2: a) MODIS SST on Jan. 23;
b) MODIS Chl a revealing the filament and initial target (but too soon into the voyage);
c) MODIS SST for 24 Jan for the region.

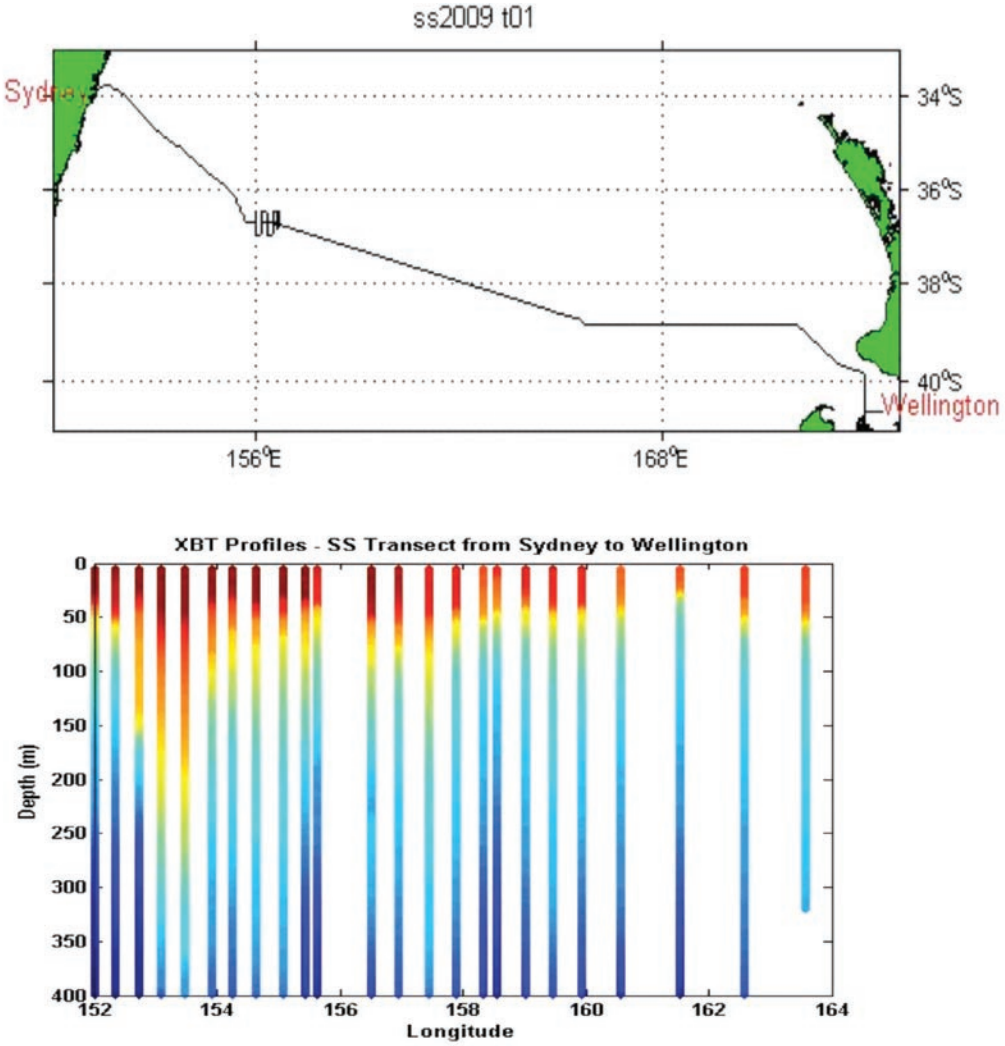


Fig. 3: Voyage track and corresponding XBT profiles across the Tasman Sea

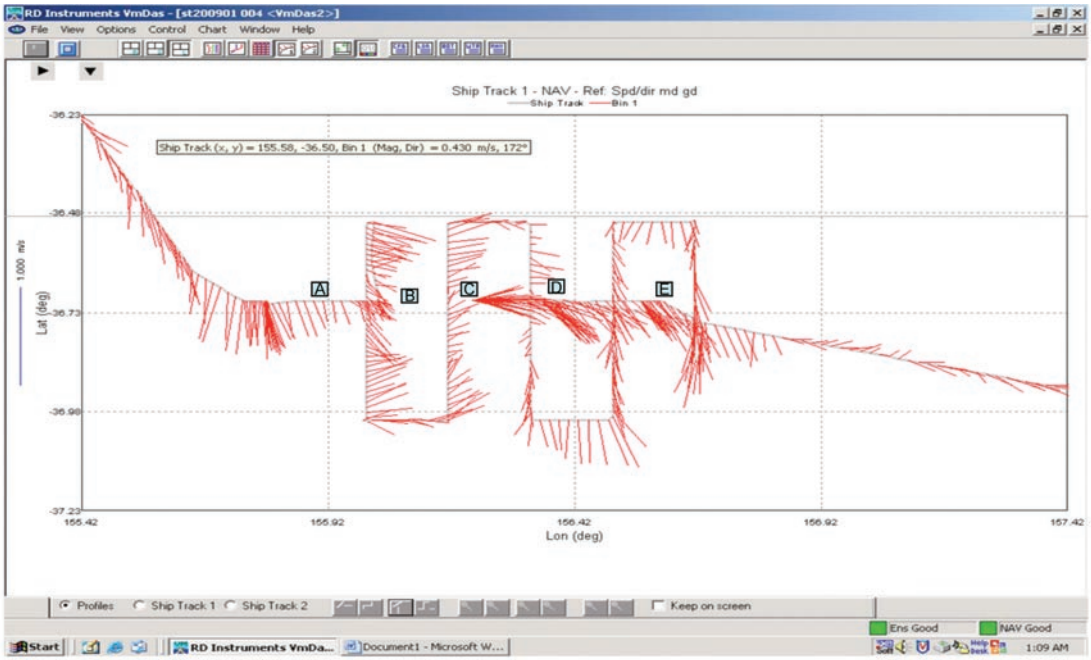


Fig. 4: Near surface (10 m) ADCP currents showing detail of survey over Gascoyne Seamount (currents differed at depth). Stations (A-E) are indicated. Station C is over the top of the seamount, and a series of XBTs (#14, 16, 17, 18, 19, 20) was conducted from the S to N transect between D and E.

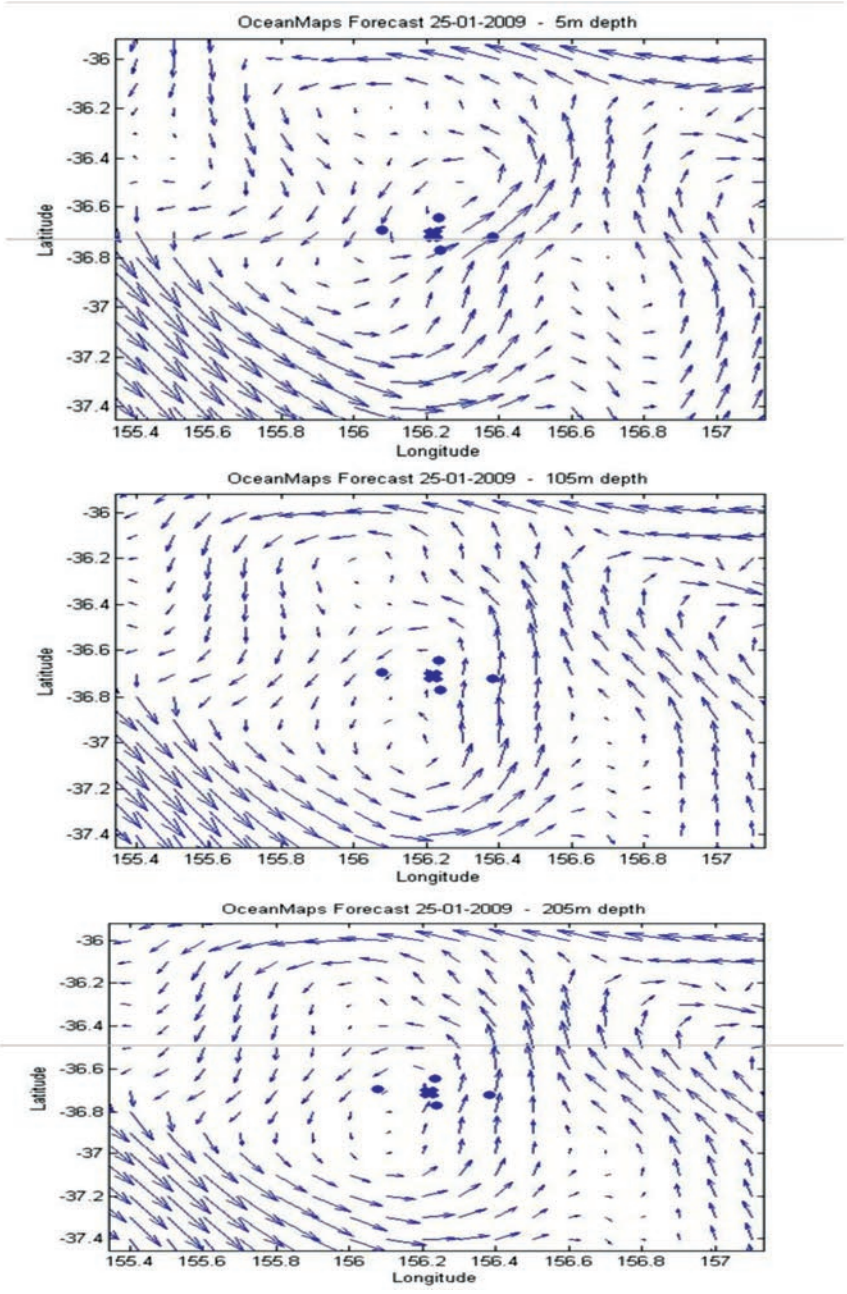


Fig. 5: Extracted OceanMaps forecast currents at 3 depths around Gascoyne (courtesy Nick Summons).

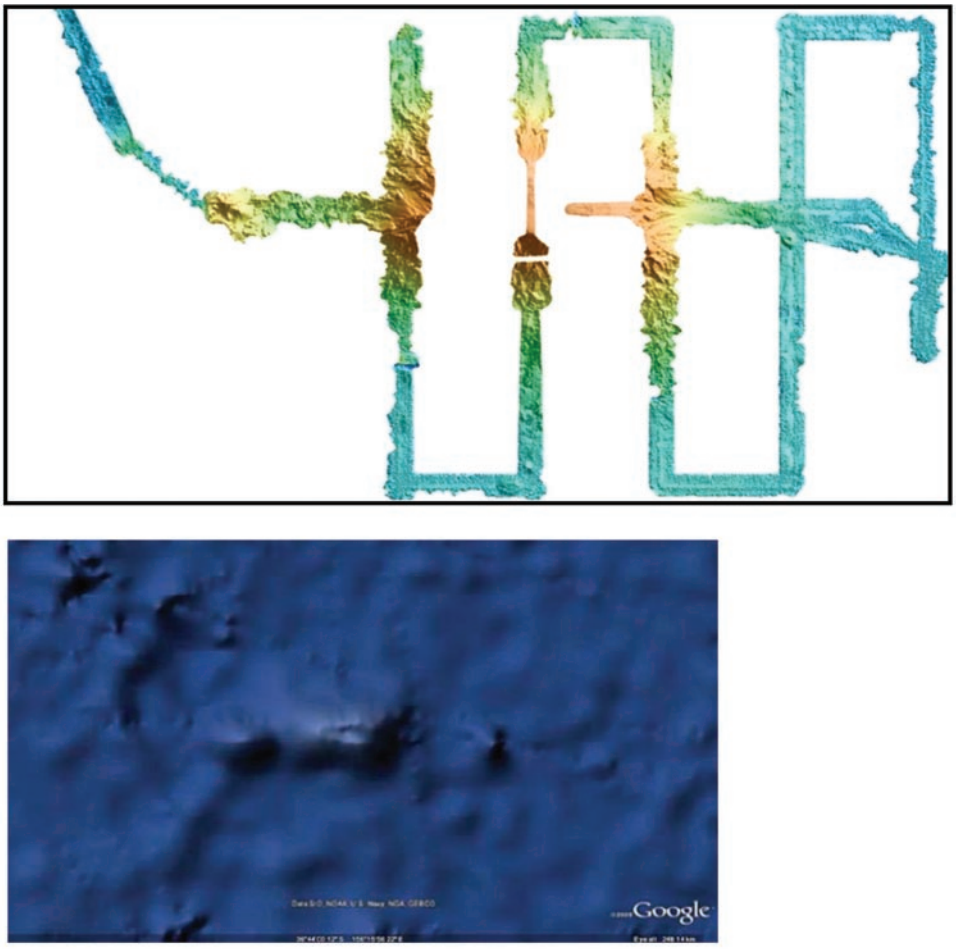


Fig. 6: Swath data obtained of Gascoyne Seamount, and corresponding Google Oceans bathymetry.

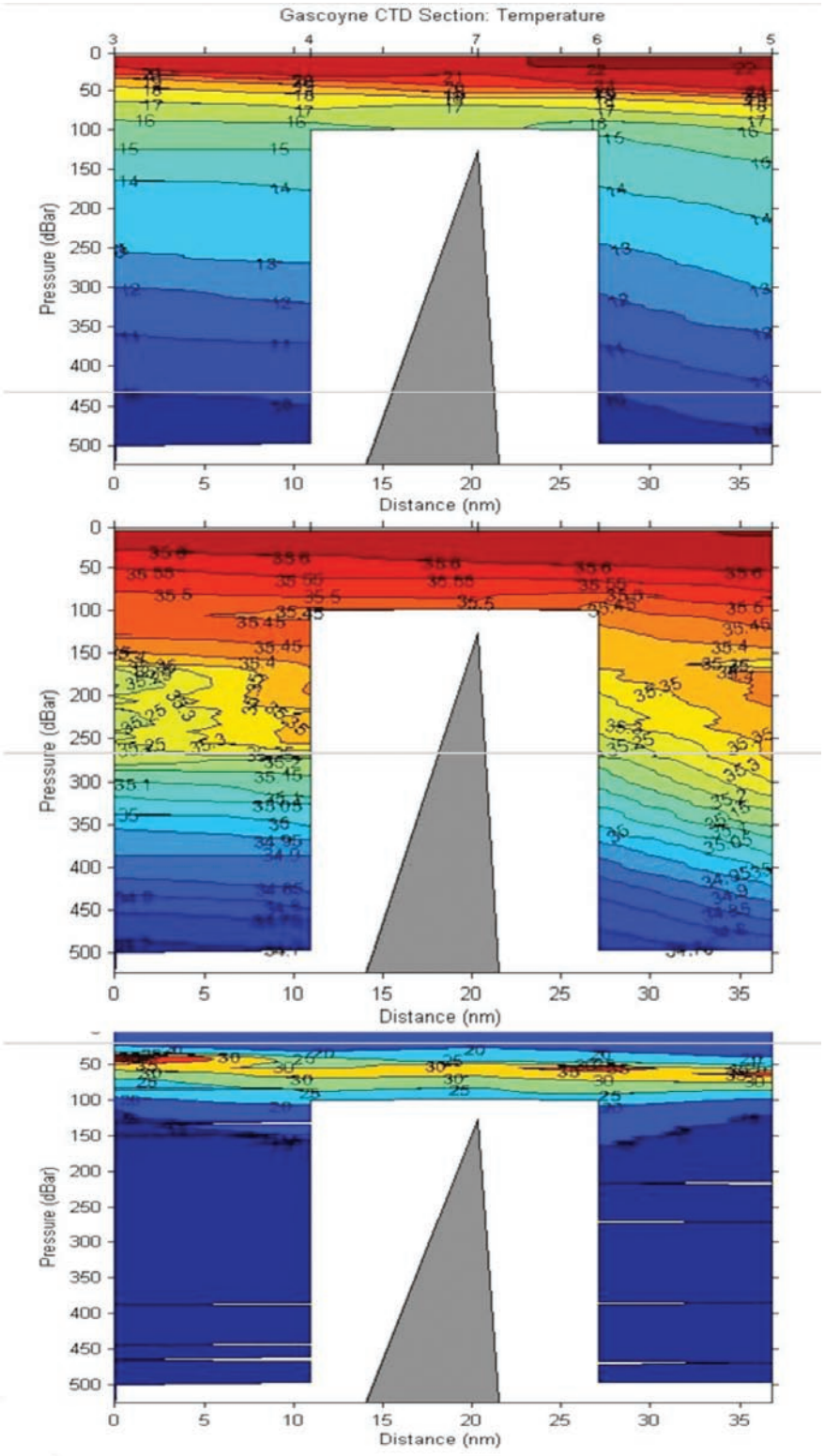


Fig. 7: Contoured CTD data from the 5 stations, W to E over Gascoyne showing temperature, salinity, uncalibrated fluoresence units

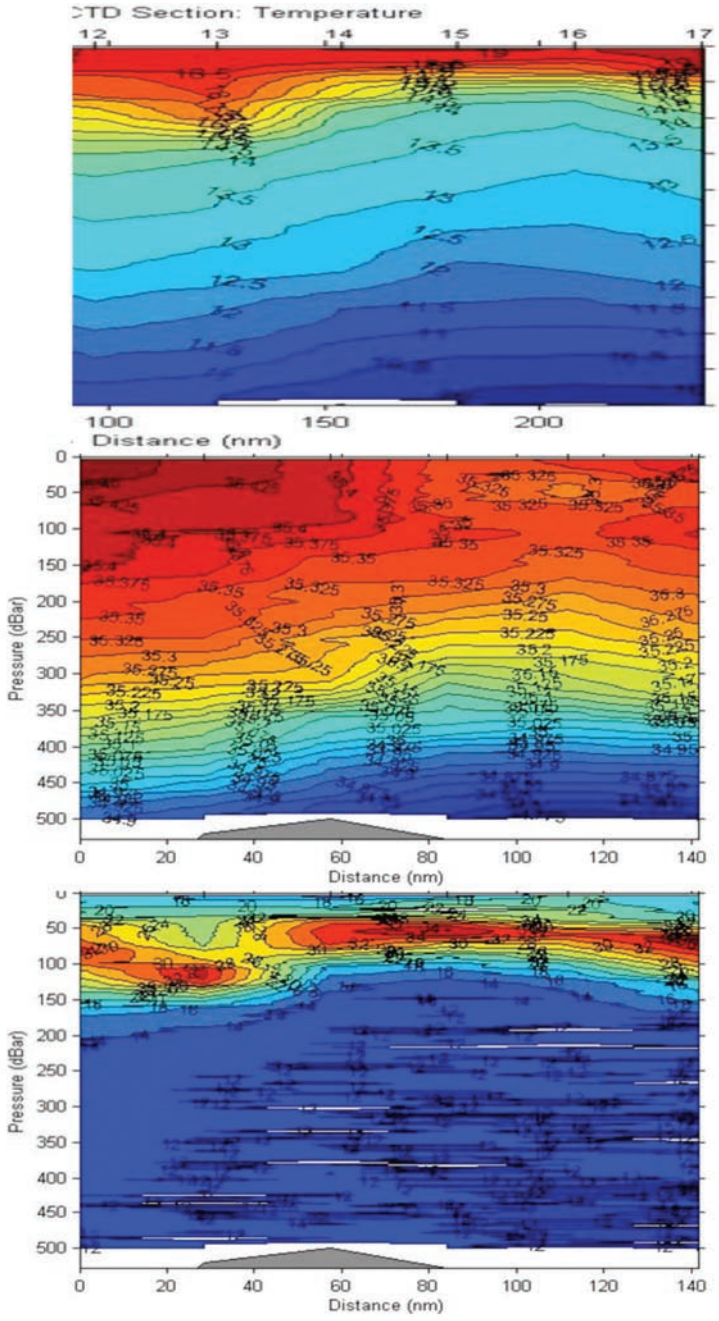
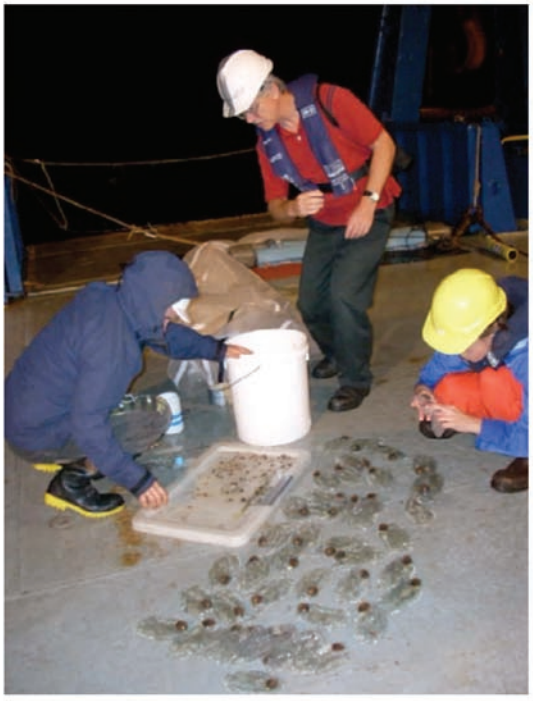
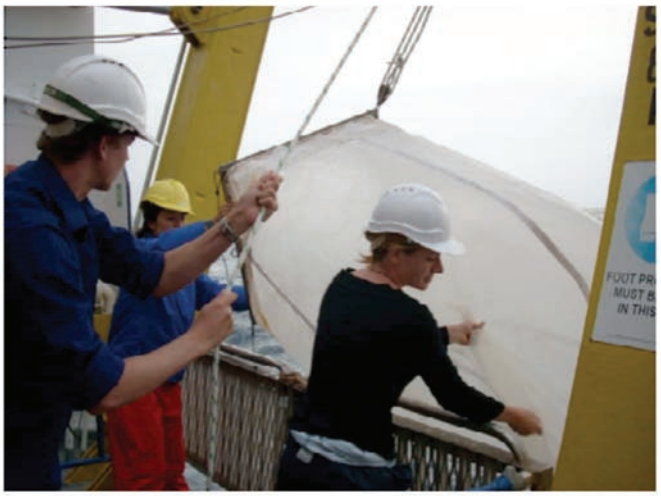


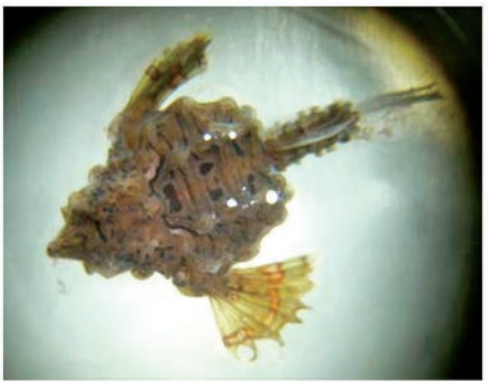
Fig. 8: Contoured CTD data of temperature, salinity, uncalibrated fluoresence units at 6 stations (#12-17, W to E), along 38 50′ deg. S over the Challenger Plateau









Appendix 1 – Science Report

Table of all CTD stations and associate N70 vertical hauls. RMT net tows (with 20 cm ring net, 100 um mesh mounted inside) and associated neuston net tows are also listed.

CTD Stn	Date	UTC	Local	Location	Lat	Long	bathy-metry	N70	RMT	20cm ring	Neuston	NOTES
1	Jan-25	8:56	19:56	Sydney	33 44.76	151 42.76	150	101,102	301	501	102,102	RMT to 80 m
2	Jan-25	11:22	22:22	Sydney	33 51.60	151 51.19	784	103,104	302	502	103,104	
3	Jan-26	10:54	21.54	Gascoyne-A	36 42	155 47.88	1974	105,106	303	503	105,106	
4	Jan-26	13:26	0.56	Gascoyne-B	36 41.98	156 01.43	738	107,108	304	504	107,108	
5	Jan-27	10:23	21.23	Gascoyne-E	36 42.04	156 33.643	4388	109,110	305	505	109,110	
6	Jan-27	12:38	23.38	Gascoyne-D	36 42.14	156 21.55	2312	111,112	306	506	111,112	
7	Jan-27	14:58	1.58	Gascoyne-C	36 41.85	156 13.05	125	113,114	307	507	113,114	RMT badly tore under weight of salps
8	Jan-28	2:10	13.08		37 11	158 33.71	5098					to 1000 with XBT
9	Jan-28	10:45	21.45		37 33.05	160 13.53	4742	115,116	308	508	115	
10	Jan-29	10:41	21:41		38 45.11	165 39.09	2581	117,118	309	509	116,117	to 1000 with XBT
11	Jan-29	17:01	12:22				1419					Thermosalinograph calibration
12	Jan-29	20:05	8:05	Challenger12	38 50	167 42.58	669					
13	Jan-29	23:02	11:02	Challenger13	38 50	168 18.91	520					
14	Jan-30	2:04	14:04	Challenger14	38 50	168 56.15	501					
15	Jan-30	5:02	17:02	Challenger15	38 50	169 30.68	523					
16	Jan-30	7:57	19:57	Challenger16	38 50	170 05.85	607					
17	Jan-30	11:00	23:00	Challenger17	38 50	170 44.22	779					

Voyage SS Transit 01-2009

"Next Wave" Transit voyage Sydney to Wellington

Iain Suthers, Sydney Institute of Marine Science (Chief Scientists)

Itinerary

Departed Sydney, (16:00) Sunday, (25 January 2009)
Arrived Wellington, 10:00 Sunday, (01 February 2009)

Contribution to Australia's national benefit:

Training of future marine scientists. Ten undergraduate and post-graduate students from 7 universities (UNSW, UTas, La Trobe, U. Melb, SCU, UoWollongong, Murdoch U) with no prior oceanographic experience, spent 7 days aboard Australia's premier oceanographic research vessel.

They used and analysed most of the *Southern Surveyor*'s equipment; with daily lectures on oceanography, climate science, Australia's Integrated Marine Observing System (IMOS) and on careers in marine science.

We discovered a surprising abundance of gelatinous zooplankton (salps) which are increasing in abundance with climate change and are under intense scrutiny as a solution for transferring carbon to the deep ocean. We made one of the first multidisciplinary studies of the biology, oceanography and bathymetry of Gascoyne Seamount.

NRPG's relevant to research previously supported by the MNF are described in each Annual Report. Copies are available for reference on the MNF Website at: www.marine.csiro.au/nationalfacility/annual/index.html

As a result of this voyage:

1. We have a better understanding of Gascoyne Seamount, including its bathymetry and the effect of currents impinging on one of our least studied seamounts. It rises from nearly 5 km deep to less than 100 m from the surface, and is located in a region of great oceanographic variability which is not easily modelled.

2. We have found that a weak and variable current can still cause significant upwelling. We found significant biomass of a large gelatinous zooplankton (salps) in the region, which have a large contribution to the fisheries and carbon flux in the region.

3. We have partially mapped Gascoyne Seamount with the vessel's high resolution swath mapper.

CSR/ROSCOP PARAMETER CODES

METEOROLOGY MARINE

M01 Upper air observations
M02 Incident radiation
M05 Occasional standard measurements
M06 Routine standard measurements
M71 Atmospheric chemistry
M90 Other meteorological measurements

PHYSICAL OCEANOGRAPHY

H71 Surface measurements underway (T,S)
H13 Bathythermograph
H09 Water bottle stations
H10 CTD stations
H11 Subsurface measurements underway (T,S)
H72 Thermistor chain
H16 Transparency (eg transmissometer)
H17 Optics (eg underwater light levels)
H73 Geochemical tracers (eg freons)
D01 Current meters
D71 Current profiler (eg ADCP)
D03 Currents measured from ship drift
D04 GEK
D05 Surface drifters/drifting buoys
D06 Neutrally buoyant floats
D09 Sea level (incl. Bottom pressure & inverted echosounder)
D72 Instrumented wave measurements
D90 Other physical oceanographic measurements

CHEMICAL OCEANOGRAPHY

H21 Oxygen
H74 Carbon dioxide
H33 Other dissolved gases
H22 Phosphate
H23 Total – P
H24 Nitrate
H25 Nitrite
H75 Total – N
H76 Ammonia
H26 Silicate
H27 Alkalinity
H28 PH
H30 Trace elements
H31 Radioactivity
H32 Isotopes
H90 Other chemical oceanographic measurements

MARINE CONTAMINANTS/POLLUTION

P01 Suspended matter
P02 Trace metals
P03 Petroleum residues
P04 Chlorinated hydrocarbons
P05 Other dissolved substances
P12 Bottom deposits
P13 Contaminants in organisms
P90 Other contaminant measurements

BIOLOGY/FISHERIES

B01 Primary productivity
B02 Phytoplankton pigments (eg chlorophyll, fluorescence)
B71 Particulate organic matter (inc POC, PON)
B06 Dissolved organic matter (inc DOC)
B72 Biochemical measurements (eg lipids, amino acids)
B73 Sediment traps
B08 Phytoplankton
B09 Zooplankton
B03 Seston
B10 Neuston
B11 Nekton
B13 Eggs & larvae
B07 Pelagic bacteria/micro-organisms
B16 Benthic bacteria/micro-organisms
B17 Phytobenthos
B18 Zoobenthos
B25 Birds
B26 Mammals & reptiles
B14 Pelagic fish
B19 Demersal fish
B20 Molluscs
B21 Crustaceans
B28 Acoustic reflection on marine organisms
B37 Taggings
B64 Gear research
B65 Exploratory fishing
B90 Other biological/fisheries measurements

MARINE GEOLOGY/GEOPHYSICS

G01 Dredge
G02 Grab
G03 Core – rock
G04 Core – soft bottom
G08 Bottom photography
G71 In-situ seafloor measurement/sampling
G72 Geophysical measurements made at depth
G73 Single-beam echosounding
G74 Multi-beam echosounding
G24 Long/short range side scan sonar
G75 Single channel seismic reflection
G76 Multichannel seismic reflection
G26 Seismic refraction
G27 Gravity measurements
G28 Magnetic measurements
G90 Other geological/geophysical measurements