

RV Investigator Voyage Plan

Voyage #:	IN2017_T02		
Voyage title:	Collaborative Australian Postgraduate Sea Training Alliance Network Pilot Voyage 1		
Mobilisation:	Henderson, 08:00 Tuesday, 14 November 2017		
Depart:	10:00, 14 November 2017		
Return:	Hobart, 12:00, 26 November 2017		
Demobilisation:	Hobart, Monday, 27 November 2017		
Voyage Manager:	Matt Kimber	Contact details:	03 6232 5186 / matt.kimber@csiro.au
CAPSTAN Director and Lead Principle Investigator:	Dr. April Abbott		
Affiliation:	Macquarie University	Contact details:	02 9850 8342 april.abbott@mq.edu.au
Chief Scientist:	A/Prof Jochen Kaempf		
Affiliation:	Flinders University	Contact details:	08 8201 2214 Jochen.Kaempf@flinders.edu.au

Scientific objectives

CAPSTAN 2017

CAPSTAN is a post-graduate training program. The Collaborative Australian Postgraduate Sea Training Alliance Network is a post-graduate at sea training initiative on the RV *Investigator*. Governed by a network of leading industry and university partners from within marine science and geoscience, CAPSTAN is a first of its kind programme which will transform the way marine science education is delivered. A truly national education initiative, CAPSTAN offers a national approach to teaching and learning in the marine sciences whilst providing a platform for institutional, industrial and generational knowledge transfer and collaboration.

Our aims have arisen out of a national desire to:

- Develop an effective, efficient form of vessel-based tertiary education by involving stakeholders and post-graduate students, and by pooling national tertiary teaching expertise and personnel resources;
- Develop a national curriculum to standardise teaching protocols/methods and learning outcomes in this area in conjunction with the new data collection equipment and facilities of the Marine National Facility RV *Investigator*, the Integrated Marine Observatory System and external stakeholders, and;
- Provide and test a multi-disciplinary research-based teaching module for marine science postgraduates with opportunities for student mobility and national network development.

Voyage objectives

CAPSTAN 2017

The training objectives of CAPSTAN's 1st Pilot Voyage are to:

- Enable national access to the RV *Investigator* to postgraduate students enrolled in Australian tertiary institutions.
- Provide hands-on training experiences with standard modern sampling equipment used in marine research, encompassing geological, biological, chemical, physical oceanographic and atmospheric equipment.
- Establish national network of new generation marine scientists.
- Develop post-graduate training programs for refinement over the pilot three-year trial period.
- Involve a diverse number of national trainers and students in the program.
- Provide trainers with the opportunity to gain experience as Chief Scientist/Co Chief Scientist.

Tasks involved in the training are yet to be detailed and will be developed over the three year pilot period. We aim to deliver a program that encompasses the following:

1. Plan and participate in a multidisciplinary marine science research survey focusing on the core disciplines of e.g. oceanography, plankton ecology, geosciences, atmospheric and fisheries sciences.
2. Evaluate the physical, chemical and biological factors that influence the abundance and distribution of marine organisms using an IMOS national Reference Station (NRS) as an example.
3. Describe the application of various scientific sampling equipment and instrumentation on-board the RV *Investigator*.
4. Acquire, process and analyse quantitative and qualitative samples.

5. Perform data analysis, quality control, interpretation and integration.
6. Prepare a final cruise report.
7. Prepare and present an element of the final cruise report to peers and crew.
8. Master the skills required to operate and conduct oneself safely in the marine environment including specific MNF sea–survival skills and laboratory safety.
9. Attain AMSA sea safety and survival skills certification for trainers, and eventually student participants.

The specific transit objectives are to:

- Undertake a general scientific assessment of key physical, biogeochemical, geological and ecological features of a specific shelf/slope region. The far western Great Australian Bight was selected as a study region (see details below) for this first CAPSTAN cruise.

Priority-ranked list of tasks to achieve the overall objectives

We believe that the proposed list of tasks is reasonable to achieve within the 2 days of intensive field data collection and that a specific prioritization of tasks is not required. In the unlikely case of bad weather, there is the option to undertake the field survey farther in the east in an alternative study region, which would free up one day. Otherwise and for continued bad weather within the window of opportunity of measurements, some repeated activities such as CTD casts would have to be cancelled.

Operational Risk Management

We do not anticipate high risk operations given that our objectives and use of equipment will function around standard equipment deployment (XBTs, CTD, plankton nets, grabs, dredge, gravity corer etc.) by the vessel and for which standard MNF operation protocols exist.

Overall activity plan including details for first 24 hours of voyage

(Approximate timings, subject to weather and operational revision)

Table 1: Overall Activity Plan

13	Nov	<p><u>Pre Mobilisation:</u></p> <ul style="list-style-type: none"> - All students and trainers to arrive at ship. - Loading of program personnel luggage and accommodation assigning. - Introductions and outline of activities. - ARGO training and outline session. - Dinner on board
14	Nov	<p><u>Mobilisation:</u></p> <ul style="list-style-type: none"> - Dispersal of boots and other gear - Departure will occur as soon as mobilisation is complete. <p><u>Post mobilisation activities:</u></p> <ul style="list-style-type: none"> - ASP seagoing induction, safety briefing and muster. - Voyage briefing by MNF Voyage Manager – policies and safety. - Briefing CAPSTAN Director and Chief and Co Chief Scientists. - Laboratory inductions and ship familiarisation activities. - Dinner at 17:00.

		<ul style="list-style-type: none"> - Coastal Transit 1 (underway data collection) - 12 hour operation throughout voyage; 2 watches @ 8 hours with 4 hours overlap (12:00-16:00)
15	Nov	Leeuwin Current transects 1-4 (exclusively underway measurements) Coastal Transit 2 (underway data collection)
16	Nov	Field Data Collection - Study Region (day 1) ST#1-ST#7
17	Nov	Field Data Collection - Study Region (day 2) ST#1-ST#7 Continued
18	Nov	Coastal transit 3 (underway data collection)
19	Nov	Transit (incl. Subtropical Front underway transects & ARGO float deployment) SF#1-SF#4
20	Nov	Transit (incl. Subtropical Front underway transects & ARGO float deployment) SF#1-SF#3
21	Nov	Transit (incl. Subtropical Front underway transects & ARGO float deployment) SF#1-SF#3
22	Nov	Transit (incl. Subtropical Front underway transects & ARGO float deployment) SF#1-SF#3
23	Nov	Transit to Coastal Transit 4 for coastal activities
24	Nov	Transit to Coastal Transit 4 for coastal activities Cruise Report writing Teaching activities
25	Nov	Transit to Hobart Cruise Report writing- student submissions due 6pm. Coastal Transit 4 (underway data collection)
26	Nov	Arrival and Demobilisation. <ul style="list-style-type: none"> - All to assist with demobilisation – cabin and lab cleaning. - 3pm Debrief CAPSTAN – (at CSIRO lecture theatre?) - All trainers and students to stay overnight at arranged accommodation. - Dinner local.
27	Nov	Airport departures.

Planned Voyage Track

Figure 1 shows the overall cruise path including 4 Coastal Transects (at approx. 6 nm distance from coast, closer where Master indicates possible), underway data collection in transects across the Leeuwin Current and the Subtropical Front, the proposed study region (for 2 days of intensive field data collection) near the Bremer Canyon, and an alternative study region off the Cape Le Grand National Park. Table 2 specifies the waypoints and station locations for the proposed study region. Figure 2 shows a detailed map of the CTD stations. Voyage details using the alternative study region is presented in the appendix.

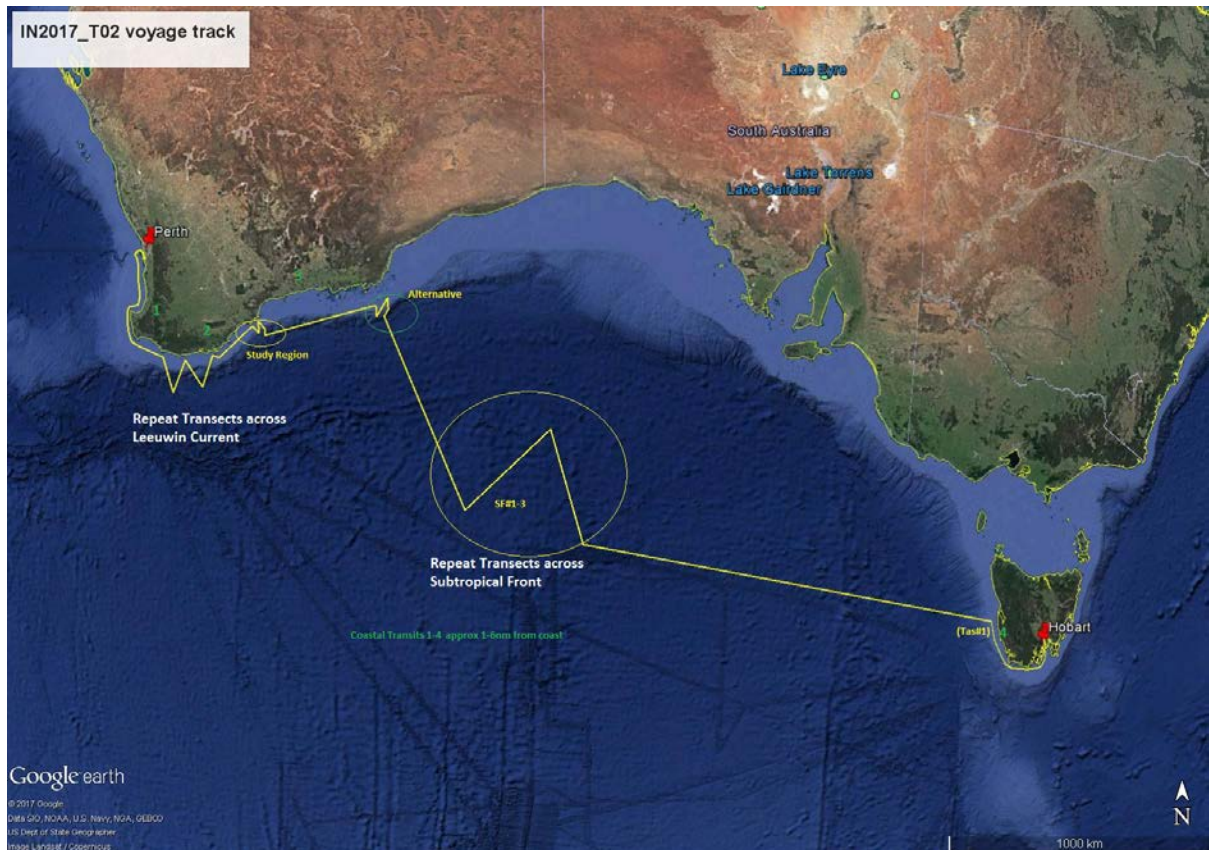


Figure 1: Travel route showing the preferred and alternative study regions, transects across key oceanographic features (the Leeuwin Current and the Subtropical Front), and four coastal transit routes within 6 nm from the coast for birdwatching & megafauna-watching activities. Drone-based measurements and ARGO float deployments will be undertaken based on opportunity.

Waypoints and stations

Table 2: Geographical coordinates of stations/waypoints for Voyage track in Figure 1.

Station	Lat	Long
Henderson/Southern Harbour	32.157	115.7616
Cape Flaming	-32.0257	115.4047
Cape Bouvard	-32.6967	115.4216
Wright Bank	-33.4328	114.9762
Cape Freycinet	-34.1385	114.8457
Cape Hamelin	-34.3951	114.9088
Cape Leeuwin	-34.5568	115.1421
LC#1	-35	116
LC#2	-36	116.2
LC#3	-35.2	116.8
LC#4	-36	117.3
LC#5	-35.2	117.8
Maudes Reef	-35.2998	118.0221
Bald Island	-35.0136	118.554
ST#1	-34.6	119.3
ST#2	-34.71	119.4
ST#3	-34.82	119.5
ST#4	-34.5	119.52
ST#5	-34.61	119.62
ST#6	-34.72	119.72
ST#7	-34.9	119.7
ST#1b (Alternative Study Region If required)	-34.48	123.5
SF#1	-40	126
SF#2	-38	129
SF#3	-41	130
TAS#1	-42.5	145
Hobart Princes Wharf 4	-42.8862	147.3387

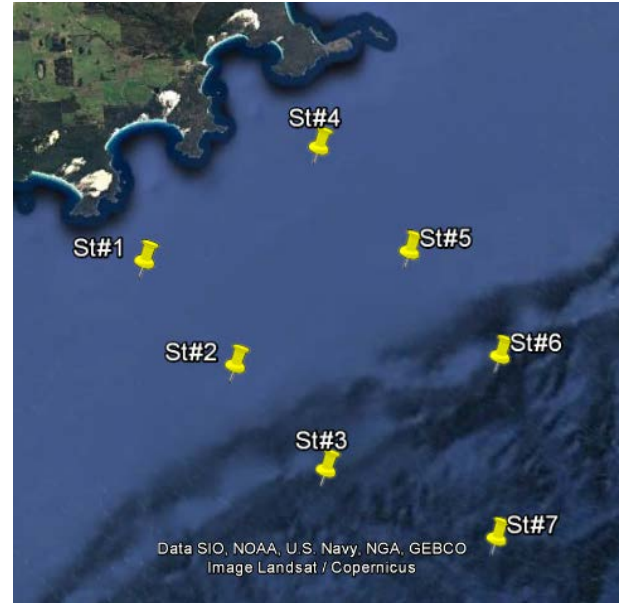


Figure 2: CTD stations in the Study Region (see Figure 1)

Time estimates

Table 1 shows the diary of planned activities. The timing of key activities based on the waypoints given in Table 2 are listed in Tables 3 and 4. All times are based on a vessel speed of 11 knots.

Table 3: Timing of key activities (Table 2 shows coordinates of CTD stations/waypoints)

From	To	Distance (nm)	Activity	Time from start (hrs)	Time from start (days)
Fremantle	LC#1	245	Coastal Transit 1	20.4	0.9
LC#1	LC#2	65	Leeuwin Current transect 1	25.8	1.1
LC#2	LC#3	57	Leeuwin Current transect 2	30.6	1.3
LC#3	LC#4	55	Leeuwin Current transect 3	35.2	1.5
LC#4	LC#5	57	Leeuwin Current transect 4	39.9	1.7
LC#5	ST#1	93	Coastal Transit 2	47.7	2.0
ST#1	ST#7	see Table 4	Field data collection (2 days)	95.7	4.0
ST#7	St#1b	225	Coastal Transit 3	114.4	4.8
St#1b	SF#1	365	Subtropical Front transect 1	144.8	6.0
SF#1	SF#2	186	Subtropical Front transect 2	160.3	6.7
SF#2	SF#3	188	Subtropical Front transect 3	176.0	7.3
SF#4	TAS#1	682	Transit	232.8	9.7
TAS#1	Hobart	186	Coastal Transit 4	248.3	10.3

Table 4: Station information, activity and timing of field data collection programme.

Station	Activity	Duration (hr)	Time from start (hr)
DAY 1 - 16 Nov (target start time is 10 am)			
at St#1	CTD profile & vertical haul net	1	1
Transit to St#2	Steaming & Neuston net	1.5	2.5
at St#2	CTD profile & vertical haul net	1	3.5
at St#2	Gravity corer or multi corer	4	7.5
Transit to St#3	Steaming	1	8.5
at St#3	Gravity corer or multi corer (sequential)	2	10.5
at St#3	CTD profile & vertical haul net	1.5	12
Transit to St#4	Seafloor mapping (path to be advised)	10	22
DAY 2 – 17 Nov (target start time is 8 am)			
at St#4	CTD profile & vertical haul net	1	1
at St#4	Vertical drop camera	3	4
Transit to St#5	Steaming & Neuston net	1.5	5.5
at St#5	CTD profile & vertical haul net	1	6.5

Station	Activity	Duration (hr)	Time from start (hr)
at St#5	Sherman sled or Smith-McIntyre Grab	3	9.5
Transit to St#6	Steaming	1	10.5
at St#6	Sherman sled or Smith-McIntyre Grab (sequential)	2	12.5
at St#6	CTD profile & vertical haul net	1.5	14
at St#6	Vertical drop camera	4	18
Transit to St#7	Steaming	1	19
at St#7	CTD profile & vertical haul net	3	22

Drone-based measurements and ARGO float deployments will be undertaken based on opportunity. A drone will be operated by one or two operators the case of mega-fauna sightings. We may also use drone-based videoing for other purposes. Possible ARGO deployment sites are on either side of the Subtropical Front.

Piggy-back projects (if applicable)

None.

Investigator equipment (MNF)

Underway measurements: Continuous Plankton Recorder (CPR)
Thermosalinograph, ADCP – 150 kHz, Biological Oceanography Underway Sensors, Sub-Bottom Profiler, Echo Sounders, weather Radar & other weather data

In-situ and net trawl measurements:

- CTD - Seabird 911 with 36 Bottle Rosette with dissolved oxygen sensors, a PAR Sensor (light), transmissometer (particles and mass concentrations) and a fluorimeter (chlorophyll-a), water samples for chl-a and nutrients (~50 samples),
- surface net for plankton tows, multi-corer with cold-room (4degC) storage,
- Smith-McIntyre Grab,
- Sherman sled/rock dredge
- Neuston net/vertical haul net.

Other: XBTs, drop camera system

Software request (Matthias Tomczak): Matlab with seawater toolbox. MNF will provide single PC with software.

Compound microscopes (x2).

(i) Standard laboratories and facilities

Name	Essential	Desirable
Constant Temperature Lab	×	
Underway Seawater Analysis Laboratory	×	
GP Wet Lab (dirty)	×	
GP Wet Lab (Clean)	×	
GP Dry Lab (Clean)	×	
Sheltered Science Area	×	
Observation deck 07 level	×	
Walk in Cool Room	×	

(ii) Standard laboratory and sampling equipment

Name	Essential	Desirable
CTD - Seabird 911 with 36 Bottle Rosette	×	
LADCP	×	
Milli -Q System	×	
Laboratory Incubators		×
Heavy Duty Electronic Balance		×
Medium Duty Electronic Balance		×
Surface Net	×	
Smith Mac grab	×	
Dissecting Microscopes	×	

(iii) Auxiliary CTD sensors

Name	Essential	Desirable
Dissolved oxygen sensor	×	
Altimeter		×
PAR sensor (Biospherical QCP-2300)	×	
Transmissometer (wetlabs C-Star 25cm)	×	
Fluorometer – Chlorophyll- <i>a</i> (Chelsea Aquatracka III – 430/685nm)	×	

(iv) Specialised laboratory and sampling equipment

May require additional support

Name	Essential	Desirable
Continuous Plankton Recorder (CPR)	×	
Gravity Coring System	×	
Multi Corer	×	
XBT System	×	

Name	Essential	Desirable
Sherman epibenthic sled	×	
Rock Dredges	×	
Rock saw	×	

(v) Underway systems

Acoustic Underway Systems

Name	Essential	Desirable
75kHz ADCP	×	
Multi Beam echo sounder EM122 12kHz (100m to full ocean depth)	×	
Multi Beam echo sounder EM710 70-100kHz (0-1000m approx.)	×	
Sub-Bottom Profiler SBP120	×	
Scientific Echo Sounders EK60 (6 bands, 18kHz-333kHz)	×	
Gravity Meter		×
Biological Oceanography Underway Sensors	×	

Atmospheric Underway Sensors

Name	Essential	Desirable
Polarimetric Weather Radar	×	

Underway Seawater Instrumentation

Name	Essential	Desirable
Thermosalinograph	×	
Fluorometer	×	
Optode	×	
PCO2		×

User Equipment

- Small 50µm meshed Plankton nets – ANU (Leanne Armand)
- Steel-toed gumboots for students - MQ
- FluoroProbe (Olaf Meynecke, Griffiths University)
- Analysis equipment of sediment cores provided by April Abbott, Kelsie Dadd & Tom Hubble
- Drone - DJI Phantom 3 professional (less than 2kg and about 30cm diameter) (Olaf Meynecke, Griffiths University)
- UV Lamp (enclosed) for slide setting

Special Requests

Makeshift secondary change-room for students with storage tubs. This will be setup through the use of one of the GP Labs.

Permits

- AFMA (lodged on 28 August 2017, approved on 4 Nov 2017) - will be effective from 15 November
- Animal Ethics Clearance (applied by & approved for Olaf Meynecke, Griffiths University) for fish work.
- Animal Ethics clearance for drone use with marine mammals (Olaf Meynecke, Griffiths University)

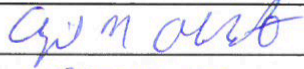
Notes: Commonwealth waters Part 8A - biological resources application is not required on the basis all biological material is discarded during the voyage.

Personnel List

	Name	Role	Affiliation
1.	Matt Kimber	Voyage Manager	CSIRO MNF
2.	Jochen Kaempf	Chief Scientist	Flinders University
3.	Leah Moore	Co-Chief Scientist	University of Canberra
4.	Leanne Armand	Trainer/ Alt Chief Scientist	Australian National University
5.	April Abbott	CAPSTAN Director/ Administrator (Trainer)	Macquarie University
6.	Rod Palmer	SIT Support	CSIRO MNF
7.	Ben Baldwinson	SIT Support	CSIRO MNF
8.	Jason Fazey	Mech Tech	CSIRO MNF
9.	Matt Boyd	GSM Support/DVM	CSIRO MNF
10.	Stuart Edwards	GSM Support	CSIRO MNF
11.	Stephen Tibben	Hydrochemistry	CSIRO MNF
12.	Anoosh Sarraf	DAP Support	CSIRO MNF
13.	Karl Malakoff	DAP Support	CSIRO MNF
14.	Carlie Devine	Videographer	CSIRO MNF
15.	Ben Arthur	Education Outreach Officer	CSIRO MNF
16.	Matthias Tomczak	Trainer Oceanographer	Flinders University
17.	Thomas Hubble	Trainer Geologist	University of Sydney
18.	Olaf Meynecke	Trainer Biological Oceanographer- Mammals/Birds	Griffiths University
19.	Eric Woehler	Trainer Marine Bird Specialist	University of Tasmania
20.	Kelsie Dadd	Trainer Geologist	University of Sydney
21.	Ajinkya Vilas Koleswar	Student	University of Western Australia, W.A.
22.	Alistair Deane	Student	University of Tasmania, TAS.
23.	Anthony Uwalaka	Student	University of Western Australia, W.A.
24.	Bronwyn Teece	Student	Macquarie University, N.S.W.
25.	Christiaan Diemont	Student	Macquarie University, N.S.W.
26.	Emma Gale	Student	Charles Darwin University, N.T.
27.	Helen Hayes	Student	UTS, N.S.W.

	Name	Role	Affiliation
28.	Helen Truscott	Student	Charles Darwin University, N.T.
29.	Ines Richter	Student	UNSW, N.S.W.
30.	Katherine Simmonds	Student	UNSW, N.S.W.
31.	Lena O'Toole	Student	University of Sydney, N.S.W.
32.	Md. Rashid Salem	Student	University of Western Australia
33.	Rebecca Riggs	Student	University of Sydney, N.S.W.
34.	Rebecca McGirr	Student	University of Sydney, N.S.W.
35.	Rhiannan Mundana	Student	University of Tasmania, TAS.
36.	Joe Moraga	Student	University of Canberra, A.C.T.
37.	Marion Tuuri	Student	Flinders University, S.A.
38.	Peta Vine	Student	Macquarie University, N.S.W.
39.	Sam Wines	Student	Deakin University, VIC
40.	Dani Harmshaw	Student	Deakin University, VIC

Signatures

Your name	April Abbott
Title	CAPSTAN Director, Macquarie University.
Signature	
Date:	9/10/2017
Your name	Jochen Kaempf
Title	Chief Scientist, Flinders University
Signature	A/Prof Jochen Kaempf <small>JOCHEN KAEMPF, CHIEF SCIENTIST, FLINDERS UNIVERSITY, GPO BOX 217, STURT ROAD, ADELAIDE, SA 5001, AUSTRALIA. TEL: 08 8302 4200. FAX: 08 8302 4201. WWW.FLINDERS.EDU.AU</small>
Date:	17-10-09

Appendix: Alternative Voyage Track

Table A1 lists the timing of key activities based on the alternative study region (see Figure 1). The timing of activities within the planned 2 days of intensive field data collection is not affected

Table A1: Timing of key activities based on alternative study region.

From	To	Distance (nm)	Activity	Time (hr)	Time (days)
Fremantle	LC#1	245	Coastal Transit 1	20.4	0.9
LC#1	LC#2	65	Leeuwin Current transect 1	25.8	1.1
LC#2	LC#3	57	Leeuwin Current transect 2	30.6	1.3
LC#3	LC#4	55	Leeuwin Current transect 3	35.2	1.5
LC#4	LC#5	57	Leeuwin Current transect 4	39.9	1.7
LC#5	ST#1b	332	Coastal Transit 2&3	67.6	2.8
ST#1b	ST#7b	See Table A2	Field data collection (2 days)	115.6	4.8
St#7b	SF#1	335	Subtropical Front Transect 1	143.5	6.0
SF#1	SF#2	186	Subtropical Front Transect 2	159.0	6.6
SF#2	SF#3	188	Subtropical Front Transect 3	174.7	7.3
SF#3	TAS#1	682	Transit	231.5	9.6
TAS#1	Hobart	186	Coastal Transit 4	247.0	10.3

Table A2: Geographical coordinates of CTD stations in alternative study region.

ST#1b	-34.48	123.5
ST#2b	-34.63	123.5
ST#3b	-34.78	123.5
ST#4b	-34.31	123.9
ST#5b	-34.46	123.9
ST#6b	-34.61	123.9
ST#7b	-34.8	123.75

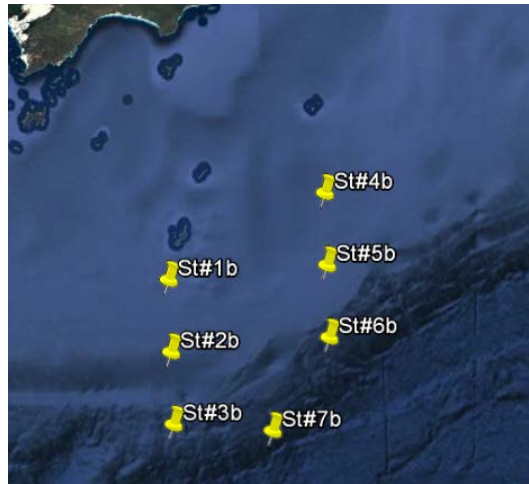


Figure A1: CTD stations in the alternative study region.