MNF Voyage Highlights and Summary

Voyage #:	IN2021_V03 (Version Final2.0)
Voyage title:	**Integrated Marine Observing System: monitoring of East Australian Current property transports at 27° S**
Mobilisation:	Hobart, Tuesday, 4th May – Friday, 7th May, 2021
Medical Clearance Period:	Hobart, Wednesday, 5th May – Friday, 7th May, 2021 *(all participants and crew remain on board once tested)*
Depart (receipt of medical results):	Saturday, 0800 Hobart 8th May, 2021 *(Departure date and time will be dictated by return of medical results)*
Arrive:	Brisbane, 0800 Thursday, 3rd June, 2021
Demobilisation:	Brisbane, Friday, 4th June, 2021
Voyage Manager:	John Hooper
Chief Scientist:	Dr. Chris Chapman
Affiliation:	CSIRO
Principal Investigators:	Dr. Bernadette Sloyan (Applicant and Chief Scientist), Dr. Amandine Schaeffer, Prof Iain Suthers
Other Projects	
Project name:	**Dynamics of larval fish diversity for ocean observing off North Stradbroke Island**
Affiliation:	Prof Iain Suthers - University of NSW

PART A – VOYAGE HIGHLIGHTS

Voyage Highlights

The Chief Scientist

Dr. Chris Chapman is a research scientist with the CSIRO's Oceans and Atmosphere business unit. He studies the role of the ocean in the climate systems and marine ecosystems. IN2021_V05 was his first voyage as chief scientist.

Title

Integrated Marine Observing System: Monitoring of East Australian Current property transports at 27^{o}S.

Purpose

This voyage will recover and re-deploy an array of six full-depth current meter and property (temperature, salinity, and pressure) moorings from the continental slope to the abyssal waters off Brisbane (27^{o}S). The observing system is designed to capture the mean and time-varying flow of the East Australian Current (EAC). To resolve interannual and decadal signals we need to maintain multi-year deployments of the array.

We will discover the spatial and temporal variability of shelf water and plankton around the Stradbroke Island National Reference Station (NRS) mooring. We will undertake biological and oceanographic sampling, using CTDs, Triaxus tows, bongo nets, SADCP, rapid-cast CTDs to characterise the interaction between shelf water and the EAC along the east coast of the Australian continent, and to sample dynamic, ephemeral frontal eddies flowing down from Fraser Island. These boundary exchanges are fundamental to coastal ecology.

The EAC array data is essential for understanding the long-term variability of the EAC and to monitor its response to a changing climate. The EAC and its interaction with shelf waters and influence on small-scale eddies are of fundamental importance to the oceanography of the region, with flow-on effects to ocean dynamics, primary productivity (i.e. phytoplankton) and therefore far-reaching impacts on annual fisheries productivity and coastal shark interactions along the northern and central NSW coasts and in southern Queensland.

Contribution to the nation

The East Australian Current (EAC) is the complex and energetic boundary current of the east coast of Australia, influencing the lives and economies of people on the eastern seaboard. It is the dominant mechanism for the redistribution of heat between the ocean and atmosphere and has a strong influence on the weather and seasonal climate, coastal ocean circulation and marine ecosystem affecting nearly half the Australian population. This project will improve our understanding of the EAC influences on climate, leading to more reliable forecasts for eastern Australia and coastal communities, and improved management of east coast fisheries.

As a result of this voyage

1. We have extended the time-series of direct observations of the seasonality variability of the East Australian Current.
2. These observations will be used by the national and international community to improve our understanding of complexity and variability of the heat and salt transport from the tropics to the Tasman Sea, over a range of temporal and spatial scales.
3. We have continued a systematic multi-disciplinary study linking physics and planktonic diversity, especially the larval fish and jellyfish community.
4. We have extensively sampled, both physically and biologically, a frontal eddy, and were able to characterise its temporal evolution and ecological impact.
5. We have provided teaching and training for 2 postdoctoral researchers, as well as 2 doctoral, and 3 undergraduate students from four Australian universities.

Next steps

Quality control and calibration of all recovered mooring instruments will begin within weeks of our return from sea. The effort to compile, QC, correct, calibrate and infill missing data is a substantial undertaking that will take several months. Once these data are curated, they will be submitted to the Australian Ocean Data Network (AODN) portal, where they will be freely and publicly available for download. All computer code used to produce these datasets will also be made publicly available through the Github remote repository. We anticipate that this process will be complete by March 2022.

Although the majority of biological samples have been sorted and identified whilst aboard, a number still remain to be sorted and identified. This work will continue on shore. Once sorted and identified, the data will be submitted to the AODN and the samples will be archived at the Australian Museum. We anticipate that this process will be completed by March 2022.

A number of scientific publications and curated datasets will arise from the work undertaken during this voyage. These will include papers describing the dynamics of the EAC transport variability, the link between the EAC and larval fish/jellyfish populations and the dynamics of frontal eddies in the EAC.

PART B - VOYAGE SUMMARY

Voyage Summary

Objectives and brief narrative of voyage

Scientific objectives

The East Australian Current (EAC) is the complex and highly energetic western boundary current of the South Pacific Ocean gyre, that shows temporal and spatial variability over a wide range of scales. Due to the narrow shelf, EAC meandering has an immediate impact on the continental shelf circulation. Exchange of heat, salt and plankton between the shelf and open ocean is achieved via EAC intrusion, submesoscale and mesoscale eddies and complex boundary layer and frontal dynamics. The dynamically driven exchange of shelf and boundary current water and EAC eddies in the western Tasman Sea affect the entire marine ecosystem from planktonic production to pelagic fish distribution and abundance by transporting oligotrophic Coral Sea water and yet stimulating upwelling along the coast and offshore.

The long-term monitoring of the EAC provides a comprehensive data set that, together with the observations, will enable improved understanding of the relationship between the EAC and the basin-scale gyre and local forcing, determine the impact of the EAC variability on the coastal circulation and the local and regional marine ecosystem. This will be achieved by production of a gridded EAC mass, and property transport time-series for use by national and global modelling groups, assimilation into high-resolution regional and coastal models currently being developed by the Australian ocean modelling community. The biological data will quantify the biomass and diversity of ichthyoplankton, jellyfish, their microbiome, and zooplanktonic size structure in relation to remotely sensed data. This, combined with the physical data, will enable predictive modelling in space and time of the biological consequences of a changing EAC on the continental shelf, and on coastal ecosystems.

Voyage objectives

The following specific voyage objectives were:

1. Recover and deploy 6 moorings at appropriate locations;
2. CTD/rosette stations at each mooring location, as well as “instrument dip” CTDs for quality control, calibration and comparison of SBE37 and SBE39 mooring instruments;
3. Triaxus and Ship ADCP sections along the mooring line and of significant oceanographic features;
4. Plankton (bongo) net tows along the EAC mooring line, and as part of the shelf-slope survey to study the larval fish diversity compared to that recorded at nearby National Reference Stations; and to compare the growth and mortality of larval fish (sardine) with the slope and intercept of the zooplankton biomass size spectrum;
5. Additional plankton net sampling on the shelf, adjacent to nearby NRS sites including opportunistic sampling of significant oceanographic features;
6. Deployment of various Argo (core and BGC) floats during the voyage;
7. Test of the CSIRO XBT Autolauncher;
8. Opportunistic surveying of the sea-floor and historical shipwrecks;
9. Active media campaign to promote the interdisciplinary nature of the science;

Results

A large amount of physical, chemical and biological data was collected during this voyage that will take several years to fully analyse. However, all primary, secondary and indeed several tertiary objectives were achieved. Specifically:

1. We successfully completed 12 mooring operations (6 mooring recoveries, and 6 mooring deployments.
2. 12 CTD/LADCP stations were completed in support of the mooring operations.
3. 12 calibration CTD stations of recovered or soon to be deployed mooring instruments were completed.
4. 3 Triaxus and Ship ADCP sections along the mooring line were completed.
5. 4 Triaxus and Ship ADCP sections through interesting oceanographic features, including repeated sampling of a sub-meso scale "frontal eddy", and several shelf/EAC sections.
6. 3 Ship ADCP/CTD and/or Rapid cast CTDs/XBTs through the frontal eddy.
7. Multiple plankton net tows near a number of NRS sites during transit, along the EAC mooring line and in the frontal eddy.
8. 6 core Argo floats and 2 BGC-Argo floats were completed. 2 CTDs with additional BGC sampling were performed in support of BGC Argo float operations.
9. Multiple tests and troubleshooting of the CSIRO XBT Autolauncher, which is now working.
10. High resolution imaging of 2 historical shipwrecks.
11. Multiple media events, including 2 televised interviews (ABC Hobart and ABC Brisbane), 5 radio interviews (ABC Brisbanex2, ABC SE NSW, ABC Gold Coast, ABC SW Vic), a live internal CSIRO-says event, one written article on the ABC website, one IMOS Ocean Current article.

EAC Mooring operations (Team Leader - Bernadette Sloyan and Chris Chapman)

A total of 6 moorings were deployed at the designated locations. Moorings were deployed by the CSIRO technical team, and the ASP crew with assistance from the physical oceanography science team. Moorings were deployed over the stern using the A-frame and the CSIRO mooring winch. Anchor drops were deployed by coordinating between the mooring technical team and the physical oceanography science team. The likely depth of the mooring was considered the critical factor in the determination of the anchor release location. A tow speed of 1 to 2 knots relative to the water was used to ensure that the mooring would stream straight behind the ship.

In addition to the 6 mooring deployments, a total of 6 moorings were recovered. These moorings were deployed during the IN2019_V05 by the CSIRO mooring team. Moorings were first located

using the acoustic releases attached to the anchors to guide ship positioning, then released. Moorings to be recovered were first grappled using the CSIRO pneumatic grapple gun, then carefully brought on board over the stern. A tow speed of 1 to 2 knots relative to the water was used to ensure that the mooring would stream behind the ship to reduce the chance of inducing entanglements or "wuzzels". Once safely attached to the CSIRO mooring winch, the remainder of the mooring was brought on board using the CSIRO mooring winch and the A-frame by the CSIRO mooring team and the ASP crew, with assistance from the physical oceanography science team.

Wuzzels occurred on two recoveries during this voyage, once due to slack current, once due to the grapple making contact in the centre of the mooring line. Both instances were well handled by the mooring technical team and ASP crew.

Physical Oceanography (Team Leaders - Chris Chapman, Amandine Schaeffer, Bernadette Sloyan)

We deployed the MNF Triaxus, the CTD/Rosette and the underway seawater to sample a number of interesting oceanographic features during the voyage:

The Triaxus was deployed with the standard instrument payload: SBE 911+CTD 23, A Biospherical QCP2300-HP PAR, and a WetLabs C-STAR Transmissometer, ECO Triplet and Laser Optical Plankton Counter. The data obtained from the SBE911+ were processed using Seabird Scientific's Seasave software, while custom software was used to process the data from the SUNA, ECO Triplet and LOPC. The CTD was deployed using the large, 36 bottle Rosette. A standard CTD payload was carrier (Sea-Bird SBE911+. Biospherical PAR, Tritech Altimeter, C-Star Transmissometer, WET Labs CDOM, WET Labs ECO Scattering, and WET Labs ECO Chlorophyll sensor). Niskin bottles were sampled for dissolved oxygen, nutrients and salinity. Additionally, two deployments of BGC Argo floats were accompanied by CTDs, which had supplemental Niskin sampling for pigments, dissolved inorganic carbon and total alkalinity.

"Routine" CTD casts were performed in support of mooring operations and BGC Argo float deployments. Pre mooring recovery and post mooring deployment CTDs were performed to ensure the data quality of the deployed mooring instruments. CTD casts performed in support of BGC Argo float deployments were taken for instrument comparison with Argo profiles.

In addition to "routine" CTDs, targeted physical oceanographic observations using the Triaxus, CTD casts, XBTs and the rapidCTD system were taken to sample the following features:

- A large eddy pair near Sydney, revealing a deep "lens" of Bass Strait water (sampled on the 10th of May with the Triaxus)
- Shelf/EAC interaction (sampled on the 12th of May with the Triaxus);
- Sampling of the frontal eddy ("Big Ed") as it evolved on the 22nd of May and the 25th of May with the Triaxus, and with shallow CTD casts on the 26th of May.
- Triaxus tows across the mooring line on the 15th of May, 21st of May and the 1st of June.

Zooplankton, larval fish and jellyfish in the EAC
(Team Leaders Kylie Pitt, Iain Suthers)

We collected 65 bongo net tows at 18 stations over the 28-day voyage, and due to the magnificently stable platform on RVI our hard-working team successfully sorted 56 samples (86%) for larval fish and jellyfish in the middle laboratory. The overall goals were 1) to broaden the spatial sampling of larval fish around the North Stradbroke Island national reference station (NRS) as part of the national IMOS-larval fish monitoring, and to contrast with the spring sampling on IN2019-v05; and 2) to continue the gelatinous zooplankton sampling of IN2019-v05.

The net was the MNF's 70 cm diameter bongo net, with 0.5 mm mesh and mesh cod-ends, with a lead CTD weight (~5 kg) on each ring; and a ~10 kg Scripps depressor. The LH bongo had two flow meters – the MNF's General Oceanics mechanical flow meter, and our Hydrobios electronic flow meter which was reset with a magnet each tow. Both flow meters will have their calibration checked back in Sydney as the factory default calibrations gave very different flow rates. The Hydrobios was purchased by IMOS for deployment to all NRS sampling. The RH bongo contained a 20 cm diameter 0.1 mm mesh net to sample fine zooplankton – this was preserved in 5% formalin in fresh water and awaits analysis in our lab-based Laser Optical Plankton Counter.

We have 3 scales of observations. A full list of samples is attached.

1. Latitudinal comparisons began sampling as soon as we left Hobart near the Maria Island mooring (National Reference Station) [Bongo1, 3 replicates]; near the Port Hacking mooring NRS (off Sydney, [Bongo2, 3 replicates); off Port Macquarie south of Pt Plomer and inside the EAC front [Bongo3]; and off SE Queensland Bongo 8, 10 – NSI shelf, (or Bongo 16, 17);
2. Broad spatial sampling in the region around the EAC mooring array (Bongos 4 to 18), with specific comparison to the samples taken near the NSI-NRS [Bongo16, 17];
3. Development of the larval fish and gelatinous community in a frontal eddy ("Big Ed") which formed off the northern tip of Fraser Island around 19 May and was sampled on 5 occasions over 2 weeks; [19 May, Bongo9; 22 May Bongo10; 23 May Bongo11; 26 May Bongo14; 2 June Bongo18]. On the last night the samples were full of Trichodesmium (a tropical cyanobacteria, capable of fixing atmospheric nitrogen). Strong winds occurred over the last weekend (30, 31 May) but the eddy was seen and re-sampled on 2 June before steaming back to meet the pilot. It is interesting to note that a week later (9 June) this eddy was still evident off Cape Byron.

For late summer the larval fish community did not have the abundance of larval sardine and mackerel but was surprisingly abundant and diverse including larval anchovy and goat fish.

The gelatinous community was dominated by doliolids (Thaliacea), ctenophores and, to a lesser extent, hydromedusae and salps. Except for doliolids, abundances of all other gelatinous taxa were substantially lower than sampled during IN2019_V05.

Additional samples of gelatinous zooplankton were collected for extraction of parasites (predominantly digenean trematodes) for a project funded by the Sea World Research and Rescue Foundation). These jellyfish were either sub-sampled from the bongo nets or collected using a pool scoop deployed over the side of the vessel when station (i.e. during CTD casts). 175 'jellyfish' (including four species of ctenophores, five species of hydromedusae and four species of salp) were inspected for parasites. A complete list of samples collected is provided.

Tissue samples from eight colonies of *Pyrosoma atlanticum* and one scyphozoan medusa *Bazinga reikei* were frozen at -80 degrees Celsius or in ethanol for genomic sequencing. These samples were collected as part of a Moore Aquatic Symbiosis Genomics Project at the Wellcome Sanger Institute (an international collaboration including Prof Pitt).

Observations on plastic particles in the plankton samples.

Microplastics were present in most of the sites that were sampled on IN2021_V03. The abundance of microplastics was lower than the abundance of larval fish and other zooplankton throughout all of the samples. There did not appear to be a trend or significant change in the composition and abundance of microplastics across the shelf, eddy and offshore sites. However, one of the shelf sites displayed a higher abundance of microplastics (Bongo13). The samples from this site were dominated by polystyrene sheeting fragments.

The types of microplastics found throughout most of the sites included hard plastic fragments, cloth fragments, fibres, and fishing line. This contrasts with the microplastic composition found on Australian beaches, which can be characterised by a presence of nurdles, polystyrene balls, and other hard and soft plastic fragments that are more readily linked to local sources of pollution. The hard plastic fragments that were found were blue, yellow, green, and red and ranged from 1 to 5mm. They had angular edges. On the cloth fragments, there was a coating of iron oxide which suggests that they had been in the ocean for a considerably long duration. The polystyrene sheeting fragments found in one of the shelf sites were larger than the other microplastics, with some reaching 5cm in length. The sheeting fragments were heavily stained in yellow and brown.

Voyage narrative

Mobilisation occurred from the 3rd of May to the 6th of May. All voyage participants were on board the vessel before 1200 on the 5th of May to begin the required 2-day quarantine while awaiting COVID test results. The RV Investigator departed the CSIRO dock 0830 on the 7th of May, transiting up-river to the Selfs Point bunkering station. Emergency drills and lab custodian inductions were held during this time.

The RV Investigator departed from Selfs Point on the 8th of May, after the 2-day COVID quarantine period and bunkering. The ship passed along the acoustic backscatter calibration lines in Storm Bay before transiting north. Scientific operations began later that day, with 3x15 minute Bongo net tows near the Maria Island National Reference Station and a test CTD conducted in 1000m of water nearby. The transit north towards the mooring line occurred during the period 8th May to 14th May. A number of scientific operations were undertaken during the transit. These operations included

Bongo net tows (near the Maria Island NRS, Port Hacking NRS, near Point Plomer), two Triaxus/SADPC sections through interesting oceanographic features (near Newcastle and Port Stephens NSW), two overflights and imaging of historical shipwrecks on the continental shelf on the south and mid-north NSW coastlines and a number of CTDs for post-deployment calibration of mooring instruments. Additionally, we deployed two BGC Argo floats, and two core Argo floats during transit, as well as testing of the CSIRO XBT autolauncher. Mooring operations were delayed somewhat by the discovery of missing equipment on the 11th of May, which necessitated a brief stop in Coffs Harbour where the missing components were delivered to the RV Investigator by Brendan Kelaher of Southern Cross University in a university launch. We arrived on site for mooring operations at 1100 on the 14th of May, too late to begin mooring operations. Pre-recovery CTDs were undertaken at the M6 (EAC_4800) and M5 (EAC_4700) mooring sites before commencing mooring operations.

Mooring operations began with the recovery of the M6 (EAC_4800) mooring on the 15th of May at 0730, one day later than anticipated. Between the 15th of May and the 2nd of June, recoveries and deployments of all 6 moorings were undertaken during daylight hours. Recoveries generally preceded deployments, separated by a day of work on the back-deck to enable the mooring technical team to remove the recovered mooring wire and dynex rope from the CSIRO mooring winch, and to enable the team to place the wire and dynex for the soon-to-be-deployed mooring on the winch. Trilateration of deployed moorings was conducted immediately following anchor drop. Pre-recovery and post-deployment instrument calibration "dip" CTDs were conducted during daylight hours in between active mooring operations. Bad weather between the 29th and the 31st of May delayed mooring operations resulting in two days of no science operations due 35 knot winds and seas of up to 8m.

During the nighttime we made extensive use of the towed-body wire, with numerous Bongo net tows and Triaxus/SADCP or rapid-cast/traditional CTD sections being undertaken. This included substantial work over the continental shelf region between North Stradbroke Island and Fraser Island, where we actively attempted to characterise shelf waters and sample physically and biologically a submesoscale frontal eddy (to which we gave to the nickname "Big Ed"). This frontal eddy was sampled on 4 separate occasions between the 18th of May and the 2nd of June.

Science operations were stopped on the evening of the 2nd of June, several hours after the final mooring deployment. We arrived at the Moreton Bay pilot boarding ground at 0300 on the 3rd of June, and were alongside at Wagner's Wharf, Pinkenba at 0800 on the 3rd of June. Demobilsation commenced immediately and was complete by the 4th of June.

Outreach, education and communications activities

The voyage had an active and successful outreach campaign, led by the MNF's media liaison officer Matt Marrison, both before, after and during the voyage. Specific media items are:

- 3rd May. ABC Hobart (television and online article) – broadcast nationally on ABC News 24 and on various 7pm bulletins (https://www.abc.net.au/news/2021-05-08/scientists-study-

warming-east-australian-current/100124448). Measured audience reach of greater than 330,000;

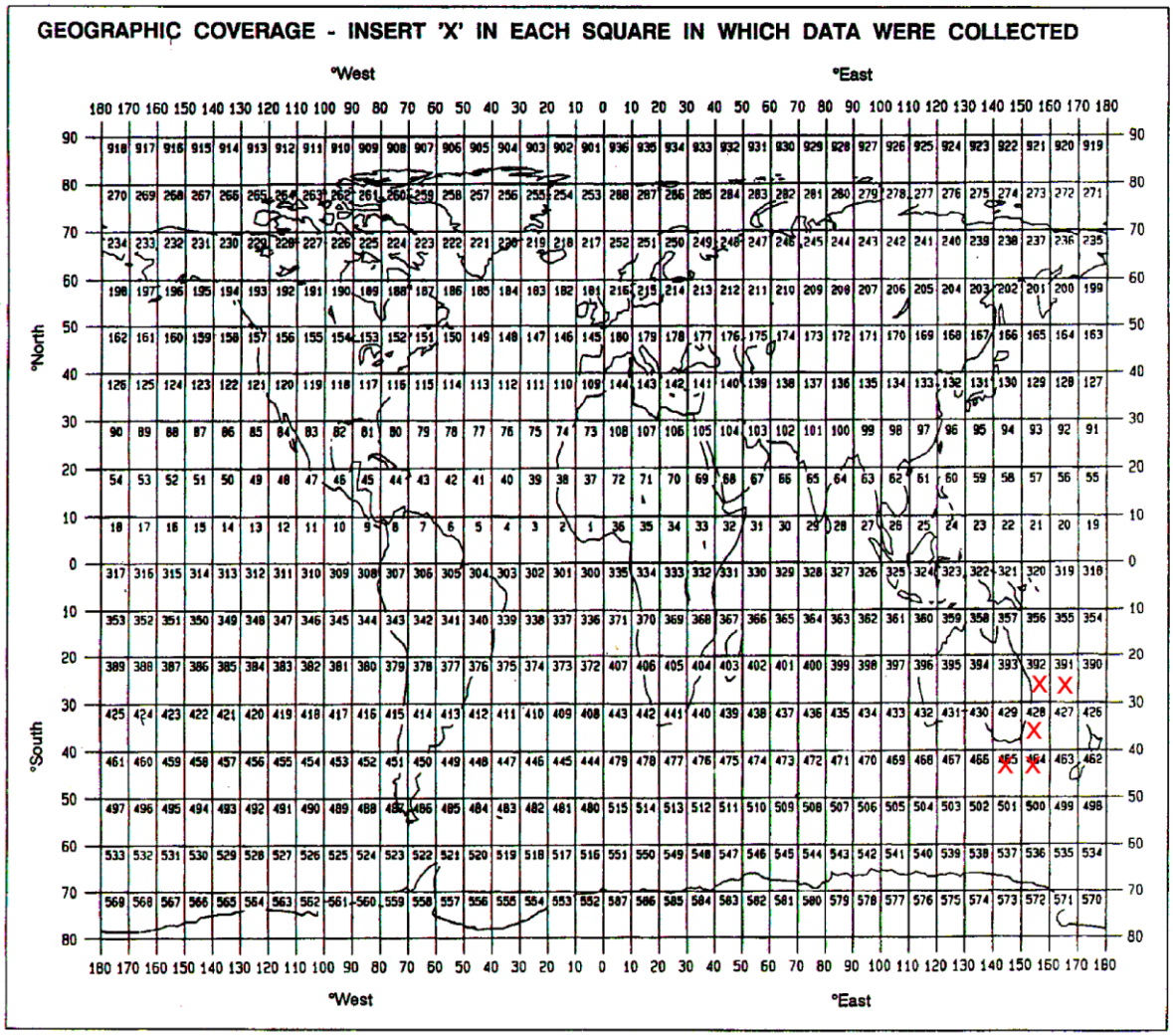
- 10th May: ABC SE NSW (radio) interview of Chris Chapman by Simon Lauder;
- 12th May: CSIRO Says – live internal webinar presented to CSIRO staff. Approximately 400 people across the organisation, including senior executives, viewed the webinar;
- 13th May: ABC Gold Coast (radio) interview of Kylie Pitt by Julie Clift;
- 19th May: ABC Brisbane (radio) interview of Chris Chapman by Rebecca Levingston;
- 24th May: ABC SW Vic (radio) interview of Iain Suthers by Gavin McGrath;
- 2nd June: ABC Brisbane (radio) interview of Chris Chapman by Rebecca Levingston;
- 3rd June: ABC Brisbane (television and online article) interview of Chris Chapman, Iain Suthers, Amandine Schaeffer, Kylie Pitt, Bernadette Sloyan (https://www.abc.net.au/news/2021-06-04/qld-csiro-ship-research-warming-waters-east-australian-current/100188006).
- 4th June. ABC News (radio) interview of Bernadette Sloyan;
- 4th June. ABC News (television) live interview of Chris Chapman by Kirsten Aiken.
- Online article published by UNSW science media and outreach: (https://newsroom.unsw.edu.au/news/science-tech/four-week-voyage-yields-secrets-changing-oceans)

The total estimated audience reach of this media effort was 1,626,532, 233 separate media mentions, with TV clips in all states and territories.

Summary

All voyage objectives, including secondary and tertiary objects were achieved. Combining the mooring voyage with targeted physical oceanographic field surveys and larval fish/gelatinous zooplankton monitoring continues to be an efficient and effective use of ship time and a productive method of bringing the biological and physical oceanographic communities together to enhance the impact of the science conducted on board.

Marsden Squares



Moorings, bottom-mounted gear and drifting systems

Item Name, Identifier (e.g. serial number)	Principal Investigator (see Title Page)	APPROXIMATE POSITION (as degrees, decimal minutes)						DATA TYPE enter code(s) from list in Appendix A	DESCRIPTION
		LATITUDE			LONGITUDE				Nature of the instrumentation.
		deg	min	N/S	deg	min	E/W		
EAC_4800	Sloyan and Chapman	27	06.324	S	155	18.318	E	H11, D01, D71	Recovery of EAC_4800 (M_6) Deployed Date : 13 September 2019 Recovered: 15 May 2021

EAC_4800	Sloyan and Chapman	27	06.158	S	155	18.138	E	H11, D01, D71	Deployment of EAC_4800 (M_6) Deployed Date : 17 May 2021.
EAC_4700	Sloyan and Chapman	27	12.4986	S	154	38.958	E	H11, D01, D71	Recovery of EAC_4700 (M_5) Deployed: 16 September 2019. Recovered: 18 May 2021
EAC_4700	Sloyan and Chapman	27	12.092	S	154	38.34	E	H11, D01, D71	Deployment of EAC_4700 (M_5) Deployed : 20 May 2021.
EAC_4200	Sloyan and Chapman	27	15.036	S	154	17.892	E	H11, D01, D71	Deployment of EAC_4200 (M4) Deployed : 20 September 2019. Recovered: 21 May 2021
EAC_4200	Sloyan and Chapman	27	14,699	S	154	17.183	E	H11, D01, D71	Deployment of EAC_4200 (M4) Deployed : 24 May 2021.

EAC_3200	Sloyan and Chapman	27	17.076	S	154	8.196	E	H11, D01, D71	Deployment of EAC_3200 (M_3) Deployed: 23 September 2019. Recovered: 25 May 2021
EAC_3200	Sloyan and Chapman	27	16.8672	S	154	8.0862	E	H11, D01, D71	Deployment of EAC_3200 (M_3) Deployed: 27 May 2021.
EAC_2000	Sloyan and Chapman	27	18.888	S	153	59.943	E	H11, D01, D71	Recovery of EAC_2000 (M_2) Deployed : 26 September 2019. Recovered: 28 May 2021
EAC_0500	Sloyan and Chapman	27	19.758	S	153	54.0408	E	H11, D01, D71	Recovery of EAC_500 (M_1) Deployed: 27 September 2019 Recovered: 28 May 2021
EAC_0500	Sloyan and Chapman	27	19.537	S	153	53.982	E	H11, D01, D71	Deployment of EAC_500 (M_1) Deployed: 1 May 2021

EAC_2000	Sloyan and Chapman	27	18.756	S	153	0.136	E	H11, D01, D71	Deployment of EAC_2000 (M_2) Deployed: 2 May 2021

Item Name, Identifier (e.g. serial number)	**Principal Investigator (see Title Page)**	**APPROXIMATE POSITION (as degrees, decimal minutes)**						**DATA TYPE enter code(s) from list in Appendix A**	**DESCRIPTION**
		LATITUDE			**LONGITUDE**				**Identify, as appropriate, the nature of the instrumentation, the parameters measured, the number of instruments and their depths, whether deployed and/or recovered, dates of deployments and/or recovery, and any site identifiers.**
		deg	**min**	**N/S**	**deg**	**min**	**E/W**		
Argo Float 1218	Chris Chapman	27	16.14	S	154	16.63	E		Water Depth (m): 4197, deployed 2021-05-24 10:31:05 UTC

Argo Float 1213	Chris Chapman	26	19.99	S	153	56.43	E		Water Depth (m): 2047, deployed 2021-05-23 10:50:58 UTC
Argo Float 1211	Chris Chapman	27	12.87	S	154	37.64	E		Water Depth (m): 4768, deployed 2021-05-21 08:11:25 UTC
Argo Float 1217	Chris Chapman	27	13.27	S	154	43.66	E		Water Depth (m): 4773, deployed 2021-05-14 11:40:14 UTC
Argo Float 1227	Chris Chapman	29	31.64	S	154	12.36	E		Water Depth (m): 3238, deployed 2021-05-13 11:00:31 UTC
Argo Float 1226	Chris Chapman	33	16.77	S	152	48.13	E		Water Depth (m): 4255, deployed 2021-05-11 15:46:08 UTC
BGC Argo Float 2002	Chris Chapman	34	24.13	S	152	30.75	E		Water Depth (m): 4868, deployed 2021-05-11 09:41:50 UTC
BGC Argo Float 2001	Chris Chapman	37	59.64	S	150	42.36	E		Water Depth (m): 4649, deployed 2021-05-09 18:34:07 UTC

Summary of data and samples collected

	Principal Investigator	NO	UNITS	DATA TYPE	DESCRIPTION

Item Name, Identifier (e.g. serial number)	(see Title Page)	(see above)	(see above)	Enter code(s) from list in Appendix A	Identify, as appropriate, the nature of the data and of the instrumentation/sampling gear and list the parameters measured. Include any supplementary information that may be appropriate e.g. vertical or horizontal profiles, depth horizons, continuous recording or discrete samples, etc. For samples taken for later analysis on shore, an indication should be given of the type of analysis planned, i.e. the purpose for which the samples were taken.
1	Chapman	36	CTD Stations	H09/H10	24 bottles on the 36 bottle rosette. At each CTD station (with the exception of shallow casts) water samples were collected for nutrients, sality and oxygen.
2	Chapman	8	Towed undulating CTD profiles	H09/H10	Pressure, temperature, conductivity, oxygen and other sensors (EcoTriplet, LOPC, Suna) were deployed on the Triaxus
3	Suthers	65	Bongo net tows	B02, B08,B09,B13	Bongo net tows in the EAC, Frontal Eddy, and continental shelf.
4	Cowley	80	XBT	H11	Testing of the XBT autolauncher and opportunistic sampling of interesting oceanographic features (frontal eddy, EAC)
5	Strutton/Trull/Chapman	2	BGC Argo Floats	D90	Deployed 2 BGC Argo Floats
6	Chapman	6	Argo Floats	D90	Deployed 6 Argo floats
7	Pitt	8	Over-the-side pool scoop collection	B09	Collection of gelatinous zooplankton collected from surface waters
8	Chapman/Scaeffer/Navidad/Heaney	22	Valeport RapidCast CTD	H10/H11	Used GSM Valeport RapidCAST CTD sensor to collect CTD data during to complement ship ADCP sections

Curation Report

Item #	Description	Storage	Access	Custodian
1.	Zooplankton collections made with the MNF's 70 cm diameter bongo net (with 0.5 mm mesh) ; two flow meters; and with a 20 cm diameter ring net (with 0.1 mm mesh) included inside the RH bongo; 10 or 15 minute tows at 3 knots; included a temperature-depth logger for each tow, n=65 tows at 18 stations	90% of samples sorted at sea; larval fish transferred to 95% ethanol; will be identified at UNSW by Dr Tony Miskiewicz and then archived at the Australian Museum; Jellyfish were sorted and identified by Griffith University team; and samples will be archived at Griffith University; All sorted zooplankton is stored in 5% formalin in 200 mL vials at Griffith University by Prof. Kylie Pitt; some bongo nets (stations 5, 7, 18) will be sorted and stored at UNSW by Prof Iain Suthers. Fine-mesh zooplankton will be analysed with a Laser Optical Plankton counter to determine the zooplankton size frequency distribution ('size spectra').	Larval fish data via IMOS and AODN.	i.suthers@unsw.edu.au
2.	Parasites (mainly digenean trematodes) removed from jellyfish. The jellyfish used for parasite sampling were sub-sampled from bongo nets or	Samples are stored in ethanol at Griffith University and will be sent to the University of Queensland for genetic sequencing and morphometric identification by	Data will be available via Assoc Prof Tom Cribb or Prof Kylie Pitt	k.pitt@griffith.edu.au

	collected using a pool scoop with a 4m extendable handle deployed over the side of the vessel when stationary (i.e. during CTD casts). Four species of ctenophores, five species of hydromedusae and four species of salps were sampled for parasites. A copy of the number of parasites extracted from each jellyfish has been provided.	Assoc. Prof Tom Cribb and Dr Scott Cutmore.		
3.	Sub-samples of jellyfish tissue (frozen at -80°C or in ethanol) or genomic sequencing. Tissue samples were collected from 8 colonies of Pyrosoma atlanticum (Chordata ; Thaliacea) and one Bazinga reikei (Cnidaria ; Scyphozoa).	Samples are stored at Griffith University but will be sent to the Wellcome Sanger Institute in the UK for genomic sequencing.	Data available upon request from Prof Kylie Pitt	k.pitt@griffith.edu.au

Track Chart

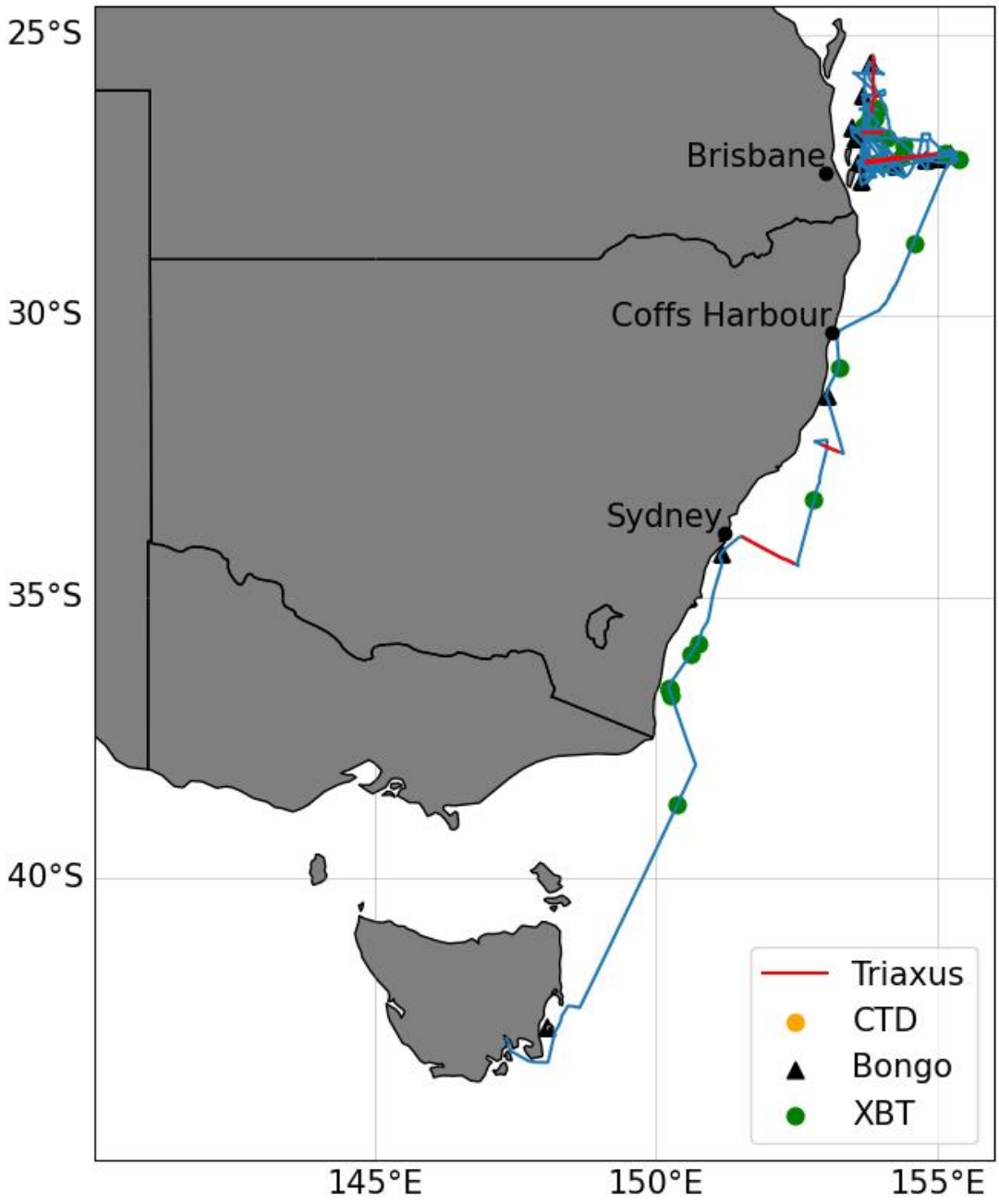


Figure 1: Full ship track showing transit

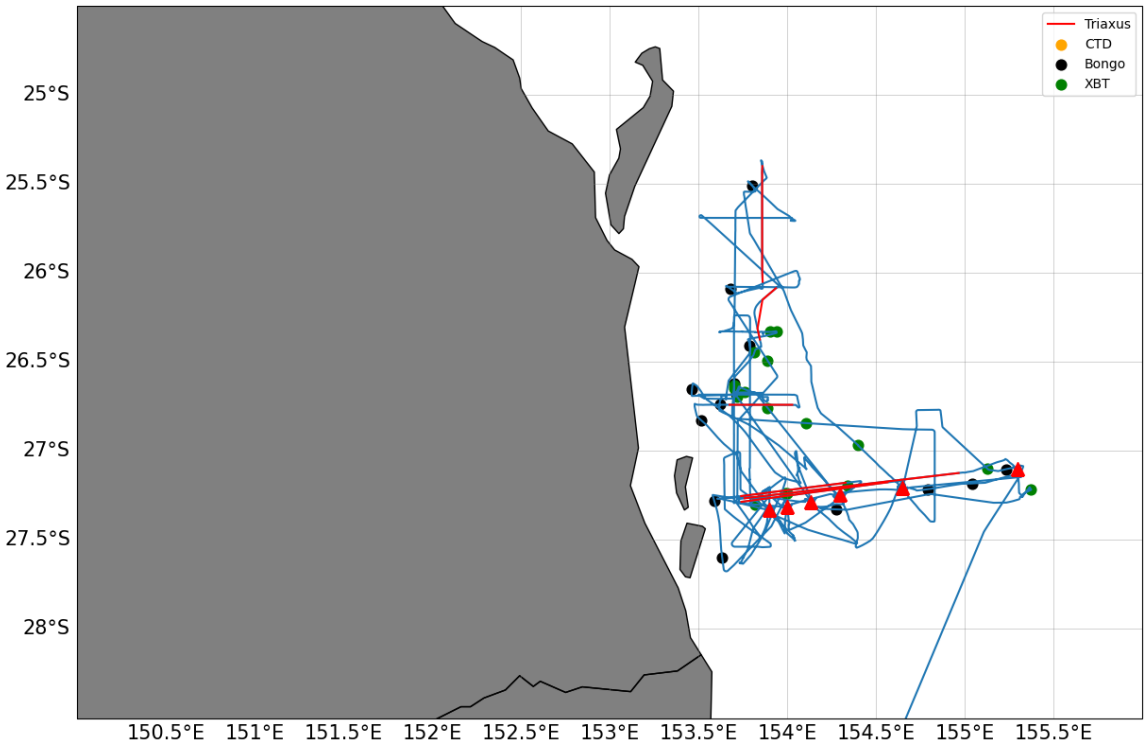


Figure 2: Ship track near the CSIRO/IMOS mooring array

Signature

Your name:	**Chris Chapman**
Title:	Chief Scientist
Signature:	
Date:	10/08/2021

Appendix A – CSR/ROSCOP Parameter Codes

	METEOROLOGY
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

	MARINE 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

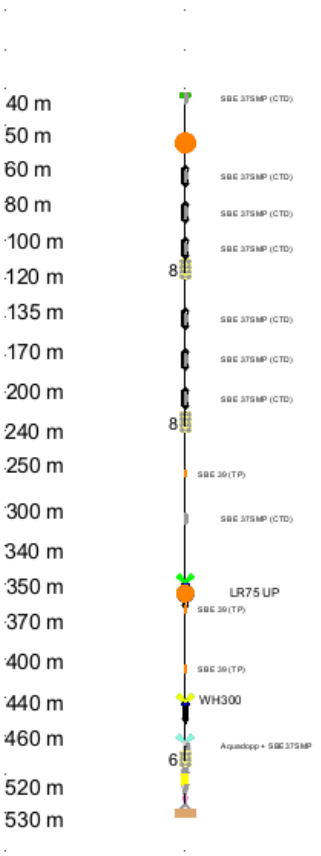
	MARINE GEOLOGY/GEOPHYSICS
G01	Dredge
G02	Grab

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

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

	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

Appendix A – Mooring Diagrams



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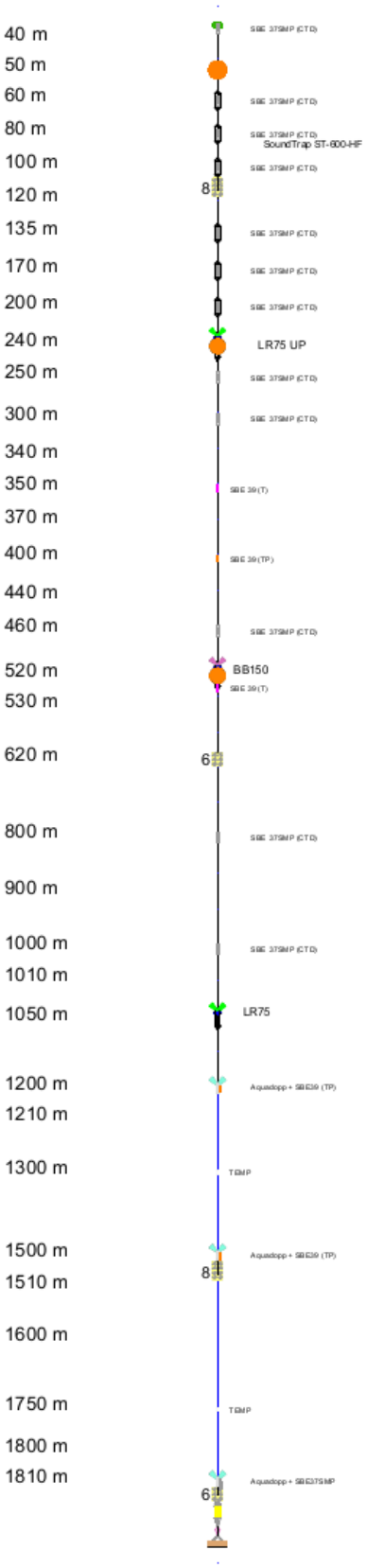

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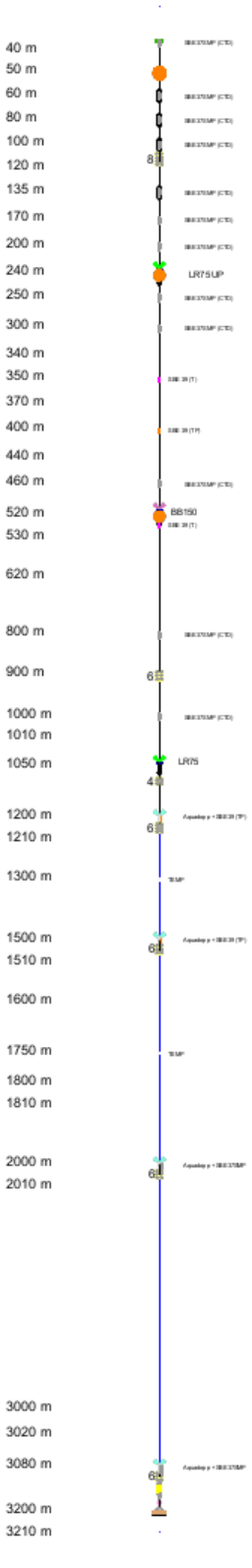

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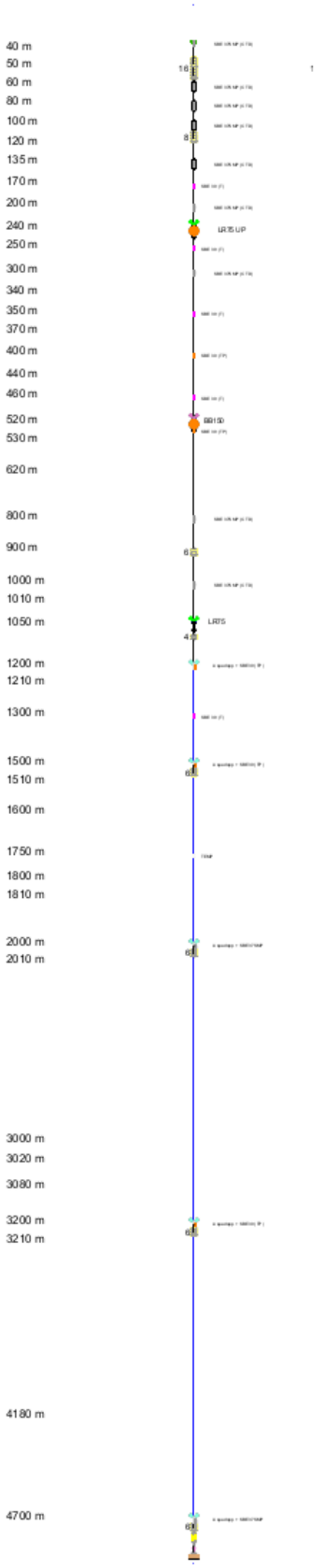
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440 m
460 m
520 m
530 m
620 m
800 m
900 m
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1200 m
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1300 m
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M2
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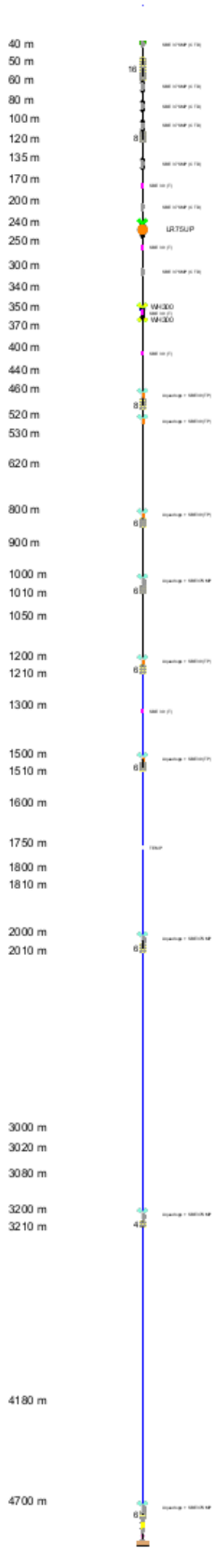

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