IMOS – TSM Report

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Introduction

The Australian Integrated Marine Observing System (IMOS) established a network of nine National Reference Stations (NRS) in 2008 (Figure 1). The aim of these stations was to collect real time temperature, salinity and fluorescence data through moored sensors and to be the site of monthly collection of *in situ* samples for sensor validation as well as to build a time series of biogeochemical parameters. For logistical reasons, not all stations could be sampled monthly – Kangaroo Island, Esperance, Ningaloo and Darwin were sampled every three months with Esperance and Ningaloo being discontinued after August 2013. During a station visit, a CTD profile is collected in addition to samples for salinity, nutrient concentration (NO_3, PO_4, Si, NH_4), pigment concentration and composition, total suspended matter (TSM), flow cytometry, microbial composition, phytoplankton identification and cell counts and zooplankton identification and abundance. For more detailed information about the NRS refer to Lynch et al (2014). The sites are all considered coastal, but cover water types from tropical (Yongala) to subtropical North Stradbroke Is., Port Hacking and Rottnest) to temperate (Kangaroo Is. and Maria Is). The Darwin site, although situated at a low latitude, is within a harbour and influenced by high sediment river outflow, so does not display the water characteristics of clear tropical water.

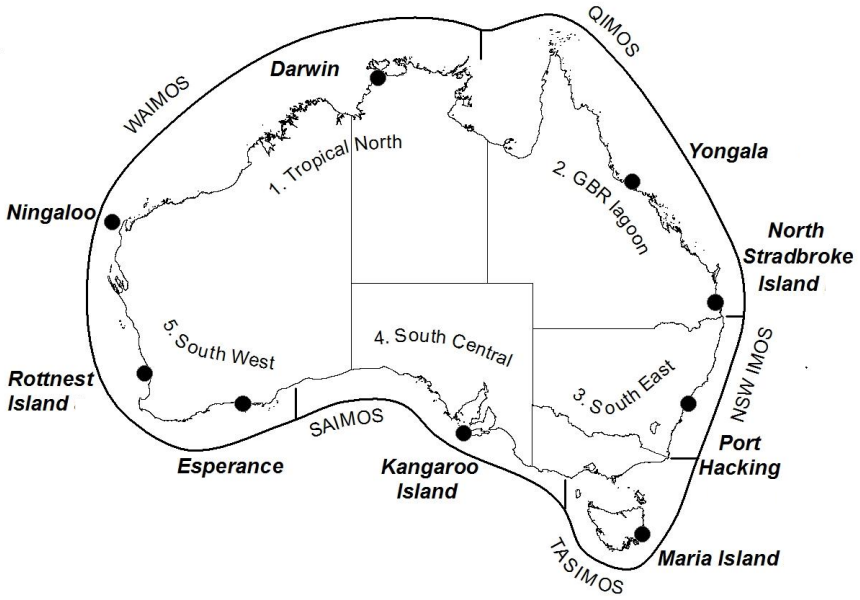

Figure 1. Map of Australia indicating location of IMOS NRS sites.

Since the start of the NRS sites there has been issues with the collection of the TSM blank sample, often resulting in values higher than the corresponding TSM samples. This has in turn caused issues

if the sample TSM value is corrected for the blank, as negative TSM values are then recorded which we know are not correct. From July 2017, we have implemented quite specific instructions and provided filtration equipment for the collection of the blank sample in an effort to make the collection consistent across all sites and potentially reduce the value of the TSM blank to a consistently low value.

Initially (2009-2012), it appears that all sites except Yongala collected just one TSM sample and one blank; Yongala collected duplicate samples and a blank. The 2009 – 2012 results are not analysed in this report, but are available in a separate spreadsheet that accompanies this report.

Around 2012 it was decided that all sites would collect two replicate TSM samples and a blank. From 2009 – July 2017, TSM samples were collected from a "pooled" sample; the pooled sample consisted of one litre samples collected at a number of depths and mixed together (Table 1). Subsamples were taken for the analysis of pigment concentration and composition, TSM, flow cytometry, and phytoplankton identification and cell counts. As the water column depth of each NRS is different the pooled sample was made up of samples from different depths (Table 1). At the beginning of the sampling program (2009), the instruction for the collection of the blank sample was to use filtered seawater. This instruction was ambiguous and it was discovered that the seawater was filtered through different types of filters at the different NRS sites. In some cases, this contributed to unusually high blank weights. Issues with high blank weights continued for several years despite efforts to address the problem.

Table 1: sampling depths which comprise the pooled sample

NRS site	Depths comprising pooled sample (m)
Yongala	0,10,20,26
North Stradbroke Island	0,10,20,30,40,50
Port Hacking	0,10,20,30,40,50
Maria Island	0,10,20,30,40,50
Kangaroo Island	0,10,20,30,40,50
Rottnest Island	0,10,20,30,40,50
Darwin	0, 10,19

From July 2017, based on feedback from end users, several changes were made to the sample collection. The remote sensing community in particular, didn't feel the TSM and pigment results from the pooled sample were meaningful for the validation of satellite retrieved estimates of TSM and Chl-a concentration; they were also concerned that two TSM replicates were not useful when both results differed significantly. Hence from July 2017, the bulk TSM sample has been collected from the surface water and three replicate samples rather than two have been collected. A blank was submitted, but from July 2017, the blank had to be collected following specific guidelines

(http://imos.org.au/facilities/nationalmooringnetwork/moorings-documentation/bgcwatersamplingvideos/).

The intention of this report is to examine the issues around the collection of the TSM samples and a corresponding blank sample. Some of the questions we would like the report and associated data sets to help address are:

1. Are the changes implemented in July 2017 improving the TSM and blank measurement
2. Are there other changes that could be made for further improvement
3. Are the blanks significantly impacting the integrity of the TSM measurement
4. Can TSM data collected previous to July 2017 be used
5. Can TSM data with no associated blanks useful

Methods

The methods used to collect and analyse the TSM samples has not changed since the inception of the NRS program; however, the place through the water column where samples were collected changed in July 2017 from a pooled water sample to a surface sample.

The methods used are based on "The REVAMP Regional Validation of MERIS chlorophyll products in North Sea coastal waters: protocol document" (Tilstone et al 2002) and are described below and can be found in the NRS Biogeochemical Manual

https://s3-ap-southeast-2.amazonaws.com/content.aodn.org.au/Documents/IMOS/Facilities/national_mooring/IMOS_NRS_BGCManual_LATEST.pdf

TSM Filter Preparation

1. Place individual 47 mm GF/F filters on a sheet of aluminium foil and cover with another sheet of foil.
2. Place in muffle furnace and set temperature to 450°C
3. Once the furnace has reached 450°C, leave it at this temperature for approximately 1 hour and then turn the furnace off.
4. When furnace is cool remove filters.
5. Rinse filters in Milli-Q water for 1 hour then remove each filter from the water using forceps and place on a clean numbered glass petri dish which contains 3 small balls of aluminium foil (this is to stop the filter drying and sticking on the glass dish).
6. Place petri dishes on a tray (a shallow cake tin is ideal) cover with a sheet of aluminium foil and place in an oven at 75 °C for approximately 3 hours.
7. Remove from oven and let cool for around 10 minutes.
8. Weigh each filter, record weight on filter log sheet and return to the same petri dish.
9. Return petri dishes to the oven at 75 °C for approximately another 2 hours.
10. Remove, cool and weigh again.
11. Generally after 2 weighings, the filters should have reached constant weight. If there is more than 0.2 mg difference between the first and second weighings, repeat the drying/weighing process.
12. Once the filters have reached constant weight store in the appropriately numbered Millipore Petri-slides until required.

13. On the TSM log sheet record the number of the Petri-slide along with the weight of the filter stored in the Petri-slide.
14. Always do the initial and final post-sampling weighing of the filters on the same balance.

Sample Collection

The surface water is filtered through glass fibre filters to collect three TSS and one blank sample. Use the pre-prepared filters in the Millipore Petri-slides.
The following procedure is performed in triplicate.

1. Shake the carboy and rinse the 2L measuring cylinder with about 50mL of sample.
2. Pour 2L of sample into the measuring cylinder.
3. Using clean stainless steel forceps place one of the numbered TSS 47 mm GF/F filter papers on the filter unit and screw on the funnel.
4. Record the time and filter number on the log sheet.
5. Pour some of the sample onto the filter and start the pump. The volume filtered (1 –4 L) will depend on location - tropical vs. temperate. Swirl the cylinder to make sure no sediment is left on the bottom of the cylinder.
6. Once the sample has finished filtering but before the filter paper is dry, rinse the filter with about 50 mL of MQ water to remove residual salt from the filter paper.
7. Remove the filter from the filter unit, with vacuum still applied, using clean stainless steel forceps and return it to the numbered petri-slide and label with the site name using a marking pen and not sticky labels for example: MAI 2063
8. The above protocols apply for the blank filter which is in a clean filter unit, with the exception that 50 mL of filtered surface water from one of the samples is used and pushed through the 0.22 um syringe filter by syringe onto the blank filter. Vacuum applied and after the 50 mL has been filtered, 50 mL of MQ water is filtered to remove residual salt from the filter paper. The blank filter is removed as described in point 7.
9. As these filters are pre-weighed and pre-treated it is very important that the entire filter is returned. If the edge starts to separate from the rest of the filter, just make sure all pieces of the filter end up in the correctly numbered petri-slide. If this is not possible make a note on the filtering log sheet.
10. Store the filters in a fridge and return to Hobart for analysis as soon as possible as the filters can deteriorate.

The samples should be stored at 4^{o}C and sent to CSIRO Hobart for analysis as soon as possible.

The method for filtering the TSM samples can be found on
http://imos.org.au/facilities/nationalmooringnetwork/moorings-documentation/bgcwatersamplingvideos/

Sample Analysis

1. Place filters in glass petri dishes, each labelled with the same number as that on the petri slide from which each filter came. Each petri dish will contain 3 small balls of aluminium foil on which the filter will sit.
2. Place petri dishes on a tray (cake tin), cover with a sheet of aluminium foil and place in an oven at 75 ^{o}C for approximately 3 hours.
3. Remove from oven and let cool (around 5 minutes).
4. Weigh each filter, record weight on the TSM log sheet against the same number and return the filter to the same petri dish.
5. Return petri dishes to the oven at 75 ^{o}C for approximately another 2 hours.

6. Remove, cool and weigh again.
7. Generally after 2 weighings, the filters should have reached constant weight. If there is more than 0.2 mg difference between the first and second weighings, repeat the drying/weighing process.
8. Determine the TSM weight by subtraction of the pre-filtration weight from the post-filtration weight.
9. Take note of the sample volume that was filtered through the filter.
10. Calculate the weight per volume (TSM).
11. Return filters to glass petri dishes and place petri dishes on the floor of a muffle furnace (note the position of each of the numbered dishes as the numbering on the dishes will be removed during the muffling process).
12. Cover the dishes loosely with a sheet of aluminium foil and program the muffle furnace to 450 °C.
13. After the furnace has reached this temperature, wait 3 hours before programming the temperature of the furnace to 20 °C.
14. When the furnace has reached 20 °C, remove the dishes and filters and weigh immediately.
15. Determine the weight of the inorganic fraction by subtraction of the pre-filtration weight from the post-filtration muffled weight. Calculate the weight per volume (TSM_{inorg}).
16. Determine the weight of the organic fraction by subtraction of the inorganic fraction weight from the total TSM weight. Calculate the weight per volume (TSM_{org}).
17. This analytical procedure is also followed for the "seawater blank" that was carried out at the time the suspended solid sample for the same station was filtered.

Chlorophyll-a

The chlorophyll-a results used in this report are from in situ samples collected from the same bulk water sample as the TSM samples.

Each site is provided with the recommended type of vials – 2mL volume tubes for pigment/HPLC filters. Below is a description of the filtering:

1. Sites will require a 240V heavy duty variable rate vacuum pump with gauges, a catcher vessel (10L bottle or flask or similar) between the pump and the filtration apparatus, and a filtering kit with at least 2 filter holders, of preferably 47 mm diameter. The filtration units supplied hold 4 filtration units of 47 mm diameter, allowing for multiple filtrations to be carried out simultaneously thus minimising processing time during this phase.
2. When using the vacuum pump, the pressure should not exceed 5 inch Hg or approx. 100 mm Hg.
3. Keep a close watch on the level in the catcher vessel - it may need to be emptied before filtering is completed
4. Filter all samples under subdued lighting where possible.

The method for filtering the pigment samples can be found at
http://imos.org.au/facilities/nationalmooringnetwork/moorings-documentation/bgcwatersamplingvideos/

The analysis is done by HPLC and the method can be found in the NRS Biogeochemical Manual on pages 43-45.

https://s3-ap-southeast-2.amazonaws.com/content.aodn.org.au/Documents/IMOS/Facilities/national_mooring/IMOS_NRS_BGCManual_LATEST.pdf

The results used in this report are the sum of the divinyl (DV) and monovinyl (MV) forms of chlorophyll-a.

Results

The examination of results include pre- and post- July 2017, however the pre-July 2017 results only go back to 2012 when duplicate TSM samples were collected at all sites.

For the pre-2017, there are no blank results reported for Maria Island. Since 2012, the CSIRO Bio-analytical Facility has filtered the sample from Maria Island as well as analysed TSM samples from all NRS sites. Due to the issues with high blank values, it was decided not to collect blank samples for the Maria Island site until the issue was resolved. This is the same case for Rottnest Island where no blank samples were collected pre-2017.

For the post-2017 analysis; Kangaroo Island which samples approximately every 3 months did not provide enough data points for the post-July 2017 analysis; Darwin also samples every 3 months, however, every second sampling trip, samples are collected approximately every 6 hours for 24 hours and so provided enough data points for the post-July 2017.

Pre 2017 results

Due to the large amount of data on each plot, the replicate TSM values have been averaged; the full pre-2017 dataset for each of the NRS sites analysed can be found in Appendices 1a, b, c, d and e. Simple plots of the average TSM data with and without corrections for the blank are shown in Figures 2, 3, 4, 5 and 6.

2017/2018 results

To ensure consistency between the pre-July 2017 and the post-July 2017 results, the post-July 2017 replicate TSM values were also averaged; the full post-July 2017 dataset for each of the NRS sites analysed can be found in Appendices 2a, b, c, d, e and f. Simple plots of the average TSM data with and without corrections for the blank are shown in Figures 7, 8, 9, 10, 11 and 12.

In addition to analysing the measured TSS blank and sample weight results, we also investigated potential errors in the weighing of the filters. To do this, 20 prepared filters were weighed on three different days without reference to the results of the previous weighings. Prior to each weighing the filters, were dried for 2 hours at 75 ^{o}C. The results of the weighings are shown in Figure 13 and the full set of results can be found in Appendix 3.

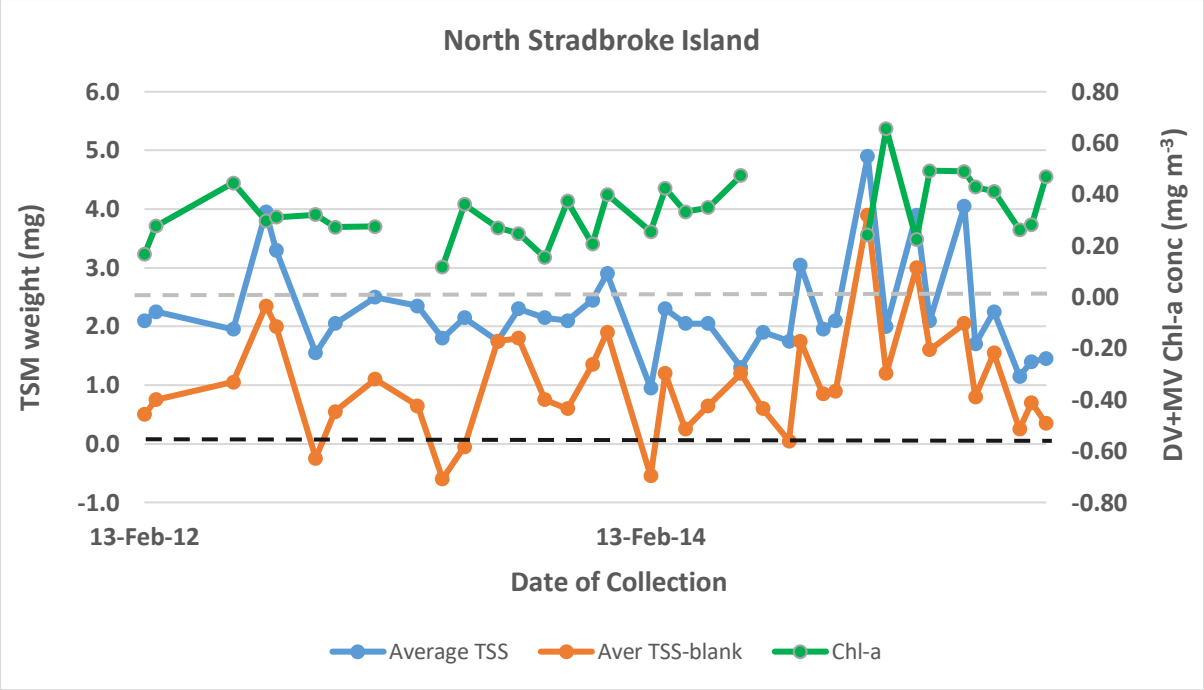

Figure 2. Average pre-July 2017 TSM values with (orange line) and without (blue line) correction for the blank. The green line is the sum of DV and MV Chl-a concentrations. Note the black dotted line indicates the zero weight for TSM and the grey dotted line indicates the zero concentration for Chl-a.

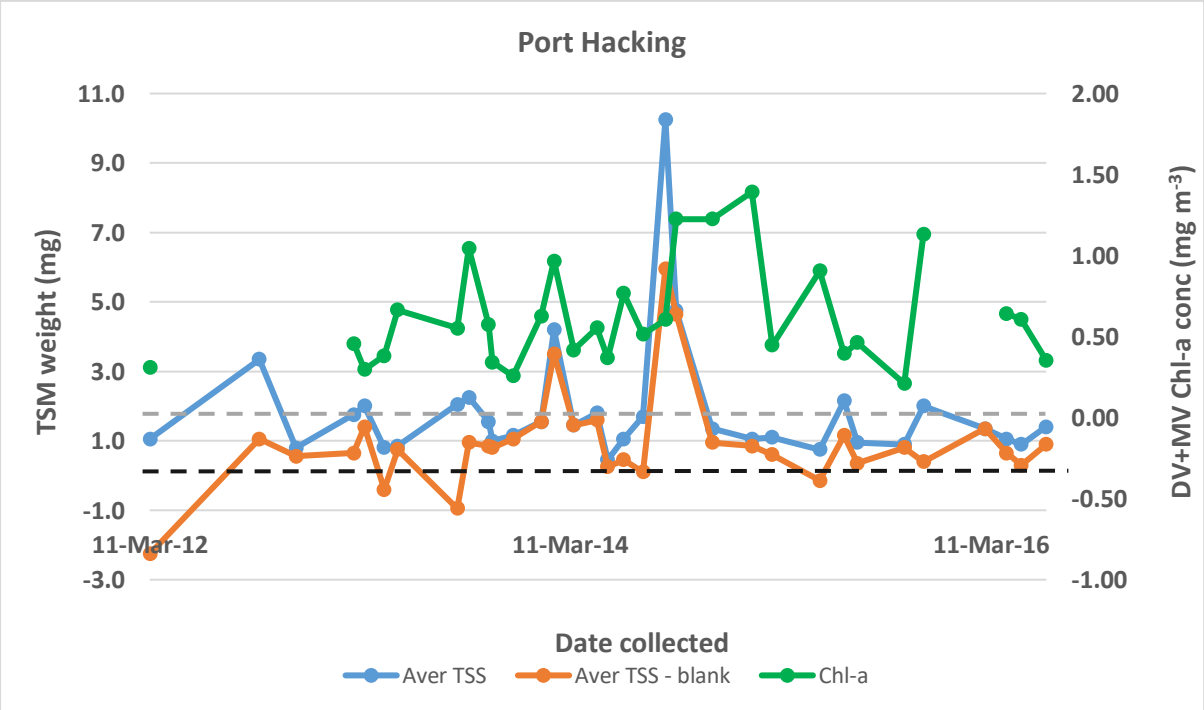

Figure 3. Average pre-July 2017 TSM values with (orange line) and without (blue line) correction for the blank. The green line is the sum of DV and MV Chl-a concentrations. Note the black dotted line indicates the zero weight for TSM and the grey dotted line indicates the zero concentration for Chl-a.

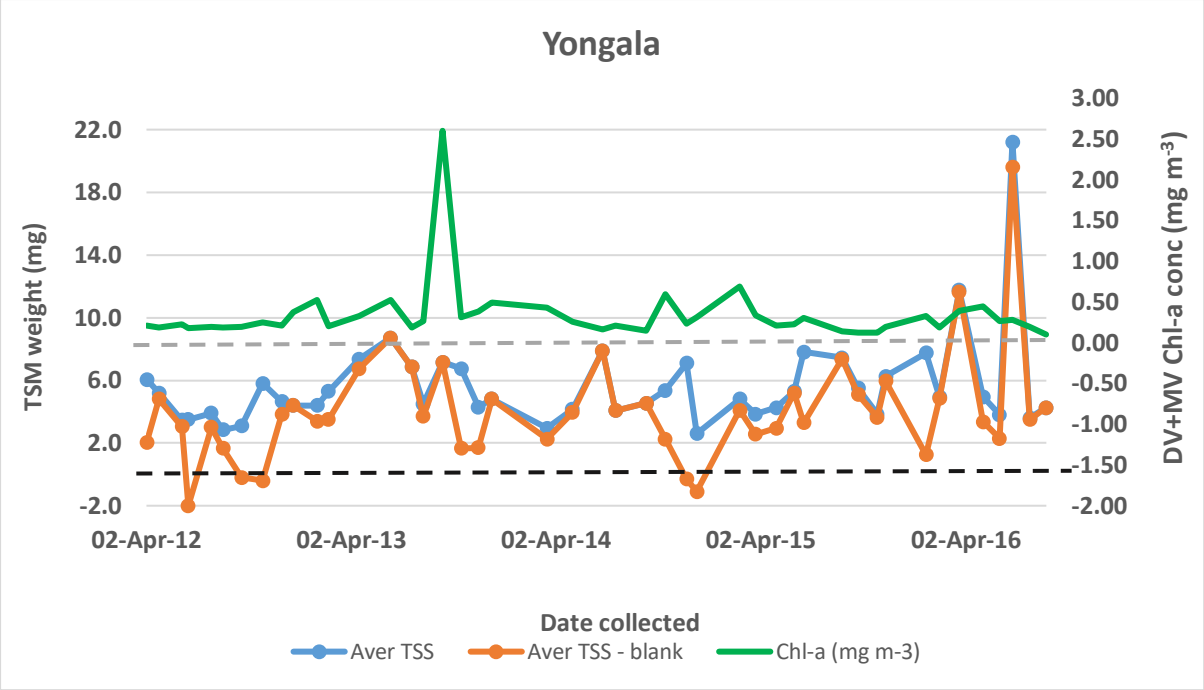

Figure 4. Average pre-July 2017 TSM values with (orange line) and without (blue line) correction for the blank. The green line is the sum of DV and MV Chl-a concentrations. Note the black dotted line indicates the zero weight for TSM and the grey dotted line indicates the zero concentration for Chl-a.

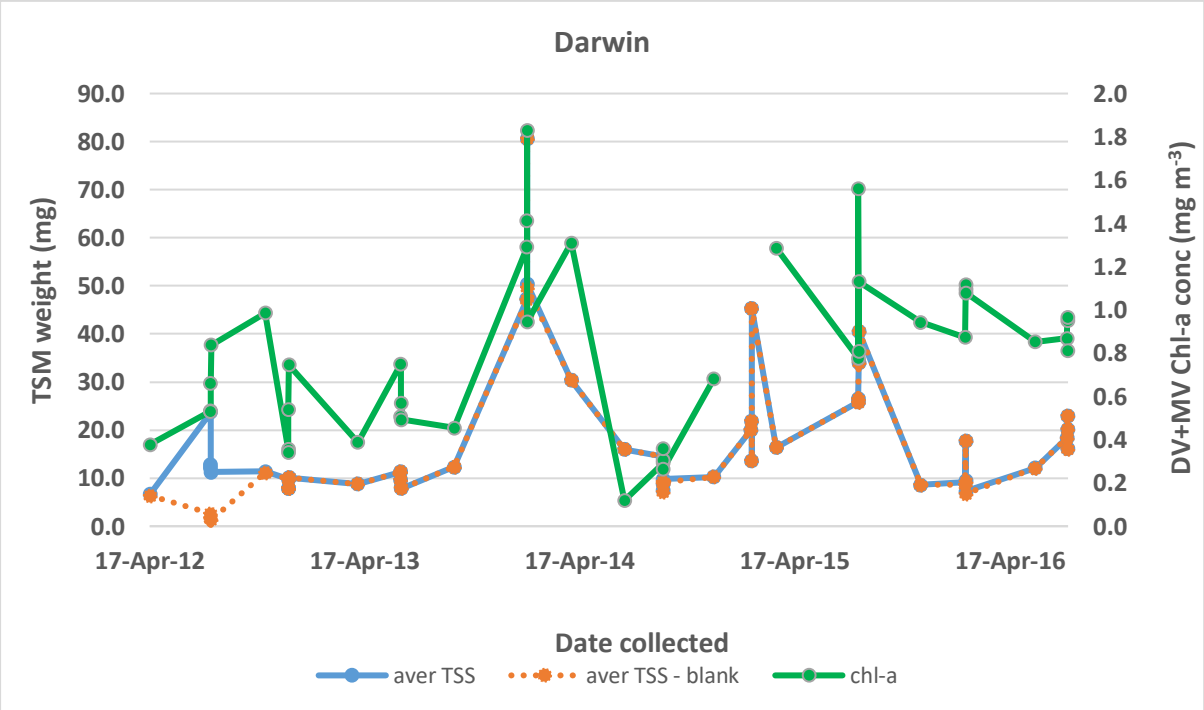

Figure 5. Average pre-July 2017 TSM values with (orange line) and without (blue line) correction for the blank. The green line is the sum of DV and MV Chl-a concentrations.

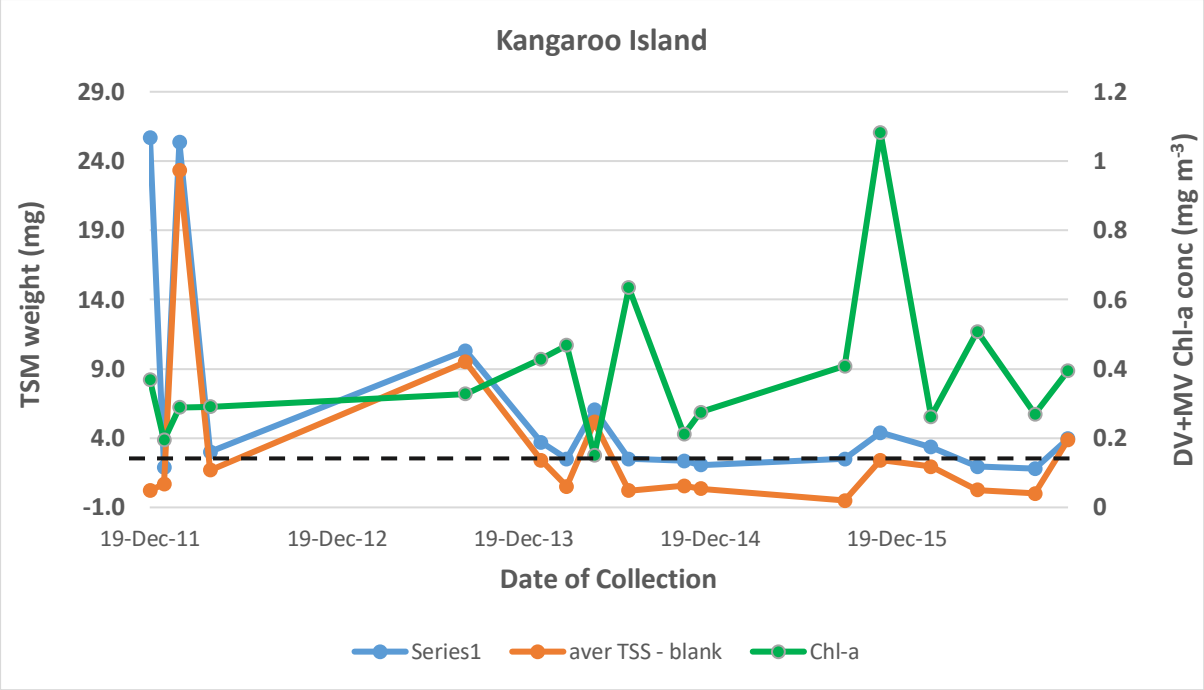

Figure 6. Average pre-July 2017 TSM values with (orange line) and without (blue line) correction for the blank. The green line is the sum of DV and MV Chl-a concentrations. Note the black dotted line indicates the zero weight for TSM.

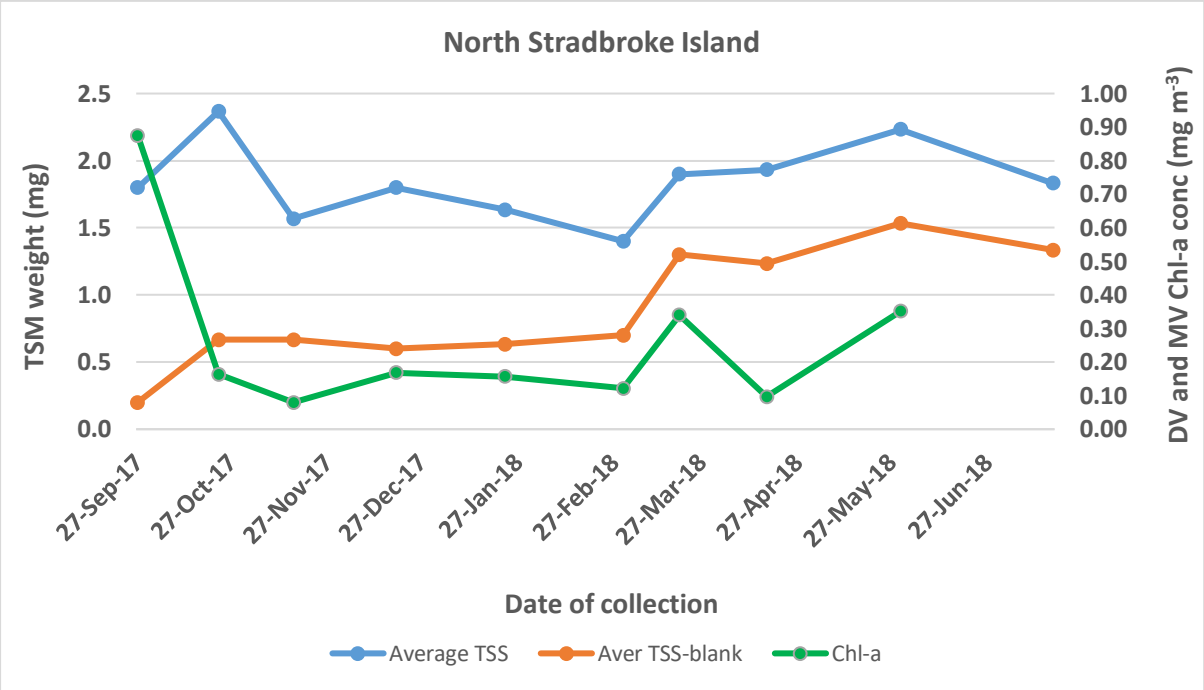

Figure 7. Average post-July 2017 TSM values with (orange line) and without (blue line) correction for the blank. The green line is the sum of DV and MV Chl-a concentrations.

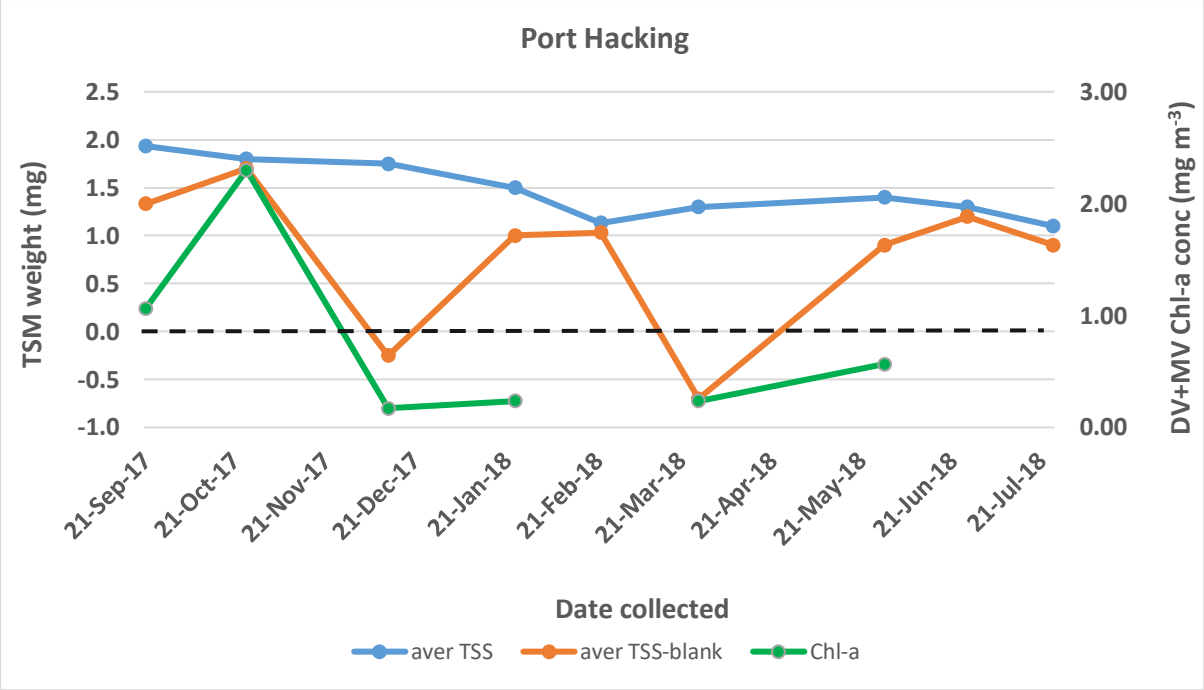

Figure 8. Average post-July 2017 TSM values with (orange line) and without (blue line) correction for the blank. The green line is the sum of DV and MV Chl-a concentrations. Note the black dotted line indicates the zero weight for TSM.

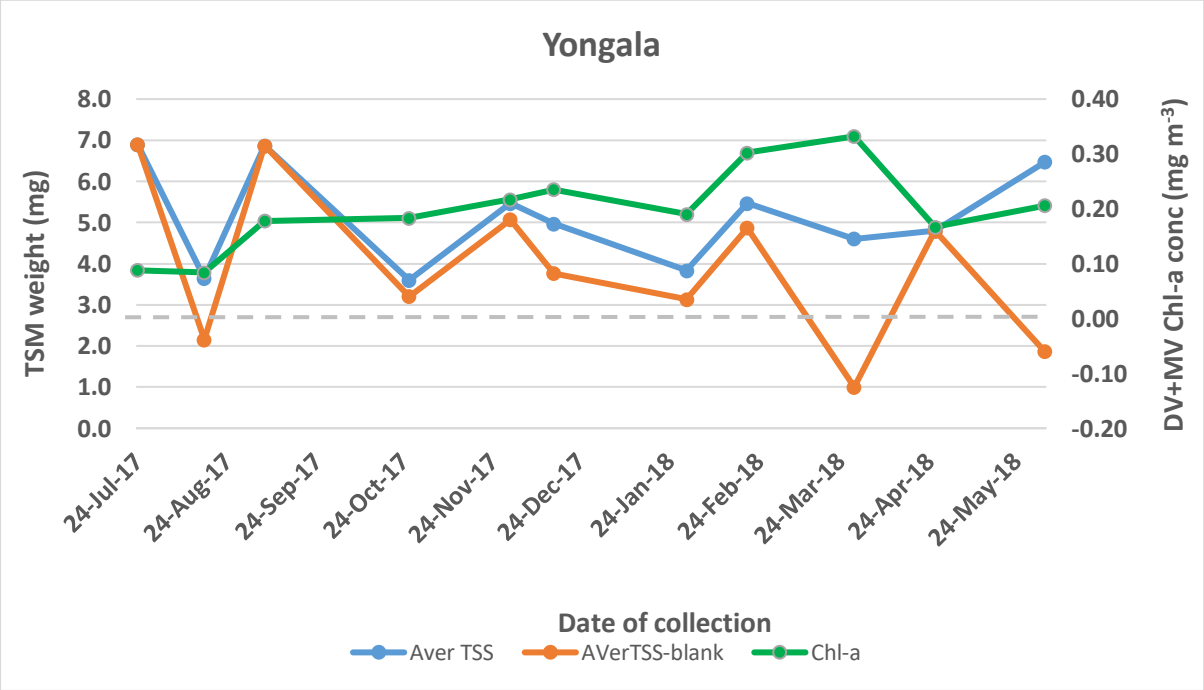

Figure 9. Average post-July 2017 TSM values with (orange line) and without (blue line) correction for the blank. The green line is the sum of DV and MV Chl-a concentrations. Note the grey dotted line indicates the zero concentration for Chl-a.

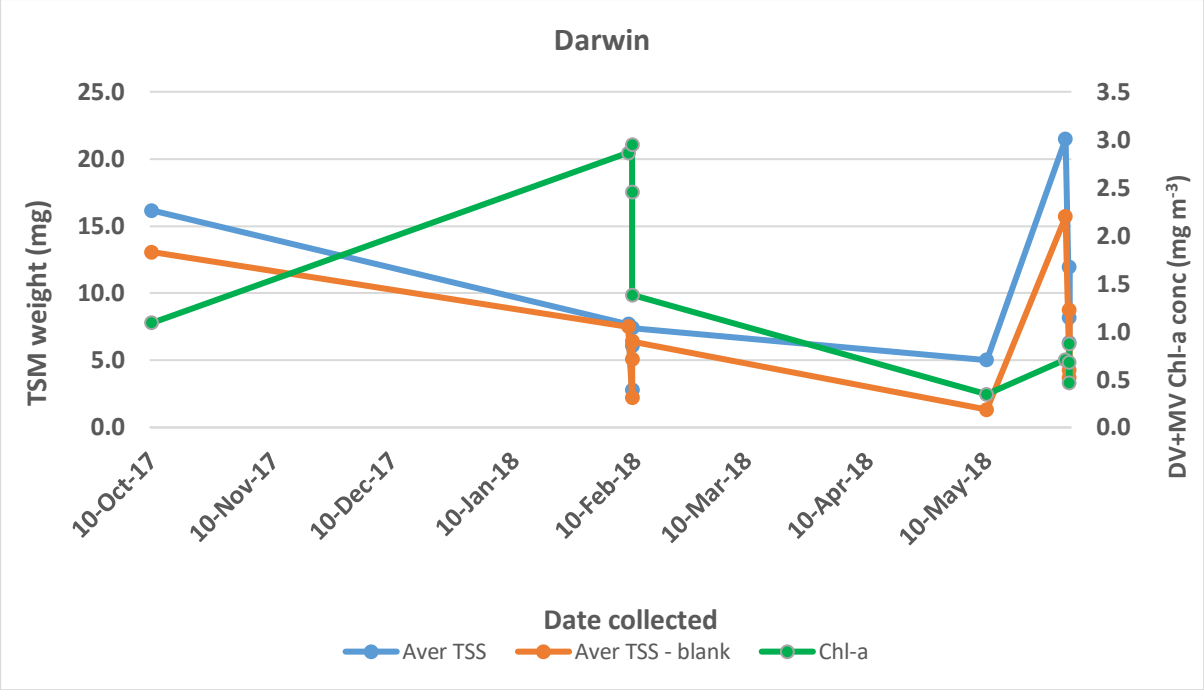

Figure 10. Average post-July 2017 TSM values with (orange line) and without (blue line) correction for the blank. The green line is the sum of DV and MV Chl-a concentrations.

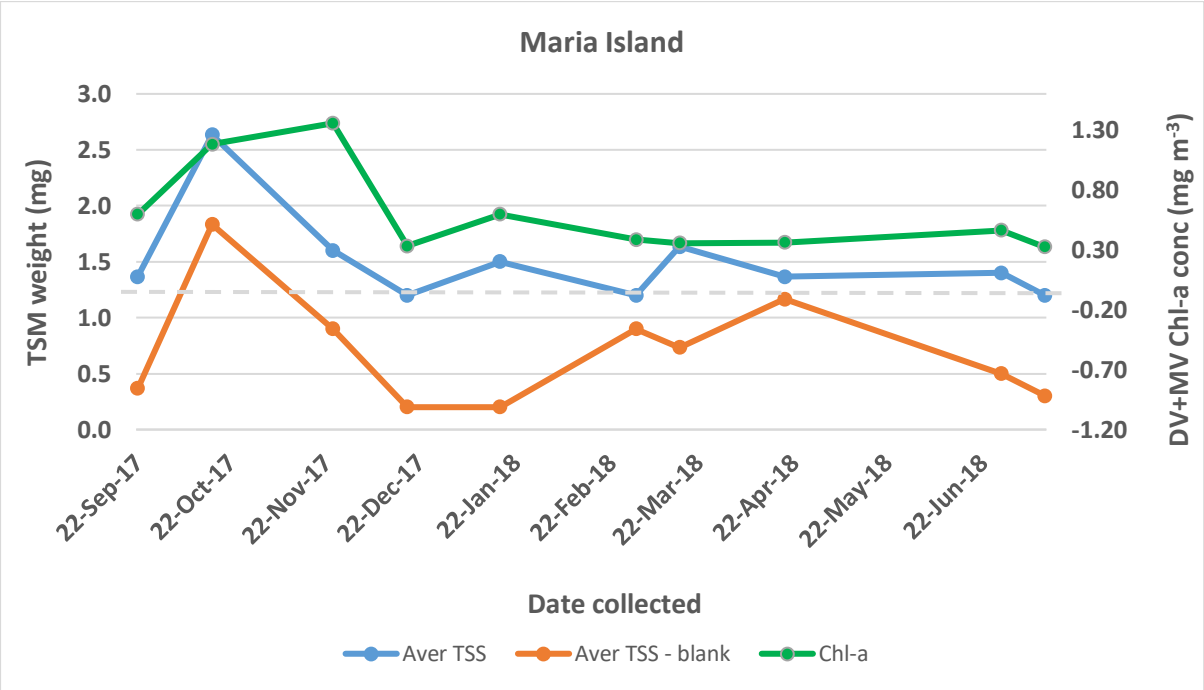

Figure 11. Average post-July 2017 TSM values with (orange line) and without (blue line) correction for the blank. The green line is the sum of DV and MV Chl-a concentrations. Note the grey dotted line indicates the zero concentration for Chl-a.

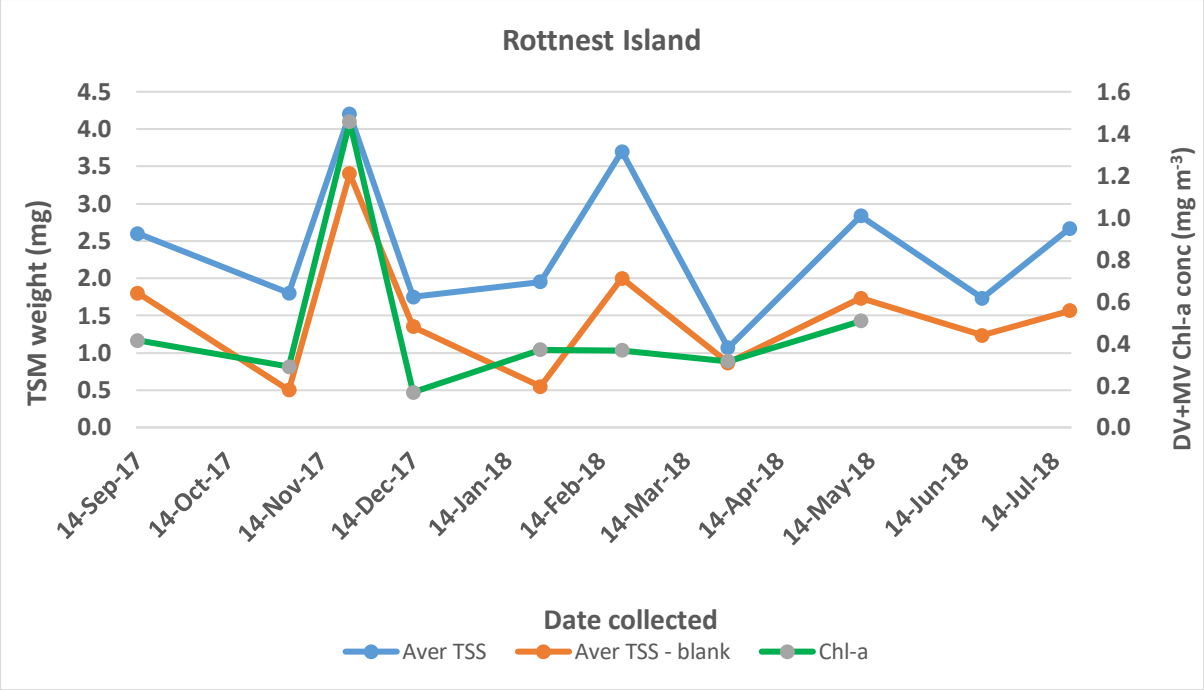

Figure 12. Average post-July 2017 TSM values with (orange line) and without (blue line) correction for the blank. The green line is the sum of DV and MV Chl-a concentrations.

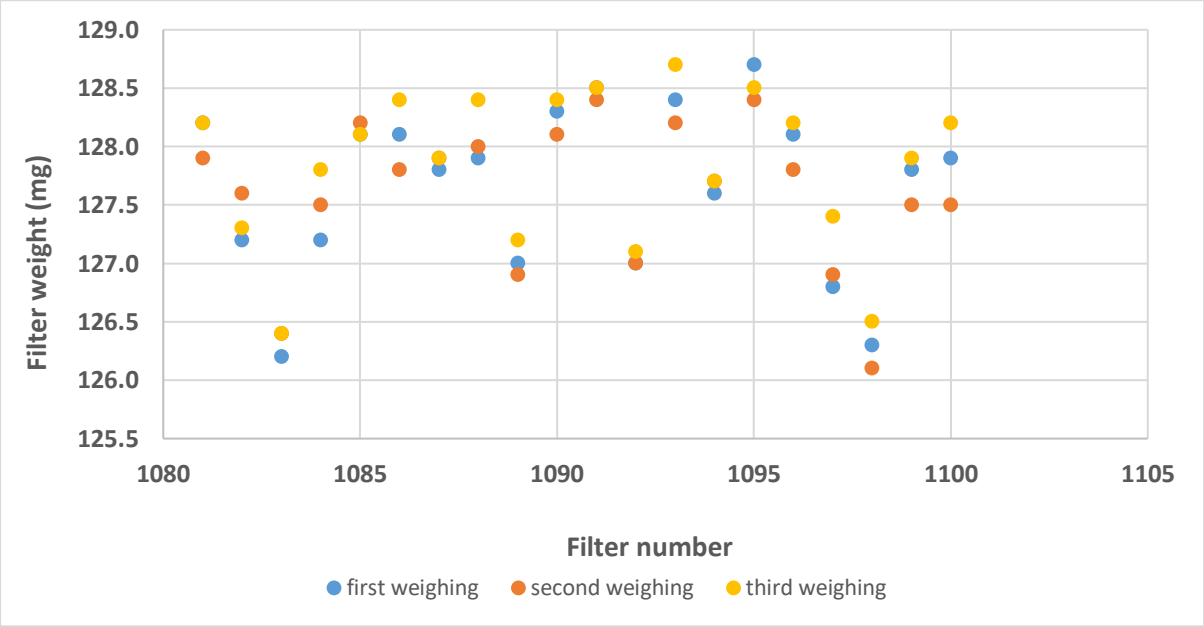

Figure 13. Weights of 20 filters to determine variance in weighing procedure. Where there are only 2 dots for a filter number, 2 of the 3 weights were the same (refer Appendix 3 for full dataset).

Statistical Analysis

The Matlab statistical toolbox was used for the statistical analysis of the data. Because the data were not normally distributed, nonparametric statistical tests were used for checking equality of medians and dispersions (variances) between pre- and post-July 2017 blanks. To test the differences between median values, a two-sided Wilcoxon rank sum test was used and the differences in the variance were tested using the Ansari-Bradley test, which is a non-parametric to the two-sample F-test of equal variances.

Table 2. Statistical analysis of blank filters

Q1 and Q3 are the 25 and 75 percentiles respectively for the data; SD is the standard deviation; N is the number of samples.

Pre- 2017						
	Average (mg)	**Median (mg)**	**Q1 (mg)**	**Q3 (mg)**	**SD (mg)**	**N**
Yongala	1.6	0.7	0.1	2.0	2.0	45
NS Island	1.2	1.3	0.9	1.5	0.5	37
Port Hacking	0.9	0.6	0.2	1.1	1.0	33
Kangaroo Is.	3.0	1.7	1.3	2.0	5.8	17
Darwin	1.3	0.0	0.0	0.3	4.1	46
Maria Island						0
Rottnest Is.						0
Post-2017 – 1 year						
	Average (mg)	**Median (mg)**	**Q1 (mg)**	**Q3 (mg)**	**SD (mg)**	**N**
Yongala	1.2	0.6	0.1	1.4	1.5	11
NS Island	1.0	0.8	0.7	1.2	0.4	10
Port Hacking	0.7	0.5	0.1	1.0	0.8	9
Kangaroo Is.	2.0	1.6	0.9	3.2	1.5	4
Darwin	2.5	2.9	1.0	3.7	1.8	10
Maria Island	0.8	0.9	0.7	1.0	0.3	10
Rottnest Is.	0.9	1.0	0.5	1.3	0.5	10
Pre-2017 and Post 2017 comparison						
	p_{median}	$P_{variance}$				
Yongala	0.6935	0.5217				
NS Island	0.0954	0.5271				
Port Hacking	0.5897	0.7541				
Kangaroo Is.	1.0000	0.1129				
Darwin	**0.0001**	**0.0346**				
All data	0.0690	**0.0004**				

Statistical analysis of the pre- and post-July 2017 blank data (Table 2; Figure 14) indicate that Darwin was the only individual site which showed a significant difference in the median weight of blank

filters pre- and post-July 2017 ($p > 0.05$). The Darwin result was significant due to 4 of the 10 post-July 2017 blank results being high; these 4 results were taken on one day when Darwin collects TSM samples every 6 hours and maybe due to an operator who was not familiar with the blank protocol. However, the low number of samples in general for the post- July 2017 category maybe affecting the overall results. The same applies to the variance results at individual sites.

However, if all data are pooled for both time periods there is a significant difference in variance of blank filter weights ($p < 0.05$; Table 2). The range of blank filter weights as indicated by the 25% and 75% values shown in Figure 14, indicate that the prescribed method to collect blank filters, instigated in July 2017, has considerably reduced the range of blank weights at all sites, except Kangaroo Island and Darwin. These 2 sites are problematic – Kangaroo Island only has 4 samples and Darwin has been discussed above. In general, the small number of observations (n approx. 10) means that caution should be used in making any decisions about the improvement or otherwise of the new sampling protocols for TSM blanks.

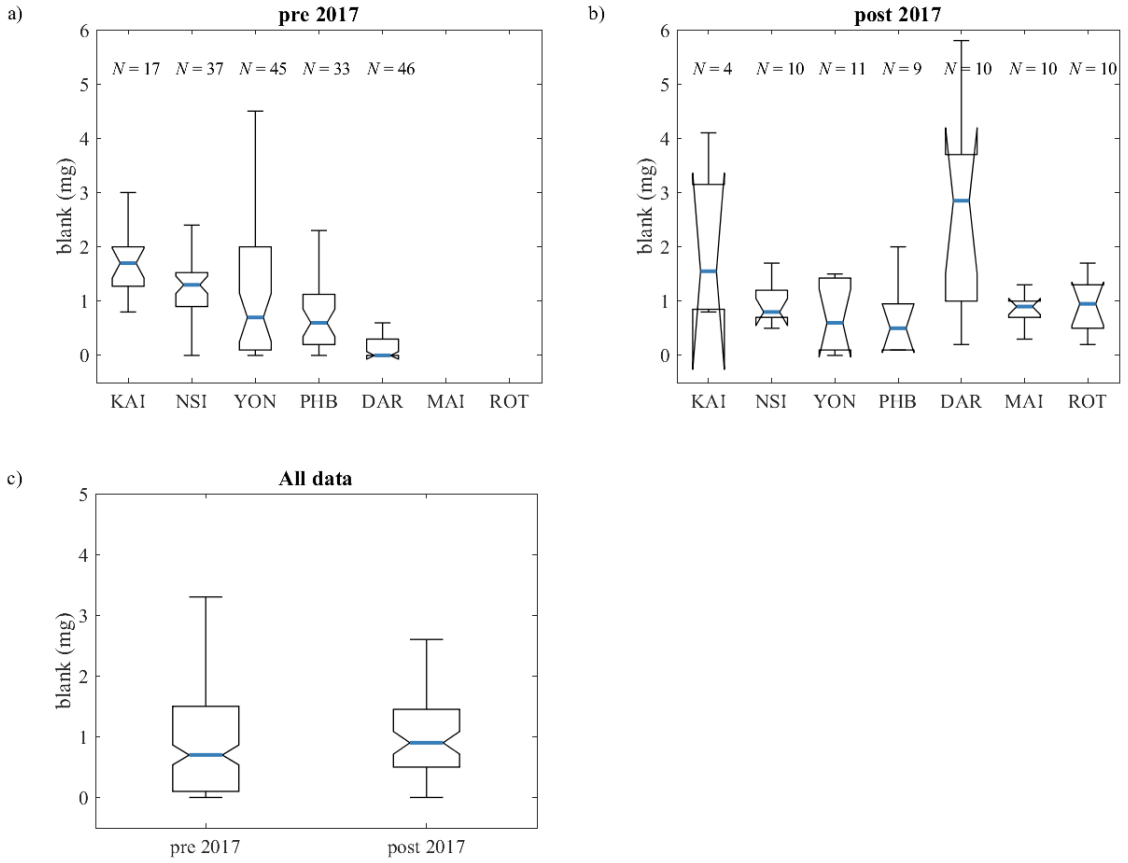

Figure 14. Box and whisker plots for (a) pre- July 2017 and (b) post- July 2017 blank samples at individual sites. (c) combined data from Kangaroo Island (KAI), North Stradbroke Island (NSI), Yongala (Yon), Port Hacking (PHB), Darwin (DAR), Maria Island (MAI) and Rottnest Island (ROT) for both pre- and post- July 2017. The blue line represents the sample median and the edges of the box indicate the 25th and 75th percentiles. The whiskers extend to the minimum and maximum results that are not considered outliers.

Correlation between the TSM and chlorophyll concentrations was also investigated, and provided some interesting results. TSM can be comprised of organic and inorganic components and there is no reason to expect a correlation between TSM and chlorophyll-a (organic component) at any of the sites. The post July 2017 results for Kangaroo Island comprised three data points and should not be considered at this time. At the temperate site, Maria Island, a significant correlation was found between the chlorophyll concentration and the uncorrected TSM weight, post-July 2017, while at Rottnest Island, a significant correlation was found between the chlorophyll concentration and both the uncorrected and corrected TSM weights, post-July 2017 ($p < 0.05$; Table 3). A high r value was observed for the same parameters at the Port Hacking site, but was not significant ($p > 0.05$). Darwin showed interesting results with a significant positive correlation between the chlorophyll concentration and both the uncorrected and corrected TSM weights, pre-July 2017 ($p < 0.05$; Table 3) and a significant negative correlation between the chlorophyll concentration and the uncorrected TSM weight, post-July 2017. Again, these results need to be considered with care as the sample size of the post-July 2017 data sets is small and maybe influencing the outcomes.

Table 3. The r and p values for the correlation between chlorophyll-a concentration and the TSM concentration both with and without correction for the weight of the blank filter ($p < 0.05$).

NRS site	Pre - July 2017				Post - July 2017			
	TSM not corrected		TSM corrected		TSM not corrected		TSM corrected	
	r	***p***	***r***	***p***	***r***	***p***	***r***	***p***
Yongala	0.209	0.168	0.232	0.125	0.012	0.971	-0.309	0.355
NS Island	-0.042	0.824	0.069	0.711	0.227	0.557	-0.301	0.431
Port Hacking	0.200	0.288	0.260	0.165	0.807	0.052	**0.874**	0.023
Kangaroo Is.	-0.075	0.776	-0.149	0.569	-0.813	0.396	-0.983	0.116
Darwin	**0.714**	**0.000**	**0.713**	**0.000**	**-0.635**	**0.049**	-0.425	0.220
Maria Island					**0.667**	**0.035**	0.524	0.120
Rottnest Is.					**0.780**	**0.022**	**0.832**	**0.010**

The independent repeated weighings of 20 blank filters shown in Figure 13, indicate a weighing error of ≤ 0.4 mg; 75% of the range size of the three weighings for each of the filters is ≤ 0.4 mg. In reality the filters are weighed to constant weight, so it could be expected the weighing error to be less than 0.4 mg.

Discussion – comparison with Neukermans et al (2012)

A comprehensive review of TSM measurements has been made by Neukermans et al (2012). The method used in this paper is based on the same method that has been used for the IMOS study – Tilstone eta l (2002), however there are some differences which are listed in Table 4. Addressing the differences; the filter supports are unlikely to make a difference in the TSM measurement. A vacuum of around 120 mm Hg has for many years been generally recommended to minimise cell breakage (Fargion and Mueller, 2000; Roesler et al, 2018). The volume of Milli-q water used in other studies to remove the salt content of the filter has varied from 30 mL – 300 mL as described in Neukermans et al (2012) and each study has suggested through testing that the volume of Milli-q water used is sufficient to remove the salt. Of more importance is the decision by IMOS not to rinse the filter edge

as is done in the Neukerman et al (2012) study. When the IMOS program began in 2008/09, each site was supplied with a set of Millipore Sterifil filtration units which have a 47 mm polypropylene filter support. With these filtration units the filter edge is very thin as shown in Figure 15a, b and c. As the edge is very thin, the amount of salt retained in this area was considered to be negligible and the risk of losing particulate matter during an edge rinsing process was considered to be very high, hence the decision not to rinse. The fourth filter shown in Figure 15d has been collected using a different filtration unit and in this case, the edge of the filter could and should be rinsed. This filter is from the Darwin site which has very high TSM values (pre- July 2017 range 6 - 51 mg/L), so the retention of salt in the filter edge would have contributed negligible weight compared to the particulate matter weight in the final TSM result.

Table 4. Methodological differences between the Neukermans et al (2012) method and the IMOS method

Neukerman et al method	IMOS method
Fritted glass filter supports	Plastic filter supports
Filtering vacuum – 300-400 mm Hg	Filtering vacuum – 120 - 130 mm Hg
Salt removal – 400-450 mL Milli-q water	Salt removal – 50 mL Milli-q water
Filter edge washed with Milli-q water	Filter edge not usually washed
Filter stored at -20°C till analysis (months)	Filter stored at 4°C till analysis (usually days)
Dried 24 hours at 75°C, weighed	Dried 6 hours at 75°C, weighed, dried 2-3 hours at 75°C, weighed – constant weight

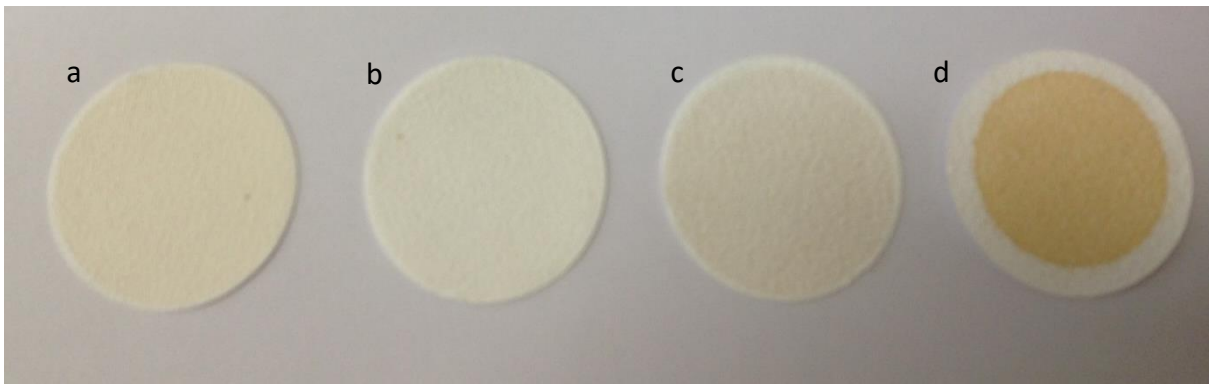

Figure 15. Photo of filter from (a) Port hacking, (b) Maria Island, (c) Kangaroo Island and (d) Darwin

Conclusions

The trial that has taken place since July 2017 was to discover whether the blank filter weights could be improved and hence the overall TSM value. A decrease in the range of blank weights at most sites has been observed, but the number of observations is small (n=10) and so care needs to be taken in taking this result as a definite improvement. Extending the trial period for at least another 12 months should indicate whether the current observed trend is accurate.

Two excel spreadsheets with the raw data accompany this report

1. 2009-2012 TSS results.xlsx
2. pre and post July 2017 IMOS TSS results.xlsx

Addendum

A further 12 months of blank measurements has been analysed. The following results should be compared to Table 2 and Figure 14. Generally, the mean blank weights for 2 years post 2017 are lower than those observed pre-2017, but only for NSI was the difference statistically significant.

Table 2 revised. Statistical analysis of blank filters

Q1 and Q3 are the 25 and 75 percentiles respectively for the data; SD is the standard deviation; N is the number of samples.

Pre- 2017						
	Average (mg)	**Median (mg)**	**Q1 (mg)**	**Q3 (mg)**	**SD (mg)**	**N**
Yongala	1.6	0.7	0.1	2.0	2.0	45
NS Island	1.2	1.3	0.9	1.5	0.5	37
Port Hacking	0.9	0.6	0.2	1.1	1.0	33
Kangaroo Is.	3.0	1.7	1.3	2.0	5.8	17
Darwin	1.3	0.0	0.0	0.3	4.1	46
Maria Island						0
Rottnest Is.						0
Post-2017 – 2 year						
	Average (mg)	**Median (mg)**	**Q1 (mg)**	**Q3 (mg)**	**SD (mg)**	**N**
Yongala	1.0	0.5	0.1	1.5	1.2	23
NS Island	0.9	0.8	0.5	1.1	0.5	18
Port Hacking	0.6	0.5	0.2	0.8	0.6	16
Kangaroo Is.	1.9	1.5	0.9	2.7	1.4	5
Darwin	2.9	3.2	1.0	3.9	1.7	16
Maria Island	0.9	0.9	0.8	1.1	0.4	16
Rottnest Is.	0.9	0.8	0.6	1.1	0.5	20
Pre-2017 and Post 2017 (2 years) comparison						
	p_{median}	$P_{variance}$				
Yongala	0.4576	0.3138				
NS Island	0.0142	0.3864				
Port Hacking	0.6296	0.3448				
Kangaroo Is.	0.9374	0.3729				
Darwin	**0.0000**	0.0904				
All data	0.0625	**0.0001**				

Adding a second year of blank measurements has not provided a definitive answer that is statistically significant for all sites. NSI was the only site which showed a statistical difference between pre-July 2017 and post-July 2017 (2 years) data. While all sites, except Darwin, showed improved or steady average, median and 75 percentile values, Darwin's values for the same parameters increased indicating the filtering of blanks had not improved over the 12 months from July 2018 to July 2019. If all samples from all sites over the 2 years are considered the median has stayed about the same as that for 1 year of samples, but the variability has reduced ($P_{variance}$ for 1 year = 0.0004 compared to for 2 years = 0.0001.

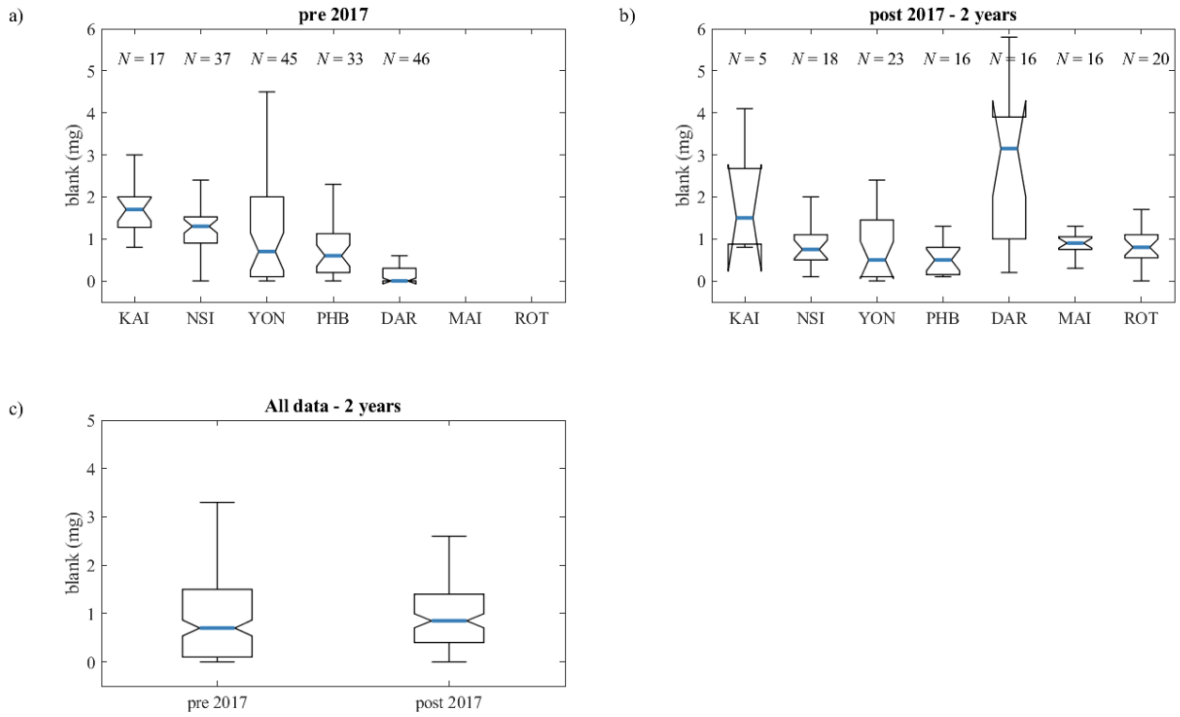

Figure 14 revised. Box and whisker plots for (a) pre- July 2017 and (b) post- July 2017 – 2years blank samples at individual sites. (c) combined data from Kangaroo Island (KAI), North Stradbroke Island (NSI), Yongala (Yon), Port Hacking (PHB), Darwin (DAR), Maria Island (MAI) and Rottnest Island (ROT) for both pre- and post- July 2017. The blue line represents the sample median and the edges of the box indicate the 25th and 75th percentiles. The whiskers extend to the minimum and maximum results that are not considered outliers.

In addition to analysing a second year of data, triplicate blank samples were collected for six months during the sample processing from the MAI site only, to determine the variability associated with the blank samples. The results are shown in Table 5. Of the 18 blank filters only one had a weight greater than 1 mg and the average weight and standard deviation calculated from all 18 filters was 0.7 $\pm$ 0.3 mg. Two different operators made the measurements and no operator effect was observed in the results. The results show that if the blank is consistently filtered in a careful and repeatable way, the variability in the blank measurement can be quite low. This test could be implemented at other sites to determine average blank values and or operator effects for each site.

Table 5. Triplicate blank measurements collected with the MAI samples.

	Weight (mg)					
Date	**Blank 1**	**Blank 2**	**Blank 3**	**Average**	**Std Dev.**	**Operator**
25-Sep-19	0.7	0.3	0.6	0.5	0.2	EB
16-Oct-19	0.9	0.8	0.5	0.7	0.2	EB
22-Nov-19	0.6	0.8	0.7	0.7	0.1	EB
11-Dec-19	0.9	0.6	1.0	0.8	0.2	BW
07-Jan-20	0.7	0.6	0.5	0.6	0.1	BW
24-Feb-20	1.6	0.5	0.6	0.9	0.6	EB

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Appendix 1a

Pre 2017 results for North Stradbroke Island

	Weight (mg)			mg m^{-3}
Date	Blank	TSM 1	TSM 2	Chl-a
13-Feb-12	1.6	1.9	2.3	0.168
29-Feb-12	1.5	1.9	2.6	0.276
20-Jun-12	0.9	1.9	2.9	0.445
06-Aug-12	1.6	2.4	5.5	0.298
21-Aug-12	1.3	2.9	3.7	0.311
17-Oct-12	1.8	1.5	1.6	0.321
14-Nov-12	1.5	1.6	2.5	0.272
11-Jan-13	1.4	2.4	2.6	0.275
13-Mar-13	1.7	2.3	2.4	
18-Apr-13	2.4	1.5	2.1	0.118
20-May-13	2.2	2.2	2.1	0.361
07-Jul-13	0.0	1.7	1.8	0.270
06-Aug-13	0.5	1.9	2.7	0.248
13-Sep-13	1.4	2.1	2.2	0.154
16-Oct-13	1.5	2.1	2.1	0.374
21-Nov-13	1.1	2.3	2.6	0.207
12-Dec-13	1.0	2.4	3.4	0.400
13-Feb-14	1.5	0.9	1.0	0.255
06-Mar-14	1.1	2.2	2.4	0.424
04-Apr-14	1.8	1.7	2.4	0.332
07-May-14	1.4	2.0	2.1	0.349
23-Jun-14	0.1	0.8	1.8	0.473
25-Jul-14	1.3	1.7	2.1	
01-Sep-14	1.7	1.6	1.9	
17-Sep-14	1.3	2.5	3.6	
20-Oct-14	1.1	1.9	2.0	
07-Nov-14	1.2	2.1	2.1	
23-Dec-14	1.0	2.5	7.3	0.241
19-Jan-15	0.8	1.7	2.3	0.657
04-Mar-15	0.9	1.8	6.0	0.224
23-Mar-15	0.5	1.6	2.6	0.492
12-May-15	2.0	1.3	6.8	0.490
28-May-15	0.9	1.6	1.8	0.429
24-Jun-15	0.7	2.2	2.3	0.412
31-Jul-15	0.9	1.0	1.3	0.262
17-Aug-15	0.7	1.3	1.5	0.281
07-Sep-15	1.1	1.0	1.9	0.469

Appendix 1b

Pre 2017 results for Port Hacking

	Weight (mg)			mg m^{-3}
Date	Blank	TSM 1	TSM 2	Chl-a
11-Mar-12	3.3	0.9	1.2	0.308
17-Sep-12	2.3	3.2	3.5	
20-Nov-12	0.2	0.3	1.3	
28-Feb-13	1.1	2.9	0.6	0.457
19-Mar-13	0.6	2.1	1.9	0.298
15-May-13	0.1	0.8	0.9	0.665
22-Apr-13	1.2	0.7	0.9	0.382
27-Aug-13	3.0	3.0	1.1	0.551
16-Sep-13	1.3	2.3	2.2	1.045
20-Oct-13	0.7	1.1	2.0	0.574
27-Oct-13	0.2	0.8	1.2	0.343
02-Dec-13	0.1	1.2	1.1	0.257
20-Jan-14	0.0	2.0	1.1	0.627
11-Feb-14	0.7	3.9	4.5	0.967
17-Mar-14	0.0	1.8	1.1	0.418
27-Apr-14	0.2	1.2	2.4	0.554
15-May-14	0.2	0.6	0.3	0.368
12-Jun-14	0.6	0.7	1.4	0.768
16-Jul-14	1.6	1.8	1.6	0.515
24-Aug-14	4.3	12.6	7.9	0.605
11-Sep-14	0.1	7.0	2.5	1.226
13-Nov-14	0.4	1.0	1.7	1.225
21-Jan-15	0.2	0.9	1.2	1.392
25-Feb-15	0.5	1.2	1.0	0.448
19-May-15	0.9	0.7	0.8	0.906
30-Jun-15	1.0	2.3	2.0	0.395
23-Jul-15	0.6	0.9	1.0	0.462
13-Oct-15	0.1	0.6	1.2	0.210
15-Nov-15	1.6	2.1	1.9	1.131
01-Mar-16	0.0	1.0	1.7	
07-Apr-16	0.4	0.8	1.3	0.642
03-May-16	0.9	0.7	1.1	0.606
15-Jun-16	0.5	1.5	1.3	0.354

Appendix 1c

Pre 2017 results for Yongala

	Weight (mg)			mg m^{-3}
Date	Blank	TSM 1	TSM 2	Chl-a
02-Apr-12	4.0	6.0	6.1	0.214
24-Apr-12	0.4	4.6	5.8	0.186
04-Jun-12	0.4	3.4	3.5	0.224
15-Jun-12	5.5	3.4	3.6	0.179
26-Jul-12	0.9	4.4	3.4	0.196
16-Aug-12	1.2	3.2	2.5	0.187
18-Sep-12	3.3	3.2	3.0	0.195
26-Oct-12	6.2	5.8	5.8	0.252
29-Nov-12	0.8	4.2	5.1	0.210
19-Dec-12	0.0	5.4	3.4	0.373
31-Jan-13	1.0	4.4	4.4	0.523
20-Feb-13	1.8	5.1	5.5	0.205
16-Apr-13	0.6	7.6	7.1	0.329
11-Jun-13	0.0	9.0	8.4	0.526
19-Jul-13	0.0	5.6	8.1	0.187
08-Aug-13	0.8	4.9	4.1	0.263
12-Sep-13	0.0	7.6	6.7	2.601
15-Oct-13	5.1	7.2	6.3	0.310
14-Nov-13	2.6	4.4	4.2	0.384
08-Dec-13	0.0	5.5	4.1	0.490
17-Mar-14	0.7	2.8	3.1	0.434
01-May-14	0.2	1.6	6.7	0.255
24-Jun-14	0.0	6.5	9.3	0.162
17-Jul-14	0.0	3.9	4.3	0.207
10-Sep-14	0.0	4.8	4.3	0.147
14-Oct-14	3.1	4.9	5.8	0.597
21-Nov-14	7.4	6.7	7.5	0.232
09-Dec-14	3.7	3.4	1.8	0.309
24-Feb-15	0.7	5.9	3.7	0.686
24-Mar-15	1.3	3.8	3.9	0.335
30-Apr-15	1.3	4.1	4.4	0.211
01-Jun-15	0.1	5.5	5.1	0.229
18-Jun-15	4.5	7.6	8.0	0.303
25-Aug-15	0.1	8.3	6.6	0.140
23-Sep-15	5.5	4.4	6.6	0.124
27-Oct-15	0.2	3.4	4.3	0.127
11-Nov-15	0.3	6.2	6.3	0.195
22-Jan-16	6.5	7.6	7.9	0.327
15-Feb-16	0.1	6.2	3.7	0.190
21-Mar-16	0.1	19.5	4.0	0.390

03-May-16	1.6	5.4	4.5	0.444
01-Jun-16	1.5	4.3	3.3	0.264
24-Jun-16	1.6	21.7	20.7	0.285
25-Jul-16	0.1	3.7	3.5	0.193
23-Aug-16	0.0	4.2	4.3	0.101

Appendix 1d

Pre 2017 results for Darwin

	Weight (mg)			mg m^{-3}
Date	**Blank**	**TSM 1**	**TSM 2**	**Chl-a**
17-Apr-12	0.3	6.4	6.9	0.378
29-Jul-12a	21.1	22.5	24.9	0.533
29-Jul-12b	13.0	13.5	10.7	0.530
29-Jul-12c	11.1	12.6	13.0	0.662
30-Jul-12	9.9	11.0	11.5	0.838
30-Oct-12	0.3	11.1	11.7	0.985
08-Dec-12a	0.0	9.0	10.6	0.355
08-Dec-12b	0.0	8.0	7.7	0.340
08-Dec-12c	0.0	7.7	8.2	0.539
09-Dec-12	0.0	10.9	9.4	0.746
05-Apr-13	0.0	9.0	8.6	0.388
17-Jun-13a	0.0	12.6	10.1	0.750
17-Jun-13b	0.0	10.2	9.0	0.507
18-Jun-13a	0.1	7.4	8.8	0.569
18-Jun-13b	0.0	7.4	8.3	0.493
17-Jan-14a	0.2	46.6	47.9	1.290
17-Jan-14b	0.3	44.7	43.5	1.414
18-Jan-14a	0.0	66.9	94.2	1.831
18-Jan-14b	0.8	49.4	51.4	0.944
03-Apr-14	0.0	30.2	30.6	1.309
02-Jul-14	0.0	16.1	15.9	0.119
06-Sep-14a	0.1	16.6	12.5	0.293
06-Sep-14b	0.4	7.0	7.9	0.306
06-Sep-14c	0.0	8.6	9.0	0.360
06-Sep-14d	0.6	10.8	8.8	0.265
01-Dec-14	0.0	9.4	11.1	0.682
02-Feb-15	0.0	20.2	19.9	
03-Feb-15a	0.0	21.7	22.1	
03-Feb-15b	0.0	13.5	13.7	
03-Feb-15c	0.0	43.7	47.0	
17-Mar-15	0.0	21.5	11.3	1.286

03-Aug-15a	0.1	26.4	25.3	0.777
03-Aug-15b	0.1	23.8	29.3	1.561
04-Aug-15a	0.0	35.4	32.6	0.809
04-Aug-15b	0.0	39.7	41.4	1.130
17-Nov-15	0.0	8.4	8.8	0.942
01-Feb-16	0.5	9.6	8.6	0.873
02-Feb-16a	0.0	19.1	16.5	1.097
02-Feb-16b	0.2	9.6	9.3	1.118
02-Feb-16c	0.5	7.2	7.3	1.079
30-May-16	0.1	12.2	12.1	0.853
23-Jul-16	0.1	18.3	18.5	0.868
24-Jul-16a	0.0	18.2	22.2	0.951
24-Jul-16b	0.0	27.9	18.1	0.965
24-Jul-16c	0.0	15.4	16.9	0.813

Appendix 1e

Pre 2017 results for Kangaroo Island

	Weight (mg)			mg m^{-3}
Date	**Blank**	**TSM 1**	**TSM 2**	**Chl-a**
19-Dec-11	25.5	27.5	23.9	0.368
16-Jan-12	1.2	1.7	2.1	0.194
15-Feb-12	2.0	24.5	26.2	0.289
27-Aug-13	0.8	10.5	10.1	0.328
22-Jan-14	1.3	2.2	5.2	0.428
13-Mar-14	2.0	2.5	2.5	0.468
07-May-14	0.9	4.7	7.4	0.151
13-Jul-14	2.3	2.9	2.1	0.634
29-Oct-14	1.8	2.5	2.2	0.211
01-Dec-14	1.7	1.9	2.2	0.275
09-Sep-15	3.0	2.5	2.5	0.408
17-Nov-15	2.0	4.5	4.3	1.082
24-Feb-16	1.4	2.7	4	0.262
25-May-16	1.7	1.8	2.1	0.508
15-Sep-16	1.8	1.6	2	0.269
18-Nov-16	0.1	3.8	4.1	0.394

Appendix 2a

Post 2017 results for North Stradbroke Island

	Weight (mg)				mg m^{-3}
Date	Blank	TSM 1	TSM 2	TSM 3	Chl-a
27-Sep-17	1.6	1.9	1.9	1.6	0.88
23-Oct-17	1.7	3.8	1.4	1.9	0.16
16-Nov-17	0.9	1.5	1.7	1.5	0.08
19-Dec-17	1.2	1.7	1.8	1.9	0.17
23-Jan-18	1.0	1.6	2.0	1.3	0.16
02-Mar-18	0.7	0.9	1.8	1.5	0.12
20-Mar-18	0.6	1.2	2.2	2.3	0.34
17-Apr-18	0.7	1.6	1.6	2.6	0.10
30-May-18	0.7	2.7	2.1	1.9	0.35
18-Jul-18	0.5	2.4	1.5	1.6	0.46
17-Aug-18	1.1	1.5	1.9	2.0	0.66
13-Sep-18	1.0	1.8	2.4	3.0	0.26
23-Oct-18	0.4	1.9	2.2	1.6	0.23
15-Nov-18	0.1	3.3	2.0	1.3	0.27
18-Jan-19	0.4	1.3	1.6	1.4	0.22
22-Mar-19	2.0	2.2	1.8	2.8	0.63
16-Apr-19	0.8	4.2	1.7	1.3	0.18
27-May-19	0.4	2.0	1.4	2.0	0.41
18-Jun-19	1.0	2.1	2.4	2.5	0.55

Appendix 2b

Post 2017 results for Port Hacking

	Weight (mg)				mg m^{-3}
Date	Blank	TSM 1	TSM 2	TSM 3	Chl-a
21-Sep-17	0.6	1.9	1.9	2.0	1.06
25-Oct-17	0.1	1.6	2.0		2.30
12-Dec-17	2.0	1.6	1.9		0.17
24-Jan-18	0.5	1.2	1.0	2.3	0.24
22-Feb-18	0.1	1.0	1.2	1.2	SL
27-Mar-18	2.0	0.6	0.9	2.4	0.24
29-May-18	0.5	1.3	1.3	1.6	0.57
26-Jun-18	0.1	1.4	1.4	1.1	0.49
25-Jul-18	0.2	1.6	0.8	0.9	1.08
05-Sep-18	1.3	1.0	1.3	1.5	4.47
27-Sep-18	0.2	1.3	1.8	1.4	1.14
20-Nov-18	0.4	0.7	0.5	1.4	1.08
19-Dec-18	0.6	2.3	2.4	2.2	0.75

21-Jan-19	0.1	1.8	2.3	2.6	0.36
27-Feb-19	0.5	2.4	1.2	2.7	0.13
08-Apr-19	1.0	1.2	1.4	1.7	0.31
22-May-19	1.3	0.9	1.2	1.0	0.44
26-Jun-19	0.5	0.9	1.0	1.2	0.49

Appendix 2c

Post 2017 results for Yongala

	Weight (mg)				mg m^{-3}
Date	**Blank**	**TSM 1**	**TSM 2**	**TSM 3**	**Chl-a**
24-Jul-17	0.0	7.5	6.3		0.09
16-Aug-17	1.5	4.4	2.9		0.08
06-Sep-17	0.0	5.6	7.1	7.9	0.18
26-Oct-17	0.4	3.9	3.7	3.2	0.18
30-Nov-17	0.4	5.6	5.4	5.4	0.22
15-Dec-17	1.2	4.0	4.2	6.7	0.24
30-Jan-18	0.7	4.3	3.7	3.5	0.19
20-Feb-18	0.6	4.7	5.0	6.7	0.30
29-Mar-18	3.6	3.9	4.5	5.4	0.33
26-Apr-18	0.0	4.0	5.5	4.9	0.17
03-Jun-18	4.6	5.8	7.4	6.2	0.21
21-Jun-18	0.1	5.7	3.4	4.1	0.28
20-Jul-18	0.5	3.2	3.7	5.0	0.12
17-Aug-18	1.3	2.9	4.4	3.2	0.15
27-Sep-18	0.0	3.2	3.9	3.5	0.14
11-Oct-18	0.2	3.2	2.7	4.4	0.25
23-Nov-18	1.8	3.3	2.8	2.9	
13-Dec-18	2.4	5.6	5.5	5.1	0.55
24-Jan-19	0.0	4.6	6.1	5.1	0.15
13-Feb-19	1.8	5.2	5.9	6.4	1.05
13-Mar-19	0.5	6.6	7.9	6.6	0.20
07-May-19	0.2	4.4	4.3	5.0	0.25
28-May-19	0.1	3.5	4.0	3.6	0.33

Appendix 2d

Post 2017 results for Darwin

	Weight (mg)				mg m^{-3}
Date	**Blank**	**TSM 1**	**TSM 2**	**TSM 3**	**Chl-a**
10-Oct-17	3.1	11.2	23.1	14.2	1.09
08-Feb-18_2130	0.2	7.7	8.3	7.1	2.86
09-Feb-18_0030	0.6	2.8	2.6	3.0	2.95
09-Feb-18_0330	1.0	7.8	2.7	7.7	2.45
09-Feb-18_0630	1.0	7.7	6.9	7.6	1.38
10-May-18	3.7	5.6	5.1	4.4	0.35
30-Jul-18_2130	5.8	12.5	25.6	26.4	0.71
31-Jul-18_0030	3.9	8.3	7.0	9.2	0.68
31-Jul-18_0330	3.2	9.0	16.7	10.1	0.47
31-Jul-18_0630	2.6	6.5	6.0	6.4	0.88
30-Oct-18	3.8	6.5	8.0	8.8	0.85
13-Feb-19_2130	0.8	5.3	5.4	5.1	0.62
14-Feb-19_0030	5.0	8.2	7.1	8.8	0.93
14-Feb-19_0330	4.6	9.9	10.1	9.2	1.06
14-Feb-19_0630	3.1	8.7	5.3	7.2	1.15
29-May-19	3.9	3.8	3.4	3.7	0.48

Appendix 2e

Post 2017 results for Maria Island

	Weight (mg)				mg m^{-3}
Date	**Blank**	**TSM 1**	**TSM 2**	**TSM 3**	**Chl-a**
22-Sep-17	1.0	1.3	1.2	1.6	0.59
16-Oct-17	0.8	2.5	2.9	2.5	1.18
24-Nov-17	0.7	1.9	1.4	1.5	1.36
18-Dec-17	1.0	1.1	1.0	1.5	0.33
17-Jan-18	1.3	1.5	1.6	1.4	0.60
02-Mar-18	0.3	0.9	1.7	1.	0.38
16-Mar-18	0.9	1.6	2.2	1.1	0.36
19-Apr-18	0.2	1.4	1.3	1.4	0.36
28-Jun-18	0.9	1.2	1.5	1.5	0.46

12-Jul-18	0.9	1.4	1.1	1.1	0.32
19-Sep-18	1.1	1.7	1.4	1.9	0.54
18-Oct-18	1.2	2.8	2.2	2.2	1.05
04-Dec-18	0.9	1.8	1.8	1.8	0.47
06-Jan-19	1.6	1.7	2.0	1.3	0.42
20-Mar-19	1.0	1.1	1.7	1.2	0.26
30-Apr-19	0.5	1.2	1.3	1.6	0.70
24-Jun-19	0.8	1.2	1.0	1.1	0.35

Appendix 2f

Post 2017 results for Rottnest Island

	Weight (mg)				mg m^{-3}
Date	**Blank**	**TSM 1**	**TSM 2**	**TSM 3**	**Chl-a**
14-Sep-17	0.8	2.6	2.6		0.41
03-Nov-17	1.3	1.7	1.9		0.29
23-Nov-17	0.8	3.1	5.3		1.46
25-Jan-18	1.4	1.8	2.1		0.37
21-Feb-18	1.7	5.7	1.7		0.37
28-Mar-18	0.2	1.4	0.7	1.1	0.31
11-May-18	1.1	3.4	2.7	2.4	0.51
20-Jun-18	0.5	1.8	1.6	1.8	0.52
19-Jul-18	1.1	2.0	3.7	2.3	0.54
27-Jul-18	0.6	4.2	4.2	5.1	0.43
31-Aug-18	0.7	3.2	3.1	3.1	0.61
21-Sep-18	0.6	1.8	1.7	4.8	0.54
24-Oct-18	2.1	2.0	2.3	2.5	0.25
30-Nov-18	0.7	1.8	0.9	2.1	0.19
11-Dec-18	0.2	2.9	2.2	2.5	0.15
25-Jan-19	0.0	1.7	1.6	1.3	0.15
06-Mar-19	0.9	2.2	1.5	1.6	0.60
07-May-19	1.0	1.5	1.3	1.6	0.27
27-May-19	1.0	1.9	1.8	1.9	0.23
21-Jun-19	0.6	1.9	2.2	0.4	0.33

Appendix 3

Repeated weights of prepared filters

Filter number	First weight 30 Jan 2018	Second weight 01 Feb 2018	Third weight 06 Feb 2018	Mean	SD	Range size
1081	128.2	127.9	128.2	128.1	0.2	0.3
1082	127.2	127.6	127.3	127.4	0.2	0.4
1083	126.2	126.4	126.4	126.3	0.1	0.2
1084	127.2	127.5	127.8	127.5	0.3	0.6
1085	128.1	128.2	128.1	128.1	0.1	0.1
1086	128.1	127.8	128.4	128.1	0.3	0.1
1087	127.8	127.9	127.9	127.9	0.1	0.5
1088	127.9	128.0	128.4	128.1	0.3	0.5
1089	127.0	126.9	127.2	127.0	0.2	0.3
1090	128.3	128.1	128.4	128.3	0.2	0.3
1091	128.5	128.4	128.5	128.5	0.1	0.1
1092	127.0	127.0	127.1	127.0	0.1	0.1
1093	128.4	128.2	128.7	128.4	0.3	0.5
1094	127.6	127.7	127.7	127.7	0.1	0.1
1095	128.7	128.4	128.5	128.5	0.2	0.3
1096	128.1	127.8	128.2	128.0	0.2	0.4
1097	126.8	126.9	127.4	127.0	0.3	0.6
1098	126.3	126.1	126.5	126.3	0.2	0.4
1099	127.8	127.5	127.9	127.7	0.2	0.4
1100	127.9	127.5	128.2	127.9	0.4	0.3