

Suspended sediment, hydrodynamic, and biogeochemical observations in Fitzroy Estuary - Keppel Bay Region, QLD, 2022-2023; an eReefs sediment dynamics study

<https://data.csiro.au/collection/csiro:59815>
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Cover Photo: Aerial image of sediment resuspension, mixing and transport in the Fitzroy Estuary during flood tide on 12 Nov. 2022. The voyage research vessel 'Adori' is visible in the centre of the image, with the fixed station 'FitzroyPylonEreefs' visible near the north shoreline (image right).

Data collection and project summary

This dataset compiles all field observations collected as part of a sediment dynamics study in the Fitzroy Estuary - Keppel Bay Region from February 2022 to April 2023. Four voyages¹ were undertaken during the 14-month study to deploy and maintain instrumentation at several fixed stations while also conducting spatial surveys and process measurements. Instrumentation, deployment timelines and locations are summarized in Table 1 and Figures 3-5, with configuration examples shown in Figures 1-2. Additionally, this data collection includes brief reports completed after each voyage, which provide a synopsis of field activities and locations along with pictures and preliminary visualization of raw data. To accommodate a range of use cases, instrument data are duplicated into two data structures: “byInstrument” and “byLocation”. All timestamps are in local time (AEST), unless otherwise noted.

The project was conducted as part of eReefs Phase 5 (<https://research.csiro.au/ereefs/>, <https://www.ereefs.org.au/>) combined with the CSIRO CERC project “*Breaking new ground in coastal sediment dynamics: A measurement-to modelling pathway to support blue growth and coastal resilience*”. Relevant links and outputs from this data collection will be periodically updated. At the time of submission, related links include those listed below.

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Related Links

- Xiao et al., (*in Review*): This first output from the CERC project includes additional information on data and sampling methods within this collection and uses these data as part of a measurement-to-modelling framework in the Fitzroy-Keppel Region.
- Eagle.io data portal for the Fitzroy Pylon <https://public.eagle.io/public/dash/r58k15af7ielwt2>
- eReefs data portal <https://portal.ereefs.info/>
- Bio-optical data collected on the November 2022 and April 2023 voyages as part of AquaWatch Great Barrier Reef Pilot study in Fitzroy River and Keppel Bay QLD. <https://data.csiro.au/collection/csiro:59835> Permalink/DOI will be available in late 2023 after processing.
 - Contact: Gemma Kerrisk, gemma.kerrisk@csiro.au
 - <https://research.csiro.au/aquawatch/great-barrier-reef/>

¹ Voyages dates were February, June, November 2022 and April 2023.

Instrumentation and Data

Several types of instrument platforms were constructed and deployed, including the following:

Fixed stations (see Fig. 4)

1. Benthic landers at the ShipChannel and PortAlma sites (Fig. 1)
2. Pylon at the FitzPylonEreefs site (Fig. 2)
3. Low-profile benthic lander for short (<48h) measurement of near-bed processes (Fig. 2)
4. Tethered and weighted CTDs at the two riverine sites

Spatial Surveys (see Fig. 5)

5. A flow-through system for continuous measurement of surface water (Crosswell et al. 2020)
6. A system for collecting continuous water column profiles while underway, which consisted of a small CTD and an electric reel (see Crosswell et al. 2022).
7. Davit-mounted towboards for acoustic profiling transects using an M9 hydrosurveyor and/or AQUAscat.
8. Profiling cage with bridle to maintain LISST-200X and EXO sonde in the horizontal while profiling.

This collection also includes two auxiliary data and media sources that may be relevant to interpretation of diel, tidal, and seasonal processes as well as general characterization of the coastal environmental setting.

- Drone imagery and video (DJI Mini3 Pro) collected during voyages which depict prominent coastal features, particularly mangroves, tidal channels, salt pans and floodplains surrounding key study sites. Also included in this directory (*./media/drone/*) are processed images and time-lapse compilations that illustrate the dramatic sediment resuspension and mixing in the Fitzroy Estuary.
- Data from a pre-existing eReefs monitoring buoy in the Fitzroy River that was damaged during floods and removed during the Feb 2022 voyage (*./Fitz_Buoy_2021/*).

Due to harsh condition in the Fitzroy Estuary, instrument failure from biofouling, electrolysis or sediment burial was high at fixed stations, depending on the instrument and location. To minimize instrument failure, platforms were modified, replaced or expanded during each maintenance interval, i.e., each voyage. Similarly, software configurations on ADCPs and probe configurations on EXO sondes were revised during the study period. For example, beginning in Nov. 2022 secondary CTD and turbidity probes were added to some fixed-station EXO sondes to allow redundancy and enable better Quality Control (QC). These secondary probes replaced Chl and fDOM bio-optics probes on the sondes, which were lower priority given the study focus. Hardware changes to EXO probes are not annotated in the dataset, as they are considered intuitive based on the data structure. For instruments with more complex software configurations, such as ADCPs and ADVs, a deployment configuration file (**.dep*) is included in the relevant directory.

Calibration and QC

All instruments that required user calibration were calibrated prior to deployment, however post-deployment calibration was generally not possible due to extreme biofouling, electrolysis or sediment adhesion/blockage. Standardized QC protocol have not otherwise been applied to this data collection given the experimental nature of the study in terms of both instrument and model development. For example, while absolute salinity values may be clearly affected by biofouling on EXO CTD probes, the data may still accurately reflect the timing of a flood pulse and may therefore be useful in assessing spatiotemporal relationships within the study system. Accordingly, the data in this collection should be considered as raw data. To facilitate use-specific QC of this dataset, all fixed station timeseries data have been manually reviewed, and relevant QC comments have been compiled in the spreadsheet *./reports_summaries/Fitzroy_2022_timeseries_summary.xlsx*. As an additional aid for QC and data interpretation, representative pictures of most sensor platforms, including pre- and post-deployment, have been included in the *./media/instrument_photos* directory.

Instrument platform examples and summary table

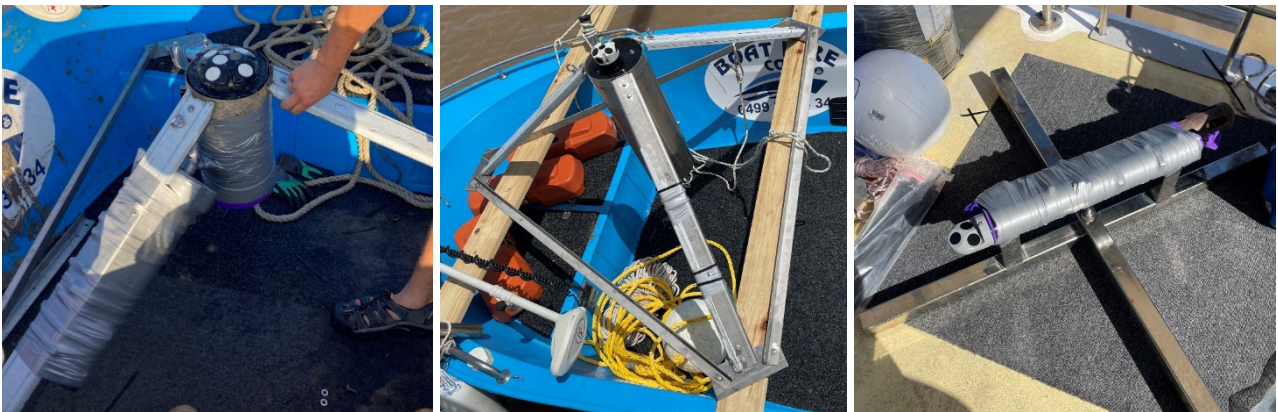


Figure 1. Benthic landers deployed at ShipChannel site (left, Signature1000 ADCP) and the PortAlma site (center, AquaDopp 1Mhz Z cell ADCP) (right, AquaDopp 1Mhz angle ADCP). See Table 1. and Figure 3 for deployment periods.

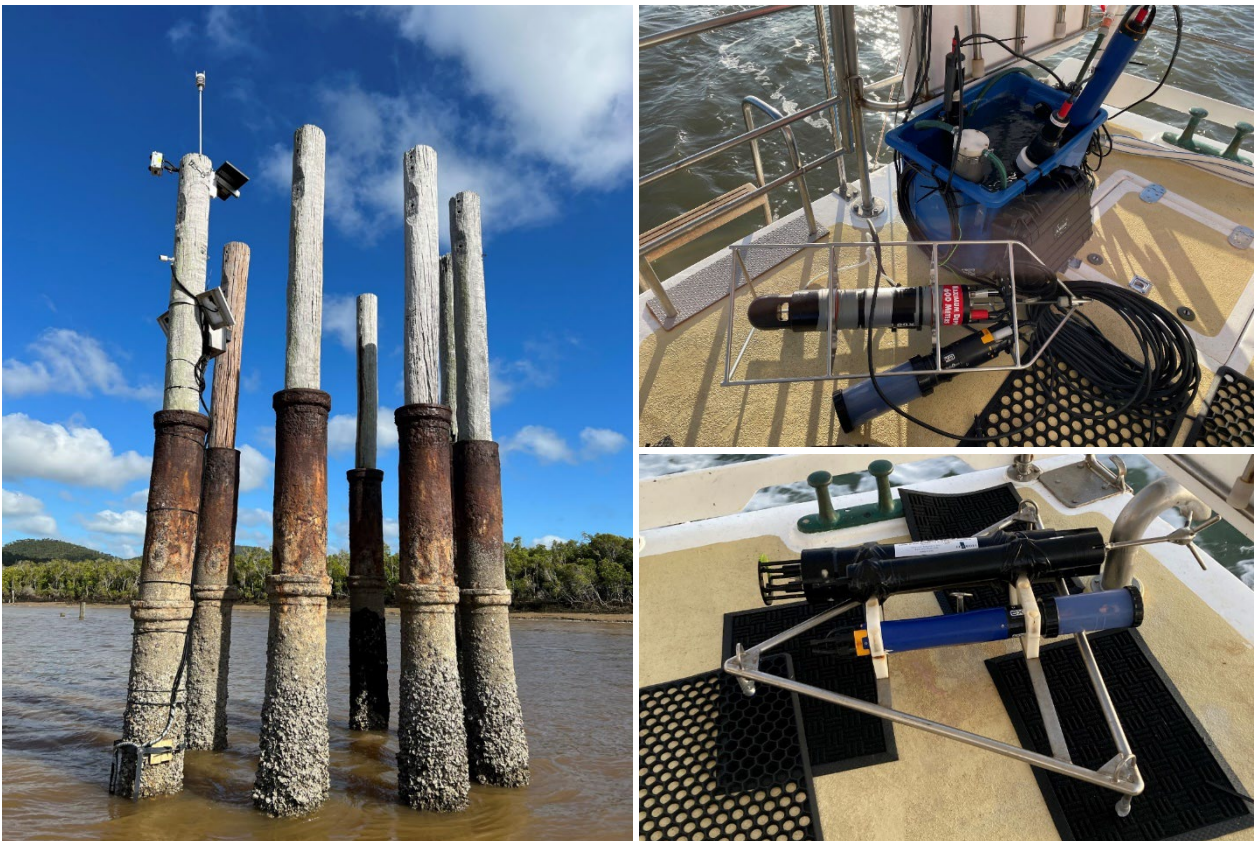


Figure 2. Left: Final configuration of FitzroyPylonEreefs station with EXO_V2 sonde and SonTek SL500 ADCP mounted on a swingarm below the water line and weather station mounted on a pole above the pylon. **Top Right:** LISST 200X and EXO_V2 sonde attached to the vertical profiling cage and in front of the water bath containing flow-through system for continuous measurement of surface water. **Bottom Right:** EXO_V2 sonde, Vector ADV and LISST 100X mounted on low-profile benthic lander for measurement of near-bed processes.

Table 1. Instrument deployments by type, application and location

Measurement type	Equipment Make and Model	Stations*: pylons & landers	Vertical Profiles	Transects	Underway/ flow-through
Physical - chemical (CTDs, sondes)	YSI EXO2 sonde	SC PA PY	X	X	X
	Van-Essen CTD-diver	PY MR UR	X	X	
	SonTek CastAway-CTD		X		
Hydrodynamics (ADCPs, ADVs)	Nortek Signature1000	SC			
	Nortek Aquadopp 1Mhz Zcell	PA			
	Nortek Aquadopp 1Mhz angle	PA			
	SonTek SL500	PY			
	SonTek M9 hydrosurveyor			X	
	Nortek Vector ADV	SC PA PY			
Sediments (Particle size, concentration, & backscatter)	Sequoia LISST 200X		X		
	Sequoia LISST 100X	SC PA PY			
	Sequoia LISST-ABS				X
	Aquatec AQUAscat 1000R			X	
	Discrete TSS samples**		X		
Other biogeochemical & optics	Contros HydroC CO ₂				X
	Wetlabs ECO-Triplet (2)				X
	TriOS OPUS UV-spec				X
	SeaBird SUNA V1 UV-spec				X
Meteorological	Vaisala WXT520	PY			
	Airmar 150WX				X

* Location codes:

X = various locations

SC = ShipChannel

PA = PortAlma

PY = FitzroyPlyonEreefs

MR = MidRiver

UR = Upriver

** Collected directly from surface via Van Dorn sampler or via peristaltic pump

Data summary figures

Long-term instrument deployments in Fitzroy Estuary-Keppel Bay 2022-2023

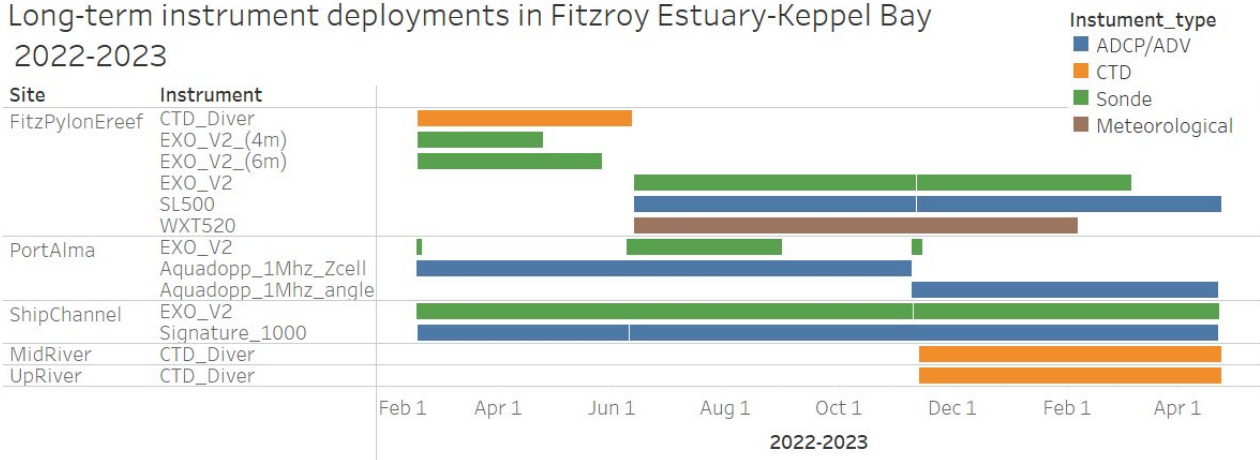


Figure 3. Gantt chart and map for long-term instrument deployments at fixed stations. Bars on the Gantt chart that terminate prior to a maintenance interval (voyage date) indicate the time of complete instrument failure.

Short-term instrument deployments in Fitzroy Estuary-Keppel Bay 2022

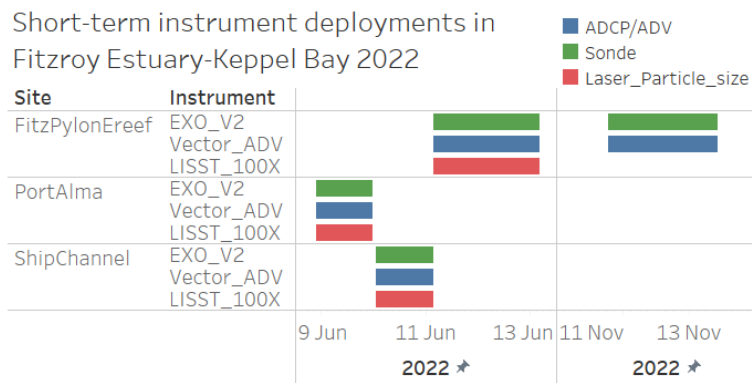


Figure 4. Gantt chart showing deployments of the low-profile benthic lander (Fig. 2) to measure near-bed processes.

Spatial sampling during 4 voyages in 2022-2023

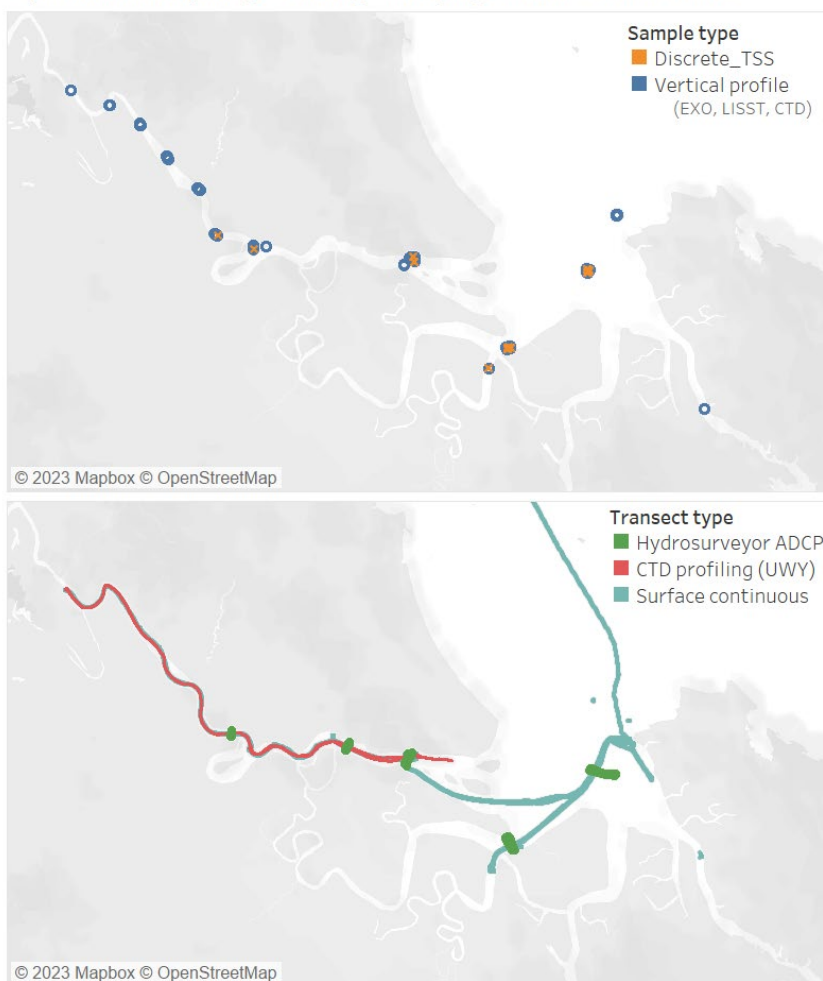


Figure 5. Top: Locations of discrete vertical profiles using the instrument cage (Fig. 2) or Castaway CTD. **Bottom:** Tracks covered by three types of spatial surveys.

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