RV *Investigator* Voyage Plan

Voyage #:	**IN2017_V04**		
Voyage title:	The whole enchilada: from production to predation in Tasman Sea ecosystems		
Mobilisation:	0800 Brisbane, Thursday, 31 August 2017		
Depart:	1400 Brisbane, Thursday, 31 August 2017		
Return:	1000 Sydney, Monday, 18 September 2017		
Demobilisation:	1000 Sydney, Monday, 18 September 2017		
Voyage Manager:	Don McKenzie	**Contact details:**	Don.mckenzie@csiro.au
Chief Scientist:	Iain Suthers		
Affiliation:	University of New South Wales	**Contact details:**	i.suthers@unsw.edu.au
Principal Investigators:	UNSW: Jason Everett, Chris Brownlee, Moninya Roughan, Shane Keating, Mark Brown U. Auckland: Andrew Jeffs UTas: Julia Blanchard, CSIRO: Alistair Hobday, UTS: Martina Doblin UBC: Evgeny Pakhomov		

Voyage objectives

Introduction. The distribution of temperature, sea-level and chlorophyll a is plain to see via satellite, and indeed some fisheries are managed by Sea Surface Temperature (SST). Our goal is to convert this physical view of the Tasman Sea to an ecosystem one, by sampling distinctive oceanographic habitats with the CTD samples (for phytoplankton); plankton nets (for zooplankton and larval fish) and the Danish trawl (for small fish, larval lobster and micronekton), down to 500 m deep (and on two occasions to 1,000 m deep).

On the observation deck, two dedicated observers will relate the birds and cetaceans to water masses to encompass the Tasman Sea ecosystem as much as possible.

The following paragraphs relate to the Aims outlined in Table 1.

Aim 1 & 2: Size Structure Ecosystems. We will convert these biological samples to a size-structured ecosystem and size-based rates (growth, mortality), supplemented by the Triaxus (plankton size) and EK60 (bioacoustics, micronekton size).

In the MicroCSI lab we will enumerate the microbes and estimate their size and condition with a flow cytometer. We will also conduct size-fractionation of the phytoplankton (0.3 to 2, 2, to 10 and >10 µm) to complement measurements of the apparent (pigments, CDOM) and inherent optical properties (absorption, backscatter, water leaving radiance) of the sampled water masses. (The optical measurements allow us to link *in situ* properties with remote sensing reflectance and thereby validate ocean colour products).

In the wet lab we will sort the zooplankton and the trawl catch into size classes, identify, weigh, and freeze most of the catch. Representative samples will be frozen for stable isotope analyses, to develop community-level body-size and trophic-level relationships for the Tasman Sea. By using stable isotopes to understand the trophic structure of the ecosystem, we can extract additional information from our samples, including estimates of food-chain length and trophic transfer efficiency.

After the voyage, we aim to develop a model to extrapolate the “size spectrum” from bacteria to fish over the western Tasman habitats, and across seasons, years and decades.

Aim 3a: Larval fish. A key part of this ecosystem synthesis is to assess the survival of commercially important larval fish (such as the forage fish sardine, mackerel and scad). Past voyages have revealed the potential for high growth and high mortality on the shelf, while entrainment offshore in frontal eddies may reduce larval mortality. Unlike other zooplankton, larval fish may be aged to the day which yields the time-dependent abundance (i.e. mortality).

A key objective is to relate the larval mortality rate with the slope of the zooplankton biomass size spectrum, from our LOPC mounted on the EZ net. Due to the logistics of the Triaxus, EZ net, and Danish trawl, we hope to make most of the samples with the MNF’s bongo net from the side of the vessel (to only ~50 m depth).

Aim 3b: Larval lobster. Very little is known about the larval biology of eastern rock lobster, Sagmariasus verreauxi. Their larval biology may be similar to the Jasus species – i.e., diurnal vertical migrators, associated with retention in large eddy systems, and at low horizontal densities.

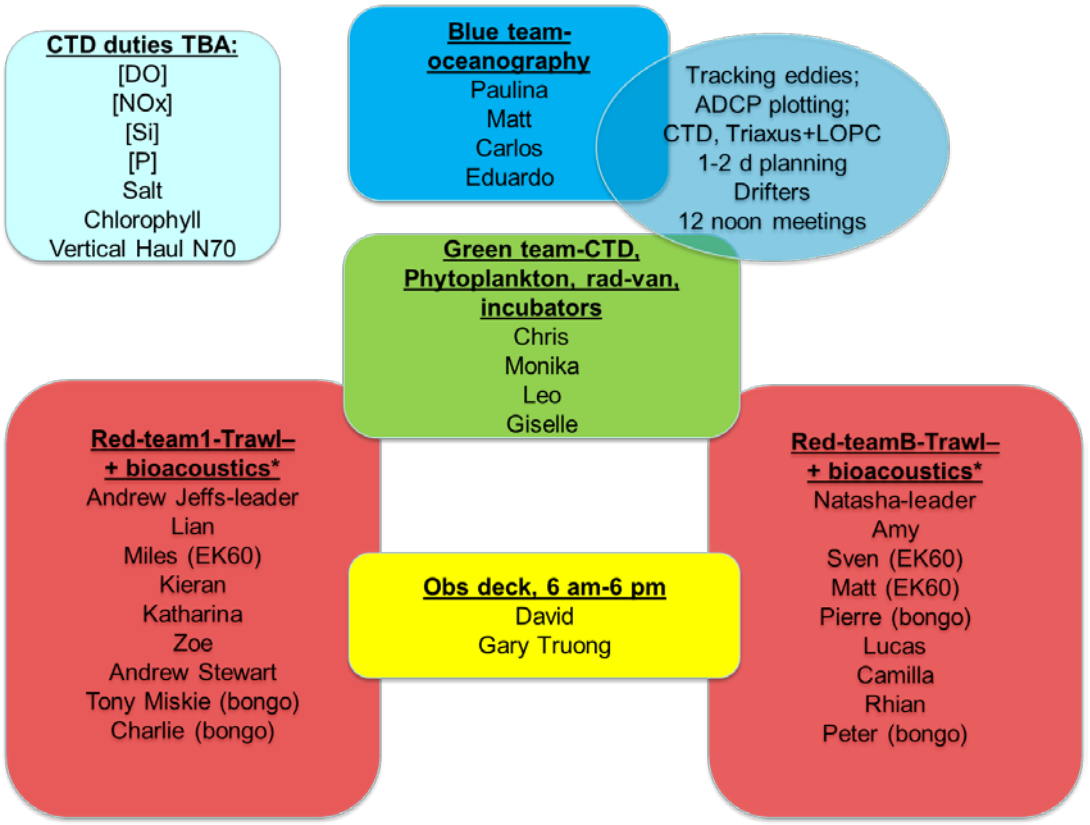
The Investigator voyage in 2015 caught only one phyllosoma of this valuable species in a small neuston net in a large warm core eddy off Sydney. Samples from the 2016 voyage indicate the small number of phyllosoma that were caught were all other species of lobsters which are of no commercial fisheries interest. Past zooplankton catches found only a small number of *J. verreauxi* phyllosoma, with some on the southern NSW coast and the remainder north of Tasmania.

Long term settlement data indicate the highest settlement of *J. verreauxi* post-larvae is at Ulladulla and Sydney, during spring, which again indicates that southern NSW is likely to be the most productive region for sampling phyllosoma and their post-larvae.

Preliminary modelling work shows that the presence of eddies aids in retention of larvae in this region, and in larval delivery to the coastline. For example, eddy dipole features downstream of the EAC separation point appear to be related to higher numbers of settlement, suggesting we are probably best to target our effort in southern NSW, especially in areas where adjoining eddies create an area of strong onshore flow.

The phyllosoma of southern rock lobster show stronger diurnal vertical migration during the dark phase of the moon, and it is likely that eastern rock lobster phyllosoma do the same. Furthermore, the phyllosoma metamorphose to post-larvae around new moon in surface waters in spring. Therefore, we need to particularly target the capture of lobster larvae in the second half of the cruise in the lead up to the new moon on 20 September.

Our science objectives from the proposal are listed below and in Table 1.



The voyage goals are to sample up to 5 regions (depending on the East Australian Current), each with different water mass characteristics, which will take 3 to 5 days each including steaming between them. We are consulting with Fisheries for safe trawling areas.

1. EAC, or Anticyclonic Eddy – North of separation zone
2. Cyclonic Eddy – North of separation zone
3. Shelf –off Sydney – Wollongong if possible (to be discussed with NSW Fisheries)
4. Anticyclonic Eddy – South of separation zone
5. Cyclonic Eddy – South of separation zone

Additional activities (not in order of priority):

1. ADCP transects, drifter deployments under the new Port Stephens HF radar, out to 150 km offshore;
2. Additional larval lobster specific trawls in southern NSW, at night;
3. Montague Island survey in daylight (similar to IN2016_v04).

Opportunistically, we will isolate drift algae if found in net tows to determine whether they have epibenthic dinoflagellates such as ciguatoxin producing taxa (ie harmful algae).

In summary, the main gear requirements for each of the 4-5 regions are:

- The CTD + vertical haul plankton net (N70) (at ~6 am-dawn; ~noon; 5 pm or 2 am);
    - After the ~noon CTD, deploy free-falling radiometer from bow or stern on the sunny side of vessel if wind permits, and also an optics package from the coring winch. The ~noon CTD may not be completed every day.
- Triaxus at 8 knots, profiling from near surface to 200 m deep
- Danish trawl+MIDOC + neuston at 3 knots (2 replicate day trawls + 2 night trawls);
    - To 500 m depth, with 100 m depth bins
    - At 2 regions from 500 to 1,000 m (day and night)
- On 4 nights only – the old Danish trawl+liner + neustons (evenings, 6 pm-2 am only);
    - To 100 m deep; on one night in mid-voyage; and again on 15th, 16th, 17th Sept.
    - If a high density patch is found, the MIDOC may be swapped over onto the lined net for 24 survey of larval lobster abundance (freeing up a one of the 4 nights)
- EZ net (500 micron mesh) + neuston at 3 knots (2 day and 2 night);
- bongo net (15 min each at 3 knots, 500 micron mesh, night only, to 50 m depth, from aft side boom and light sediment winch to permit concurrent deck activity); therefore we can't do surface neuston during a bongo tow.
- The UTS container laboratory plus the rad van for microbial abundance, condition and size estimates in parallel with primary production using stable isotope measurements.

The CTDs and Triaxus can be shuffled around the other activities so they can be conducted around dawn (for production) and possibly around noon (for light levels).

The bongo net deployments are meant to be quickly, easily deployed after the Triaxus, EZ or Danish trawl are safely back on deck.

Scientific objectives

Table 1. The overall objective of the voyage is to determine, for a range of Tasman Sea water-masses, the size based ecosystem encompassing almost 6 orders of magnitude in size (from microns to ~30 cm).

Aim	Scientific objective	Required vessel activity	Lead investigators on board
1	**Aim 1 (planktonic rates):** To estimate production and predation rates from stable isotope incubations and the biomass size spectra of phytoplankton (0.001 to 0.1 mm), zooplankton (0.1 to 10 mm) and micronekton (10 to 300 mm).	1) CTD, vertical haul nets, micro-CSI container lab, Radvan. Optics and radiometer deployment (noon CTD only) 2) Triaxus+laser optical plankton counter (LOPC), EZ Net (5 nets, 500 um mesh) + Neuston (500 um mesh) 3) New Danish trawl+MIDOC and EZ net	1) Phytoplankton size, production: Brownlee, Laiolo, Wozniak, Firme 2) Zooplankton size, production: Suthers, Henschke, Everett 3) Plankton vertical flux: Henschke, Stewart 4) Eddy characteristics: Cetina Heredia, Archer
2	**Aim 2 (pelagic ecosystems):** To compare the size structure of the lower ecosystem levels to simultaneous trawl-based surveys of micronekton/fish and observations of birds/cetaceans.	1) EZ net, Triaxus+LOPC 2) New Danish trawl+MIDOC, EK60 3) Continuous daylight observations from Obs Deck.	1) Suthers, Jeffs, Henschke 2) Stewart, Gastauer, Parsons, Holland 3) Slip, Truong
3a	**Aim 3a (larval fish):** To test if larval fish survival is significantly greater offshore than on the shelf.	1) Bongo net *at night only*, especially shelf vs. off-shelf + surface neuston tows	Suthers, Pepin, Miskiewicz, Hinchliffe
3b	**Aim 3b (larval lobster):** To determine the distribution and abundance of larval eastern rock lobster, (*Sagmariasus verreauxi*)	1) Old-Danish trawl+line *at night only*, shallow tows, especially in southern NSW (unless we discover a high density patch, then 24 h with MIDOC on old lined net. 2) Opportunistic neuston tows and surface RMT tows from coring boom during trawling	Jeffs, Garcia, Cetina Heredia et al.

Aim	Scientific objective	Required vessel activity	Lead investigators on board
1-3	Underway data	Apart from the usual underway instruments, we require continuously recording: EK60 bioacoustic measurements, hydrophone and ADCP.	Gastauer, Parsons, Holland
Alt	Deploy drifters into eddies, and off Port Stephens		Archer, Cetina Heredina et al.
Alt	Survey Montague Is. (repeat IN2015_V04 track)	Underway data, ME70 and EK60, Triaxus + LOPC at constant 20 m depth?	Suthers, Gastauer, Parsons, Slip

Table 2 – Outline of sampling activity over 3-4 days, to be repeated at each watermass. The order of activities is only indicative and will be altered as required based upon priorities and ocean conditions.

Time	Activity	Replicates	Duration	Total
	Steam 12 hours to each region, CTD to 2000 m + Vertical Haul Net, and ~noon optics package	1 1	12 h 3	15 h
	Triaxus tow in day, and night	2	5 h	10 h
Day	1) CTD to 2,000 m and vertical hauls from 50 m; 2) Trawl+MIDOC to 500 m + Neuston tow 3) Bongo nets	2 2 4	2 h 3 h 15 min	11 h
Night	1) CTD to 2,000 m; 2) Trawl+MIDOC to 500 m + Neuston tow	2 2	2h 3 h	10 h
Day	1) CTD to 2,000 m; 2) EZ net to 500 m + Neuston tow 3) Bongo net tows	2 2 8	2 h 2 h 15 min	10 h
Night	1) CTD to 2,000 m; 2) EZ net to 500 m + Neuston tow	2 2	2 2	8 h
	Contingency 8 hours	Total core-work per region		64 h
	ADCP transects and drifter deployments off Newcastle, contingency	1		24 h total
	Extra specific old-Danish trawls+liner in southern NSW to 100 m on 4 nights, including 15th, 16th, 17th September	4	2h ea.	8 h x 4 nights
	2 deep trawls+MIDOC 500 to 1,000 m deep at 2 regions	4	4 h ea.	16 h total
	Total activity on voyage	~5 water-masses	72 h ea.	18 days

* Any remaining hours on station, up to 72 hours, will be made up with extra replicates or additional projects such as drifter deployment or serendipitous sampling of the various water-masses; some will be banked for southern NSW phyllosoma trawls

Table 3 – Summary of the total gear deployments for the whole region

Gear	Replicates	Total
CTD to 2,000 m x 9 depths, nuts at 1,000; 500; 300; 200; 100; 75; 50; 25; surface And 2 vertical hauls with N70 net from 50 m depth An optics package from coring boom, and a free-fall radiometer (~noon CTD only)	4 or 5 watermasses, 6 or 7 CTDs each; 9 bottle depths each CTD = ~240 nutrients	~35 CTDs, ~240 nutrients (NOx, P, Si); 70 vertical hauls
12 NOAA lagrangian drifters	Off Newcastle under new HF radar	12
New Danish Trawl+MIDOC to 500 m	4 or 5 regions x 2 day/2 night Plus four trawls 500-1000 m	24
Old-Danish Trawl, <100 m depth	4 nights only (including 15th, 16th, 17th September), x 4 reps Possibly a 24 h series with MIDOC	16
EZ net, 5 nets and including 100 um mesh nets inside	4 or 5 regions x 2 (day/night) * 2 reps	20
Neuston net + RMT neuston	During trawls and EZ	48
Bongo net top 50 m only, from side of vessel	5 regions x 6 reps at night. 15 min each	30

Operational Risk Management

No potentially high risk work has been identified outside standard operations.

1. We will promote and advertise the vessel's presence off Montague Island.
2. List of IMOS moorings attached (especially north of Montague)

* Suthers and NSW Fisheries (Liggins) will determine the latitudinal ranges where lobster gear occurs (which all is <130 m isobath) and will publicise the vessel and its activities for the entire NSW coast commencing late July.

Overall activity plan including details for first 24 hours of voyage

Please note: The times below are local; and conservatively assume 10 knot transit speeds (rather than 11 knots).

Date	Day	Activity
Thurs 31 Aug Mobilisation	0	Load container lab on Wednesday 30 Aug. and set up in evening General mobilisation 18:00 Dock-side initial CTD-training, including assignment to scientists of specific CTD tasks on each shift (DO, nutrients, salts)
Thurs 31 Aug	1	14:00 Depart Brisbane Steam offshore and SE for 6 h; 15:00 during the steam, tool box for a) CTD, b) N70 vertical haul net [VH], c) Triaxus; d) ~noon optics package and radiometer. 18:00 Bottle-test CTD to 1,000 m at 18:00; Including second CTD-training ~1 h for all relevant scientists, after which they assume their normal shifts.

Date	Day	Activity
		Continue to steam east for to first water mass
Fri 1 Sept	2	Arrive at first water mass (Region-1) Depending on time deploy Triaxus-1 at 8 knots; then first real CTD to 2000 m (or vice versa); Tool box for Danish Trawl+MIDOC [i.e. DT+MIDOC hereafter] Deploy first DT-MIDOC to 500 m at 3 knots, including surface neuston nets from side (and possibly surface RMT depending on tow loads) Noon CTD + VH, optics package from coring boom; radiometer free-fall drop from bow Day-trawl to 500 m (2nd) at 3 knots [i.e. DT+MIDOC-2] CTD to 2000 m Evening DT-MIDOC-3 and -4 at 3 knots; plus bongo nets from side when not trawling at 3 knots
Sat 2 Sept	3	Night time Triaxus-2 at 8 knots, to ~6 am (swap over tow body winch Triaxus to EZ net for afternoon) Dawn CTD to 2000 m and production samples Daytime deep DT-MIDOC 500-1000 m at 3 knots Noon CTD + optics etc. and prepare EZ net including EZ tool box Daytime EZ net-1 to 500 m at 3 knots CTD Evening EZ net-2 to 500 m; and repeated EZ net-3 In between EZs, deploy bongo net from side Night-time deep DT-MIDOC 500-1000 m at 3 knots Possibly a second DT-MIDOC? (Bongo net from side when not trawling) (nb Iain, Triaxus not possible as EZ net is connected)
Sun 3 Sept	4	Dawn CTD Daytime EZ net-4 to 500 m. Noon CTD + optics Possible Daytime EZ net-5 to 500 m CTD Evening EZ-net tows interspersed with bongo tows. Complete Region 1 by ~ 2am and steam to Region 2

Date	Day	Activity
Mon 4 Sept	5	Region 2 (repeat sampling as per Region 1), including deep DT+MIDOC of 500-1000; May deploy EZ-net before Triaxus to reduce swapping the termination
Tues 5 Sept	6	Region 2
Wed 6 Sept	7	Region 2
Thurs 7 Sept	8	Steam towards region off Port Stephens, and ADCP transects off Port Stephens out to 150 km offshore; deploy lagrangian drifters etc. under new Newcastle radar. Possible ~noon CTD During the daytime steam, swap over to old-DT+liner for larval lobster for 8 hours from 6 pm to 2 am, one night ~33 degrees S. After 2 am steam to Region 3 and reattach new-DT+MIDOC
Fri 8 Sept	9	Region 3 – repeat (but no more 1000 deep DT-MIDOCs)
Sat 9 Sept	10	Region 3
Sun 10 Sept	11	Region 3
Mon 11 Sept	12	Region 3 or Region 4
Tues 12 Sept	13	Region 4 – repeat Be aware that >35 degrees S, the southern EZ and bongo nets may suffer from vast amounts of green slime (Thallissiosira)
Wed 13 Sept	14	Region 4
Thurs 14 Sept	15	Region 4 Last new DT-MIDOC tows in evening to 2 am
Fri 15 Sept	16	Daytime – Steam to lobster sampling region (dependent on oceanography). Swap from new-DT to old-DT+liner Evening – old-DT+liner until 3 am Interspersed with bongo nets when not trawling
Sat 16 Sept	17	Dawn CTD+last productivity measurements Daytime survey around Montague Island, repeating IN2016_v04 shore-parallel transects north and south of the island Possibly towing Triaxus at constant depth 20 m? Evening – old-DT+liner until 3 am near Site 4 Interspersed with bongo nets
Sun 17 Sept	18	Steam towards Jervis Bay Noon-CTD, VH, optics package, and radiometer free-fall Evening – towing old-DT-lined along slope, towards Sydney; Interspersed with bongo nets Finish all science activities off Wollongong by 2 am Steam to Sydney Heads
Mon 18 Sept	19	10:00 Meet pilot in Sydney Heads Pilot to harbour Demobilisation

Voyage track example

As with all voyages, our sampling program will depend on the oceanographic features (i.e., presence of eddies, southward extent of EAC), the ability to adaptively sample based on real-time oceanographic information (i.e. satellite data) as well as the weather. The draft voyage track (Fig. 1) shows the expected oceanographic targets (rather than the specific latitude and longitude) over the first half of the voyage. All sampling will take place within the domain of the map, but exact sites may change

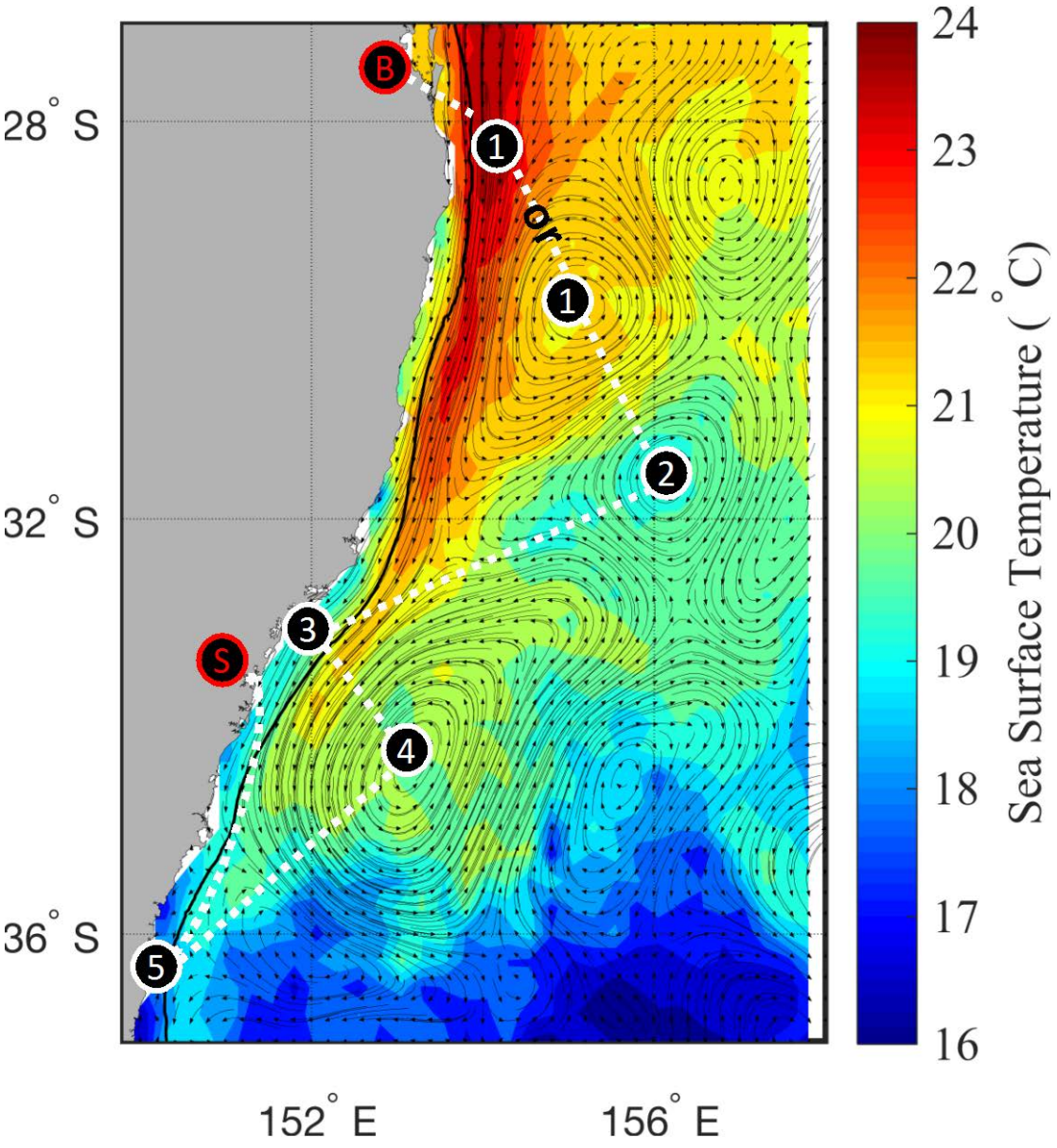


Fig. 1 Voyage track 31 Aug-18 Sept. from B, Brisbane to S, Sydney. 1) EAC or anticyclonic eddy; 2) cyclonic eddy; 3) Shelf; 4) anticyclonic eddy; 5) Montague Island and/or adjacent cyclonic eddy. We intend to depart Montague Island for Jervis Bay in afternoon 17 September to do evening trawls along slope towards Wollongong, ceasing 2 am to return to Sydney.

Between sites 2 and 3 we intend to steam for 12-24 hours under the new HF radar and deploy drifters. We will make trawls for lobster larvae at night on last 3 nights between 34-36 degrees S.

Waypoints and stations

Total Length:	2100.78 NM
Start Time:	00:00
Total Time:	19 days

No.	Watermass	Latitude	Longitude	Crs	Dist (NM)	Total Dist (NM)	
Brisbane		-27.5	153.03			0	
	1	-28	154		61	61	
	2	-31.5	156		235	296	
	3	-33.2	152		227	523	
	4	-34.25	153.2		87	610	
	5	-36.3	150.3		188	798	
Sydney		-33.9	151.213		153	951	

Time estimates

See table for Overall Activity Plan and first 24 hours.

Piggy-back projects (if applicable)

Not applicable.

Investigator equipment (MNF)

Oceanographic data collection

- CTD rosette (to 2,000 m) – 24 bottle + 12 L Niskins, with auxiliary instruments:
  - Altimeter
  - PAR
  - Transmissometer
  - Chlorophyll Fluorometer (Chelsea)
- Triaxus with CTD, Ecotriplet, transmissometer, PAR and LOPC
- Bioacoustics recordings ME70 and EK60 to 1500 m (Matt optimised set up)
- ADCP 150 kHz (turning off 75 kHz provides less interference with EK60 and/or ME70)
- Real-time view to adaptively sample, as well as access to data from underway systems (Thermosalinograph, Atmospheric Underway Sensors, Biological Oceanography Underway Sensors)
- EK60 18, 38, 70, 120, 200, 333 kHz
- ME70 (midwater multibeam system to map 3d fish biomass; to be discussed with Kloser's group and optimised with the EK60)

- Hydrophones for recording passive acoustics (whales) as per IN2016-v04 including the displays on the observation deck
- Swath and EM122 Multibeam Echosounder; EM710 MKII Multibeam Echosounder
    - (notes for Iain: EM122 is 12kHz to 12,000 m; EM710 runs from 40 to 100KHz and is much better in waters less than 500 m – (so 710 to about 1000 m depth and the em122 from about 400m).
- Isotope lab – Radvan
- Deck incubators for size-structured primary production

Micronekton sampling

- Danish trawl with MIDOC and 5 codends plus second set for quick turnaround
- Old Danish trawl with liner, for upper 100 m only, at night only from 6 pm to 2 am (other than a possible 24 h series with MIDOC if a high density patch is found).

Plankton sampling

- 25 micron net
- EZ net with 5 nets, 500 micron mesh + small UNSW 100 micron nets within MNF nets
- Bongo nets (2 x 500 µm); for rapid deployments from the side of the vessel at night only in between trawls, Triaxus, EZ etc
- Neuston net with bungee cord support and load cell
- UNSW's RMT net with 1,000 um mesh for opportunistic neuston sampling for larval lobster, and load cell

Labs

- -80 freezers, -20 freezer, blast freezer and controlled temperature lab
- Scientific clean seawater in GP clean wet lab
- Access to Fish lab (for plankton sorting and fixing)
- Access to GP clean wet lab
- Access to the Constant Temperature lab for larval lobster rearing (where we'll store the lagrangian drifters)
- Clean dry lab for phytoplankton measurements, including chlorophyll-a determinations
- Access to underway lab (for fluorometers and other underway equipment)
- Hydrochemistry support to analyse regular CTD for dissolved nutrients
- Preservation and photography Lab for Andrew Stewart

Observation Deck

- Hydrophones recording with automatic download and backup to ship hard drives at regular intervals to prevent onboard storage filling up
- Screens for Grafana

User Equipment

UTS

- UTS Micro-CSI laboratory van
- Laboratory based peristaltic and vacuum pumps
- Filtration manifolds for filtering seawater

UNSW

- Dissecting microscope and HD camera system for zooplankton and larval fish
- 13 NOAA SVP Drifters (as per IN2016-V04,)
- RMT net, no weights but needs 4 point bridle, 1000 um mesh? (to be decided)
- N70 vertical haul net and 35 kg weight

UoAuckland

- 4 small seawater kreisel tanks for holding live larval lobsters in the running seawater lab

CSIRO Marine labs

- Mark Baird's optics package and radiometer

Special Requests

- Liner 10 mm to old-Danish Trawl; new Danish Trawl with MIDOC
- We would like to have a daily voyage planning meeting at 2 pm
- Radvan for primary production
- Deck incubators to house incubations
- Micro-CSI laboratory on deck 02 requires power, freshwater connection
- Neuston net boom deployed for duration of voyage
- Starboard aft boom to be used for towing the bongo net from the light sediment winch, in between trawling or EZ nets.
- Wifi Internet access for scientists to live-tweet and blog the voyage as per our approved application

Permits

- AFMA permit number #1003357;
- Dept of Environment permit applied on 6 July 2017.
- UNSW Animal Care and Ethics Approval 17/91A.
- No Foreign Clearances are required.
- Report to Voyage manager in August on informing DPI-Fisheries; the lobster community and also the Montague Island community

Sampling teams

Shifts will be 2am-2pm; 2 pm-2am

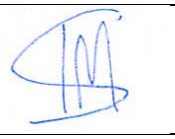
CTD to 2,000 + vertical haul (N70); + ~noon radiometer and optics package	Triaxus And LOPC	Danish trawl+MID OC and Neuston nets	EZ-Nets and Neuston net	Bongo nets	EK60, ME70 + ADCP	Deck observations 6 am to 6 pm
Blue Team Leaders: Cetina Heredia/ Viera Rocha plus Green Team Brownlee Firme Wozniak/ Laiolo	Blue Team	Red-1 Red-2	Red-1 Red-2	Red-1 Red-2	Gastauer, Parsons, Holland And help with the trawling	Slip and Truong

	Shift A			Shift B	
	2pm-2am			2am-2pm	
Cabin	a.k.a The Footballers			a.k.a. The Rowers	Cabin
108	Lian Kwong	Nets and Trawl Size Spectra		Natasha Henschke (Shift Leader)	108
309	Andrew Jeffs (Shift Leader)	Phyllosoma + Nets and Trawl Size Spectra	Nets and Trawl Size Spectra	Marina Richardson	106
308	Miles Parsons	Bioacoustics + Nets and Trawl Size Spectra		Sven Gastauer	308
102	Kieran Murphy	Nets and Trawl Size Spectra	Bioacoustics + Nets and Trawl Size Spectra	Matt Holland	102
303	Tony Miskiewicz	Larval Fish		Pierre Pepin	304
101	Charlie Hinchliffe	Larval Fish	Nets and Trawl Size Spectra	Lucas Kas	101
103	Katharina Alter	Nets and Trawl Size Spectra		Camilla Novglio	103
105	Zoe White	Phyllosoma + Nets and Trawl Size Spectra	Nets and Trawl Size Spectra	Rhian Evans	105
310	Andrew Stewart	Fish ID	Nets and Trawl Size Spectra	Peter Garside	310
106	Paulina Cetina Heredia	Oceanography		Carlos Vieira Rocha	309
104	Mathew Archer	Oceanography		Eduardo Vitarelli	104
	Shift C - A Whale of a Time - 6 am - 6pm				
311	David Slip	Visual Observations		Gary Truong	311
	Shift D - Chasing the Sun - 5am - 5pm				
312	Chris Brownlee	Phyto Size Spectra	Primary Production	Giselle Firme	107
107	Monika Wozniak	Bio-Optics + Phyto Size Spectra	Bio-Optics + Phyto Size Spectra	Leonardo Liaolo	312

Personnel List

1.	Don McKenzie	Voyage Manager	CSIRO MNF
2.	Ben Baldwinson	SIT Support	CSIRO MNF
3.	Ian McRobert	SIT Support	CSIRO MNF
4.	Bernadette Heaney	GSM Support	CSIRO MNF
5.	Matt Boyd	GSM Support	CSIRO MNF
6.	Peter Hughes	Hydrochemistry	CSIRO MNF
7.	Kendall Sherrin	Hydrochemistry	CSIRO MNF
8.	Anoosh Sarraf	DAP Support	CSIRO MNF
9.	Karl Malakoff	DAP Support	CSIRO MNF
10.	Jason Fazey	Mechanical Support	CSIRO MNF
11.	Mark Lewis	Mechanical Support	CSIRO MNF
12.	Iain Suthers	Chief Scientist	UNSW and SIMS
13.	Amy Coghlan	Red, larval fish	U. British Columbia, Canada
14.	Camilla Novglio	Red	UTas
15.	Kieran Murphy	Red (PhD, squid)	UTas
16.	Katharina Alter	Red	UTas
17.	Andrew Jeffs	Red - phyllosoma	U. Auckland, NZ
18.	Zoe White	Red – MSc zoopl size	UNSW
19.	Natasha Henschke	Red – Deputy Chief Sci	UNSW/U. British Columbia, Canada
20.	Lian Kwong	Red (PhD)	U. British Columbia, Canada
21.	Rhian Evans	Red (PhD)	UTas
22.	Pierre Pepin	Red, larval fish-1	Fisheries & Oceans Canada
23.	Tony Miskiewicz	Red, larval fish-2	UNSW
24.	Charlie Hinchliffe	Red, PhD, larval fish-3	UNSW
25.	Matt Holland	Red (PhD - EK60)	UNSW
26.	Miles Parsons	Red - EK60 specialist	Curtin U
27.	Sven Gastauer	Red – EK60 specialist	UTas
28.	Peter Garside	Red (MSc)	UNSW
29.	Andrew Stewart	Red – fish ID specialist	Te Papa – Auckland Museum
30.	Monika Wozniak	Green, optics postdoc	CSIRO
31.	Giselle Firme	Green (PhD)	UTS
32.	Leonardo Liaolo	Green (PhD)	UTS
33.	Chris Brownlee	Green, MicroCSI	UNSW
34.	Paulina Cetina Heredia	Blue, post-doc	UNSW
35.	Carlos Vieira Rocha	Blue, PhD	UNSW
36.	Mathew Archer	Blue, Radar postdoc	UNSW
37.	Eduardo Vitarelli	Blue, PhD	UNSW
38.	David Slip	Seabird ID Obs Deck	Taronga Zoo
39.	Gary Truong	PhD– cetaceans Obs Deck	UNSW
40.	Lucas Kas	Red – (hons)	UNSW

Signature

Your name	Iain Suthers
Title	Chief Scientist
Signature	
Date:	14 July 2017

List of additional figures and documents

1. Latest locations of IMOS moorings (14 July 2017) next page below – of main concern will be near Narooma (Montague Island).
2. Lobster gear on the south coast mid-shelf; fine across all latitudes between Sydney and Montague Island outside 70 fathoms. Nick Giles is DPI Fisheries Manager,

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- Central Coast (out of Broken Bay):
  - Peter Offner: he and other fishers will have fish traps out to 65 fa, so outside 70 fa OK
- Sydney: Several lobster fishers:
  - Potentially some mid-shelf lobster gear (and maybe fish gear) inside 70 fa, so outside 70 fa OK
- Kiama:
  - Steve Drake: mid-shelf lobster gear going in around Sep. 7 out to 65 fa, so outside 70 fa is OK
- Jervis Bay:
  - Scott Westley: mid-shelf lobster gear going in around Sep. 7 out to 68 fa, so outside 70 fa is OK
- Narooma (Montague area):
  - Les Muller: mid-shelf lobster gear not going in until October so OK

So, in short, between Sydney and Montague, based on my inquiries, you will not interact with set lobster traps in depths greater than 70 fa, which is 130 m. If you wanted to impose a further conservative margin, you could use 140 m as your limit.

Based on your previous advice Iain, you will not be inside the shelf break to the north of Sydney and there will not be any lobster traps outside 200m during September - so you are on safe ground there. If, however, you do decide you want to come in over the shelf break on the north coast - it is likely there will be lobster gear (and fish gear) on the mid-shelf at this time.

Please note that my advice above relates principally to the lobster fishery with a bit of additional info re fish trapping where the lobster fishers I contacted also provided this info.

IMOS moorings

	Mooring:	**Lat**			**Long**		
Coffs	CH100 - T	30	15.9	S	153	23.695	E
	CH100 - ADCP	30	16.034	S	153	23.779	E
	CH070 - T	30	16.338	S	153	17.943	E
	CH070 - ADCP	30	16.642	S	153	17.803	E
	CH050 - T	30	18.611	S	153	13.753	E
Sydney	SYD140 - T	33	59.729	S	151	27.02	E
	SYD140 - ADCP	33	59.613	S	151	27.018	E
	SYD100 - T	33	56.644	S	151	22.924	E
	SYD100 - ADCP	33	56.533	S	151	22.946	E
	ORS065 - T	33	53.63	S	151	18.886	E
	ORS065 - ADCP	33	53.685	S	151	18.887	E
	PH100 - T	34	7.167	S	151	13.474	E
	PH100 - ADCP	34	7.212	S	151	13.471	E
Narooma	BMP120 - T	36	12.262	S	150	19.026	E
	BMP120 - ADCP	36	12.471	S	150	18.996	E
	BMP070 - T	36	11.384	S	150	11.305	E
	BMP070 - ADCP	36	11.496	S	150	11.242	E

*T refers to a Temperature string, which is a mooring from the seabed up to 15m below the surface. Made of 5 – 8mm dyneema.

**ADCP moorings are bottom mounted and typically will not be more than 2m high.

*** ORS065 is the only mooring with a surface expression/buoy.