

Survey of water quality and suspended solid metals for ten (10) sites around Saibai and Boigu Islands in the Torres Strait, June 2018 (NESP TWQ 2.2.2, CSIRO)



[Metadata](#) | [Metadata \(XML\)](#)
[Visualization service URL \(WMS\) \(nesp2:TS_NESP-TWQ-2-2-2_CSIRO_TS-Mine-Pollution-Survey_201806_WQ-Metals\)](#) |

Title	Survey of water quality and suspended solid metals for ten (10) sites around Saibai and Boigu Islands in the Torres Strait, June 2018 (NESP TWQ 2.2.2, CSIRO)
Date	2019-05-10
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Abstract	<p>This dataset summarises the results of a survey of water quality and suspended solid metal data for ten (10) sites around Saibai and Boigu Islands in the Torres Strait during November 2018. This is the second survey for this project, where the first survey identified the area around Saibai as having elevated metal concentrations compared to other areas of the Torres Strait. This survey was conducted to investigate this finding. Water samples were collected from five sites around Saibai Island and five sites around Boigu Island.</p> <p>METHODS:</p> <p>- Sample Collection Sampling was conducted by the CSIRO team with the assistance of TSRA staff from on-board the TSRA patrol vessels stationed at both islands. It was not possible to deploy a tender off the main boat, so water samples were collected from the back of the patrol vessel using 5 L acid washed containers. Water samples were collected by immersing the container by hand to a depth of approximately 0.5 m. Powder free plastic gloves were worn during the sampling operation. The containers were filled and rinsed twice with water from the Location prior to filling. It should be noted that this method of sampling is not recommended for the accurate determination of dissolved zinc in marine waters as many aluminium hulled boats and outboard motors are equipped with zinc sacrificial anodes that release dissolved zinc into solution.</p> <p>For quality control purposes, a field blank was prepared during both the Saibai and Boigu legs of the field trip. Duplicate samples were collected at sites S1, 8 and B1.</p> <p>Salinity and pH were measured using an Orion Star A329 portable meter (Thermo Scientific). Sample pH was measured using a Thermo Scientific Orion Gel-Filled ROSS pH Ultra Triode Electrode (8107UWMMMD) that was calibrated using pH 4.00, 7.00 and 10.00 buffers. Salinity was measured using a Thermo Scientific Orion Conductivity Cell (013010MD) that was calibrated using KCl conductivity standards.</p> <p>Water samples were transported back to the Island and were processed within five hours of collection in a designated clean area free of dust and other conspicuous sources of metal contamination. As a precaution against sample contamination, surfaces coming into contact with sample containers or lab apparatus were covered with clean plastic. Pre-weighed 0.45 µm membrane filters were used for sample filtration and were retained for particulate metals analysis of suspended sediments. The water and sediment samples were stored chilled and 'hand carried' back to the CSIRO laboratories in Sydney for analysis of dissolved and TSS-bound metals.</p> <p>- Water sample processing</p>

Water samples for analysis of trace metals were vacuum filtered through acid-washed 0.45 µm Millipore membrane filters using an acid washed polycarbonate filtration apparatus (Sartorius). The filtration assemblies were further cleaned before processing each sample by first filtering a 100 mL volume of 10% v/v nitric acid solution followed by two 150 mL volumes of deionised water, and finally, a 50 mL volume of sample. For each volume of these solutions the filtration rig was held on an angle and rotated both before and after filtration so that the solutions came into contact with all surfaces of the top and bottom compartments of the apparatus to ensure rigorous rinsing / pre-treatment was achieved. The 50 mL aliquot of sample used to pre-clean the filtration rig was poured into the 1 L acid washed Nalgene filtrate receiving bottle, shaken to pre-treat the bottle, and discarded to waste. The sample was then filtered and the filtrate transferred into the receiving bottle. Approximately 900 mL of each sample filtrate was retained for analysis. Filtrates were then preserved by addition of 2 mL/L of concentrated nitric acid (Merck Tracepur).

For the field blanks, approximately half of the 1L sample was filtered and preserved. The remaining 500 mL was acidified and retained for subsequent analysis. The difference between the filtered and unfiltered field blanks gave an indication if filtration resulted in contamination.

Suspended sediment samples for total suspended sediment (TSS) and TSS-bound metals analyses were acquired by filtering known volumes of water through pre-weighed 0.45 µm membrane filters (Millipore). The filters were rinsed with 10% nitric acid before use and each sample was filtered using the filtration procedure described above. After the sample was filtered and the filtrate removed, the upper compartment of the filtration apparatus and the filter were rinsed with approximately 20 mL of deionised water to remove any salt. The filters were placed into acid-washed plastic Petri slides and stored frozen. The filters were transferred to the CSIRO Lucas Heights laboratories, after which they were oven-dried at 60°C, cooled to room temperature in a desiccator, and weighed. This procedure was repeated three times to ensure the mass was consistent, after which, the filters were stored at room temperature until total recoverable (TR) metals analysis was performed. The TSS concentration (mg/L) of the water samples was calculated using the difference in the mass of the filter before and after filtration divided by the volume of sample filtered.

- Analysis of dissolved metals

Dissolved Cd, Co, Cu, Ni, Pb and Zn in filtered samples were analysed by complexation and solvent extraction prior followed by quantitation of the pre-concentrated metals by ICPMS. The extraction procedure allowed the pre-concentration of metals by a factor of 25, thus allowing more accurate quantification. A dithiocarbamate complexation/solvent extraction method based on the procedure described by Magnusson and Westerlund (1981) was employed. The major differences were the use of a combined sodium bicarbonate buffer/ammonium pyrrolidine dithiocarbamate reagent (Apte and Gunn, 1987) and 1,1,1-trichloroethane as the extraction solvent in place of Freon. In brief, sample aliquots (250 mL) were buffered to pH 5 by the addition of the combined reagent and extracted into two 10-mL portions of triple-distilled trichloroethane. The extracts were combined and the metals back-extracted into 1 mL of concentrated nitric acid (Merck Tracepur). The back extracts were diluted to a final volume of 10 mL by addition of deionised water and analysed by inductively coupled plasma-mass spectrometry (ICPMS) (Agilent, 7500CE) using the instrument operating conditions recommended by the manufacturer. For quality control purposes a portion of the certified reference seawater NASS-6 (National Research Council (NRC), Canada) CRM was analysed in every sample batch.

Dissolved aluminium and iron concentrations were measured directly on portions of acidified filtered waters by ICP-AES (Varian730 ES) using matrix-matched standards. The concentrations of dissolved chromium were measured directly by ICP-MS (Agilent 7500CE) following three-fold dilution with deionised water and calibration against matrix-matched standards.

The concentration of dissolved arsenic in the filtered samples was measured by hydride generation atomic absorption spectrometry (HG-AAS), using procedures based on the standard methods described by APHA (1998). Samples were first digested by addition of potassium persulfate (1% m/v final concentration) and heating to 120°C for 30 min in an autoclave. Hydrochloric acid, (3 M final concentration) was then added to the samples. Pentavalent arsenic was then pre-reduced to arsenic (III) by addition of potassium iodide (1% (m/v) final concentration) and ascorbic acid (0.2% (m/v) final concentration) and left standing for at least 30 min at room temperature prior to analysis. Arsenic concentrations were then measured by HG-AAS using a Varian VGA system operated under standard conditions recommended by the manufacturer. Arsenic (III) in solution was reduced to arsine by reduction with sodium borohydride, which was stripped from solution with argon gas into a

silica tube, electrically heated at 925°C. Heating converted arsine into arsenic vapour, which was quantified by atomic absorption spectrometry.

For quality control purposes a portion of the certified reference seawater NASS-6 (National Research Council (NRC), Canada) CRM was analysed in every sample batch.

DOC was measured on aliquots of filtered samples collected during the June 2018 survey using a Shimadzu TOC-LCSH Total Organic Carbon Analyser using the procedures recommended by the manufacturer.

- Analysis of metals bound to total suspended solids (TSS)

TSS was digested in pre-cleaned Teflon digestion vessels using aqua-regia digestions in a microwave-assisted reaction system (MARS). The membrane filters containing the suspended sediments were transferred into the MARS digestion vessels and subjected to pressurised digestion. The method involved adding 2.5 mL of concentrated nitric acid (Tracepur, Merck) and 7.5 mL of concentrated hydrochloric acid (Tracepur, Merck) to each digestion vessel and heating at high pressure in a MARS digestion system for 90 minutes. Once cool, the digest vessels were vented followed by dilution of the digest to a final volume of 40 mL using deionised water. The masses of the empty vessel, the vessel plus sample, and the vessel plus sample and acid mixture before and after heating were recorded to allow calculation of a dilution factor used in the determination of metal concentrations in the initial undiluted sample. For quality control purposes, portions of the certified reference sediments ERM-CC018 (IRMM) and PACS-3 (NRC Canada) were analysed in each sample batch.

Format:

This dataset consists of a single Comma Separated Value (CSV) table containing the data provided by the project team.

Data Location:

This dataset is filed in the eAtlas enduring data repository at: data\NESP-TWQ-2\2.2.2_TS-mine-pollution

Metadata language	eng
Character set	UTF8
Hierarchy level	Dataset

OnLine resource

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Protocol	WWW:LINK-1.0-http--metadata-URL
Linkage	https://eatlas.org.au/data/uuid/71127e4d-9f14-4c57-9845-1dce0b541d8d
Protocol	WWW:LINK-1.0-http--related
Linkage	https://eatlas.org.au/nesp-twq-2/ts-mine-pollution-2-2-2
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Protocol	WWW:LINK-1.0-http--related
Linkage	https://maps.eatlas.org.au/maps/wms

Protocol	OGC:WMS-1.1.1-http-get-map
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Point of contact

Individual name	Apte, Simon, Dr
Organisation name	CSIRO Land and Water
Role	Point of contact
Topic category	Biota

Extent

Description	Torres Strait, Australia
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Geographic bounding box

West bound	143.402
East bound	142.079
South bound	-10.607
North bound	-9.217

File identifier	03d84b70-d64c-4d89-846b-f1aa14f30ff7
Metadata language	eng
Character set	UTF8

Metadata author

Individual name	eAtlas Data Manager
Organisation name	Australian Institute of Marine Science (AIMS)
Role	metadataContact
Date stamp	2019-05-10T05:05:18