

**MARINE
NATIONAL FACILITY**

**voyageplan
SS10-2008**

2008 *RV Southern Surveyor*
program

Biological oceanography of coastal cold-core eddies and of salps in the continental shelf waters off the Stockton Bight of eastern Australia

Itinerary

Mobilise Sydney 0900hrs, Friday 10 October, 2008

Depart Sydney 1500hrs, Friday 10 October, 2008

Arrive Newcastle 0800hrs, Monday 20 October, 2008 and demobilise

Principal Investigators

Professor Iain Suthers (Chief Scientist) – University of New South Wales and Sydney Institute of Marine Science **email:** I.Suthers@unsw.edu.au **mobile:** 0414 385 351

Dr Mark Baird – University of New South Wales and CMAR
email: m.baird@unsw.edu.au **mobile:** 0416 631 657

Dr Jason Everett – University of New South Wales
email: Jason.Everett@unsw.edu.au **mobile:** 0411 162 701



Scientific Objectives

The East Australian Current (EAC) can generate small cyclonic eddies (30-100 km diameter) south of the separation/upwelling zone off central NSW, in the region of the Stockton Bight (east of Port Stephens, 33°S). Stockton Bight is anecdotally recognised as an unusual nursery area for NSW fisheries. These coastal cold-core eddies entrain filaments of enriched coastal water in a process reminiscent of the coastal cyclonic eddies of the Kuroshio Current, California Current and Agulhas Current, which are well documented for their fisheries importance. In the last 18 hours of our Oct. 2006 voyage, returning to Sydney, we sampled such an eddy revealing dramatic concentrations of late stage larvae of commercial fishes, compared to similar tows in the Tasman Front, or the coastal waters. EAC cyclonic eddies are rarely considered and have never before been biologically sampled. With hindsight, it seems obvious that these eddies are probably crucial for our fisheries and are relevant for marine park planning.

The spring is also a time of salp swarms. Salps are large, fast-growing gelatinous zooplankton that graze on unlimited picoplankton and bacteria. Their dense blooms can alter the food chain by significantly removing phytoplankton and recorded in the guts of many fish. Described as the fastest growing animals on the planet, salps clearly have a major role in global carbon flux, but are essentially unstudied in the EAC since the work of Heron and others 20 years ago. By feeding on particles 1000 fold smaller than themselves, salps confound our biogeochemical models (Baird & Suthers 2007) and probably confound the biomass estimates of our optical plankton counter.

Our aims are :

- i) the biological oceanography of small (<50 km diameter, and possibly large) cyclonic eddies off the Stockton Bight in comparison to coastal waters, possibly in conjunction with an IMOS Slocum Glider in late 2008; and
- ii) the ecology and vertical distribution of salps in shelf waters. The spatial pattern of sampling will take into consideration the synoptic and forecast oceanographic conditions from BlueLink.

Voyage Objectives

During September and early October we will be examining MODIS image and BlueLink forecasts, searching for development of small 50 km diameter coastal eddies and possibly any similar eddies offshore. A week before and certainly 3 days before departure we will have a clear objective in mind. A Slocum Glider will likely be deployed during the week of departure off Newcastle.

- 1)** We intend to examine at least two (2) conspicuous eddies, south of the separation zone off Stockton Bight, however we may have to steam as far south as Jervis Bay (36deg. S) to find one. We will test whether a cyclonic eddy has greater zooplankton biomass or production and in larval fish growth in small cyclonic eddies (<50 km diameter, and if possible a large one ~100 km), in comparison to similar sampling in coastal waters.

2) SeaSoar, ADCP and CTD. We will make at least two SeaSoar and ADCP transects across each eddy. During the day, standard CTD profiles with the rosette sampler will also be used to overlay longer and deeper SeaSoar profiles with nutrients (nitrate, nitrite, ammonia, TRP, Si), which will be particularly intensive near the separation area.

3) EZ net trawls, and Rectangular Midwater Trawl. We wish to examine vertical distribution of salps. Outside the eddy field and in general coastal water in about 100 m of water, we will tow the EZ net and neuston net at 3 knots, at 12 midnight, 4 am, 8 am, 12 noon, 4 pm and 8 pm over 3 days and 3 nights.

Using the same trawl wire (fitted with Sonardayne) we will make replicated oblique Rectangular Midwater Trawl tows (RMT, 0.75 x 1.5 m, 0.5 mm mesh pelagic trawl), at 1.5 ms⁻¹ will be made from the surface to the thermocline.

Neuston net tows from the side of the vessel will be made at the same time.

Below decks, the 0.5 mm mesh net sample will be quickly sorted and 10 individuals of abundant larval taxa will be transferred to NUNC vials and frozen in liquid nitrogen until RNA:DNA analysis; the remainder will be placed in buffered formalin and transferred to 95% ethanol within 4 weeks for otoliths and age determination.

4) Plankton culturing experiments in the fish lab. During the voyage we wish to have tubs of seawater in the Fish Lab (to be discussed)

Voyage Track

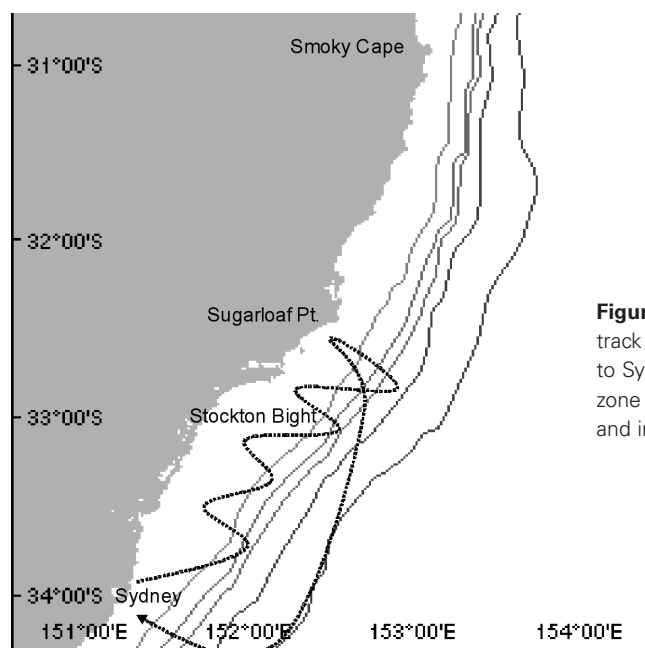


Figure 1: Proposed voyage track (dotted line) from Sydney to Sydney out to the separation zone south of Sugarloaf Point and into the Stockton Bight.

Time Estimates

Scientific watches will be from 1400 – 0200 (“night”), and 0200-1400 (“day”)

Friday 10 Oct. Mobilise crew and depart at 1500 for swath mapping regions, arriving in region at around 22:00 (60 nautical miles). Compare underway data with latest MODIS image and forecasts. (nb first deployments of any gear will be done in daylight, either before or after lunch when both shifts are awake)

Sat. 11 Oct. 1300 CTD test in 1200 m off Newcastle, and CTD training.
15:00 Commence 8 hour SeaSoar and ADCP Transect1 across eddy, followed by CTD stations along return path.

Sun 12 Oct. 1300 RMT toolbox and conduct first RMT + Neuston tows
1500 Commence 8 hour SeaSoar and ADCP Transect2 across eddy, followed by 10 CTD stations along return path. RMT tows will occur at either end of transect.

Mon 13 Oct. 1300 EZ net toolbox and then conduct first EZ net tow at salp site.
1500 Commence 8 hour SeaSoar and ADCP Transect3 across eddy, followed by 10 CTD stations along return path. RMT tows will occur at either end of transect.

Tues 14 Oct. Continue EZ net tows at salp site, interspersed with CTD profiles.
Complete RMT and EZ net tows in eddy core and outside eddy.

Wed. 15 Oct. Move to 2nd new eddy or feature and repeat
SeaSoar and CTD transects, RMT and EZ net tows.
If appropriate, further swath mapping of new area.

Thurs 16 Oct. Repeat SeaSoar and CTD transects, RMT and EZ net tows.

Fri 17 Oct. Repeat SeaSoar and CTD transects, RMT and EZ net tows.

Sat. 18 Oct. Move to 3rd new eddy or feature.
Repeat SeaSoar (possibly CTD) transects, RMT and EZ net tows.
If appropriate, further swath mapping of new area.

Sun 19 Oct. Repeat SeaSoar (possibly CTD) transects, RMT and EZ net tows.

Mon. 20 Oct. Dock in Newcastle at 0800hrs

Southern Surveyor Equipment

Underway data and ADCP

CTD, fluorescence, 6 bottles for nutrients, DO, T, S (possibly 12 if we need to filter water)

EZ net and 500 um mesh nets (only 5 depth strata,
ie 5 nets per tow, totalling 1 hour tow)

SeaSoar and winch

EM-300

Fish lab for experiments

Sonardyne

User Equipment

- Optical plankton Counter (to be attached to the Seasoar) as per SS 09/06
- Rectangular Midwater Trawl Net (+ spare) to be supplied by Iain Suthers, as per SS09/06, using conducting wire winch (i.e. SeaSoar's) with National Facility's Sonardyne.
- Neuston net from forward boom.
- Vacuum pump, filters for chlorophyll, isotopes
- Liquid Nitrogen dewer, filled.
- Formalin, alcohol, jars, consumables
Microscopes in Fish and GP lab
44 litre tanks (nally bins) with seawater

Special Requests

Forward neuston net boom

Personnel List

Iain Suthers	UNSW	Chief Scientist
Mark Baird	UNSW	Salp biology
Jason Everett	UNSW	Salp biology (post-doc)
Anthony Richardson	Univ. of Qu.	Plankton
Christel Hassler	CMAR	Oceanographer
Natasha Henschke	UNSW	Biology (honours)
Matthew Taylor	UNSW	Krill biology (post-doc)
Helen MacDonald	UNSW	Oceanography (PhD)
Will Figueria	Univ.Tech, Sydney; USyd	Larval fish and BlueLink
Benjamin Harris	UNSW	Chlorophyll (honours)
Justine Djajadikarta	UTS	
Adrienne Gatt	UNSW	Plankton (honours)
Drew Mills	CMAR	MNF Electronics Support
Pamela Brodie	CMAR	MNF Voyage Manager/Computing support
Alicia Navidad	CMAR	MNF Hydrochemistry Support

There will be at least two MNF support staff included in this list. Refer the Application Form and liaise with the Operations Manager as required.

Any additional scientific berths over 12 up to the maximum of 15 must be occupied by System Support Technicians (SST's) as per AMSA requirements. You must identify these SST's on the personnel list as well as quoting their AMSA Certificate of Safety Training number. The Operations Manager can assist as most MNF support staff have the required qualifications.

As per AMSA requirements for additional berths on *Southern Surveyor*, the following personnel are designated as System Support Technicians and are required to carry their original AMSA medical and AMSA Certificate of Safety Training on the voyage:

Name	AMSA Certificate of Safety Training No.
Drew Mills	AS02348
Alicia Navidad	AS04836
Pamela Brodie	AS02447

This voyage plan is in accordance with the directions of the Marine National Facility Steering Committee for the Research Vessel *Southern Surveyor*.

Iain Suthers
Chief Scientist

An idealised East Australian Current, and a possible voyage track for SS10/2008, showing SeaSoar and CTD stations (short, thick dotted lines crossing eddies). Three cyclonic (clockwise, upwelling) eddies are shown with A entraining oceanic water, B entraining coastally enriched water from off Port Stephens (as in October 2006, still in "spin-up mode") while C is an older possibly senescent eddy containing a mature biological community. We hope to find smaller eddies (about half the size illustrated). East and south of A is the formation of antic-cyclonic, warm core eddies. Such eddies are often larger and tend to predominate. Station D in ~100 m water is where we will conduct EZ net tows for salps. Box labelled E is a possible area that remains to be swath mapped (to be confirmed with Ron Boyd). A Slocum Glider will be simultaneously located in eddy B.

After visiting E and settling the crew, our priorities are to sample locations B, D, A, C.

