Great Barrier Reef Catchment Loads Monitoring Program

Report Summary 2015–2016

The Great Barrier Reef Catchment Loads Monitoring Program is a large-scale water quality monitoring program conducted along the east coast of Queensland. It provides measures of annual loads (mass) of total suspended solids and nutrients (nitrogen and phosphorus) from 14 priority basins that discharge to the Great Barrier Reef. For 12 of these priority basins annual pesticide loads and summed annual toxic loads of pesticides are also described. This program is part of the Reef Water Quality Protection Plan (Reef Plan), and the Paddock to Reef Integrated Monitoring, Modelling and Reporting Program (Paddock to Reef Program). It also provides loads data to validate and calibrate catchment models, which assist in evaluating progress towards the water quality targets of Reef Plan. This summary outlines the monitored loads data for 2015–2016.

Australian Government

Queensland Government

Monitoring sites

Thirty-five basins along the east coast of Queensland flow into the reef lagoon. A total of 26 sites were monitored within 14 of these basins (Figure 1). These consist of 17 end-of-catchment[1] sites and nine nested sub-catchment sites that were monitored for total suspended solids and nutrients. A subset of 15 end-of-catchment sites and two nested sub-catchment sites across 12 basins were monitored for pesticides, including the five photosystem II inhibiting pesticides, ametryn, atrazine, diuron, hexazinone and tebuthiuron.

Rainfall

Total rainfall was average to very much below average in the monitored catchments of the Wet Tropics, Burdekin, Fitzroy and Burnett Mary regions (Figure 2). The monitored catchments in the Mackay Whitsunday region received average rainfall whereas the monitored catchments in the Cape York region received average to above average rainfall during the monitoring year.

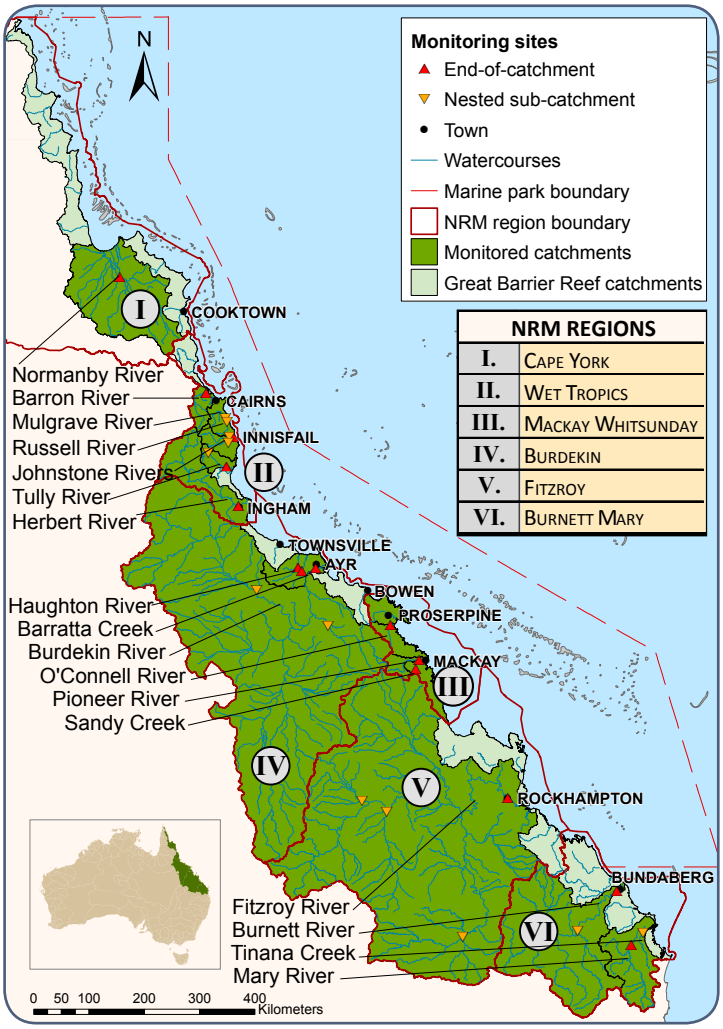


Figure 1 Natural resource management regions, catchments and sites monitored in 2015–2016.

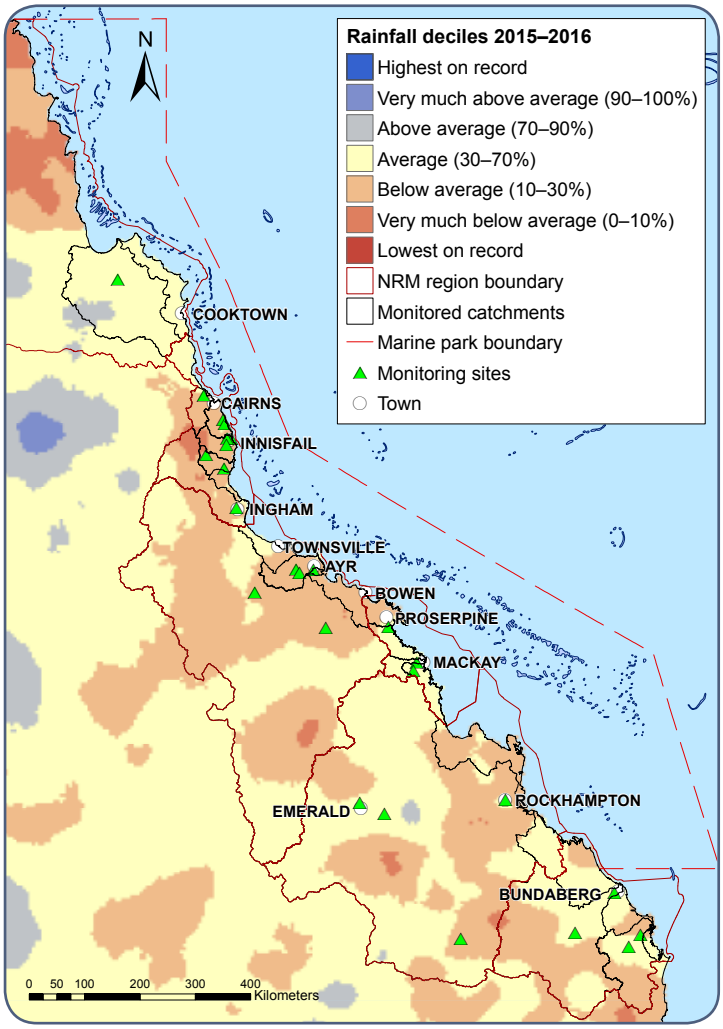


Figure 2 Queensland 2015–2016 rainfall deciles with respect to long-term mean rainfall.

1 End-of-catchment sites are defined as sites located at the lowest point in a river or creek where the volume of water passing that point can be accurately measured.

River discharge

During the 2015–2016 monitoring year, annual river discharge in all monitored catchments was less than the long-term average.

In the Normanby, Mulgrave, Russell, Johnstone and Tully catchments, annual discharge was between 61 per cent and 89 per cent of the long-term average. In the Sandy and Pioneer catchments, the proportion of annual discharge to average long-term discharge was 55 and 57 per cent, respectively. In all other monitored catchments, the annual discharge was less than half the long-term average.

Annual discharge in the Mary (24 per cent), Barron (24 per cent), Burdekin (18 per cent) and O'Connell (8 per cent) catchments was very low compared to the long-term average.

Total suspended solids

The combined monitored annual load of total suspended solids during the 2015–2016 monitoring year was 1800 kt (Figure 4). The main contributing catchments were the Burdekin (700 kt) and Fitzroy (670 kt) catchments which generated 39 per cent and 37 per cent of the combined monitored total suspended solids load, respectively. The remaining catchments contributed less than 25 per cent of the combined monitored annual total suspended solids load. The lowest monitored annual total suspended solids load during the 2015–2016 monitoring year was in Tinana Creek catchment (0.17 kt).

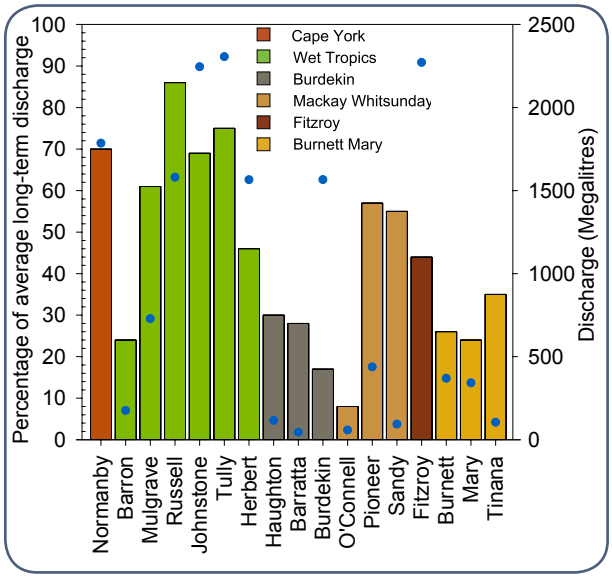


Figure 3 Percentage of average long-term discharge (bars) and annual discharge (blue dots) for 2015–2016. Natural resource management regions are grouped by colour.

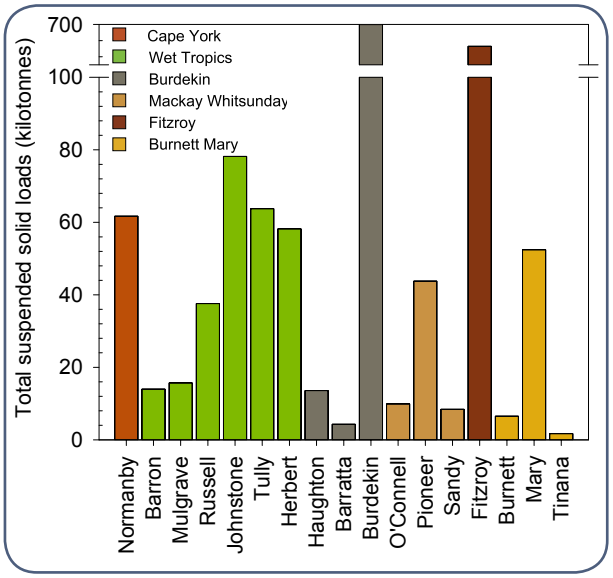
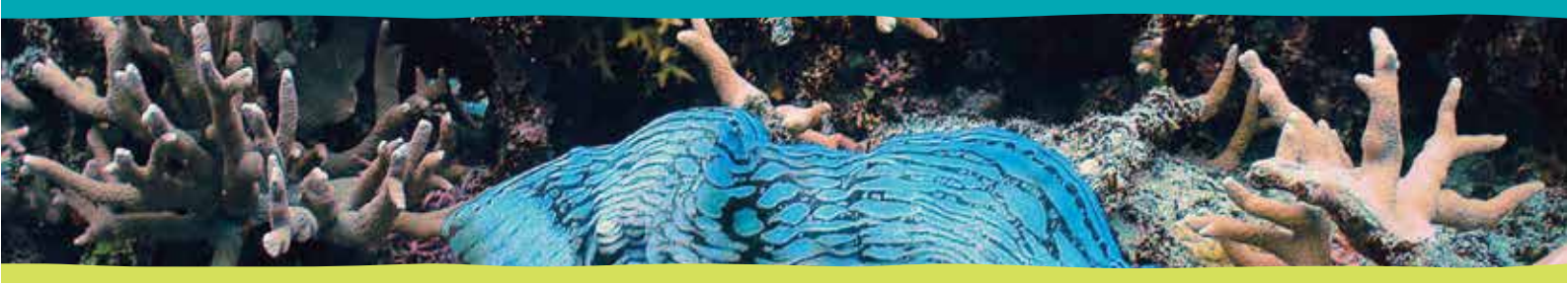


Figure 4 Annual monitored total suspended solids loads for 2015–2016. Natural resource management regions are grouped by colour.

Image: Queensland Department of Science, Information Technology and Innovation



Nitrogen

The combined monitored annual load of total nitrogen was 11,000 t. Thirty per cent of the total monitored nitrogen load was derived from the Fitzroy (3300 t) catchment with moderate loads also monitored in the Burdekin (1500 t), Tully (1100 t), Normanby (910 t) and Herbert (840 t) catchments (Figure 5).

The combined monitored annual load of dissolved inorganic nitrogen was 2900 t (Figure 5), which accounted for 26 per cent of the monitored annual total nitrogen load. The largest monitored annual load of dissolved inorganic nitrogen was in the Fitzroy catchment (680 t) with moderate loads in the Tully (510 t), Russell (310 t), Burdekin (280 t), Herbert (270 t) and Johnstone (260 t) catchments.

The combined monitored annual load of particulate nitrogen was 4100 t (Figure 5). The largest monitored annual loads of particulate nitrogen during the 2015–2016 monitoring year were derived from the Fitzroy (1600 t), Burdekin (540 t) and Johnstone (300 t) catchments. The remaining catchments each contributed less than seven per cent of the combined monitored load.

Image: Great Barrier Reef Marine Park Authority

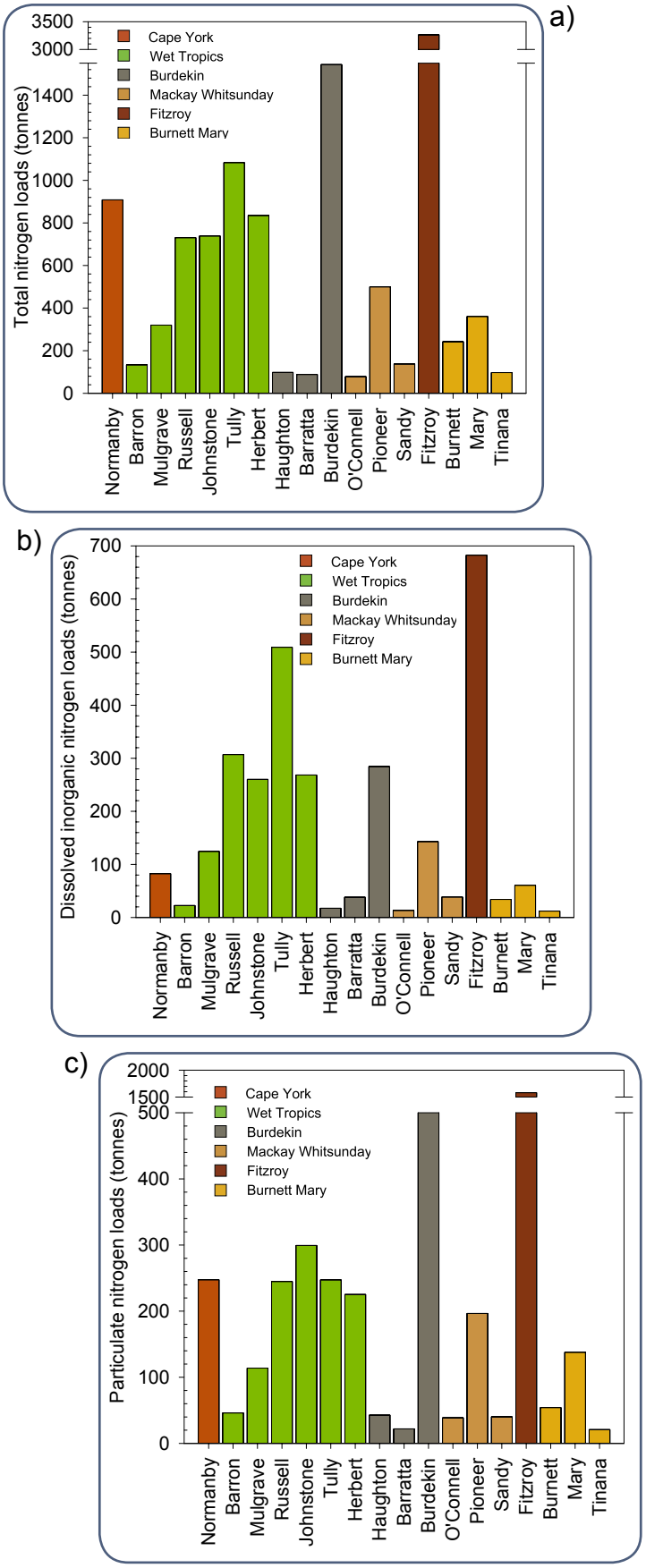
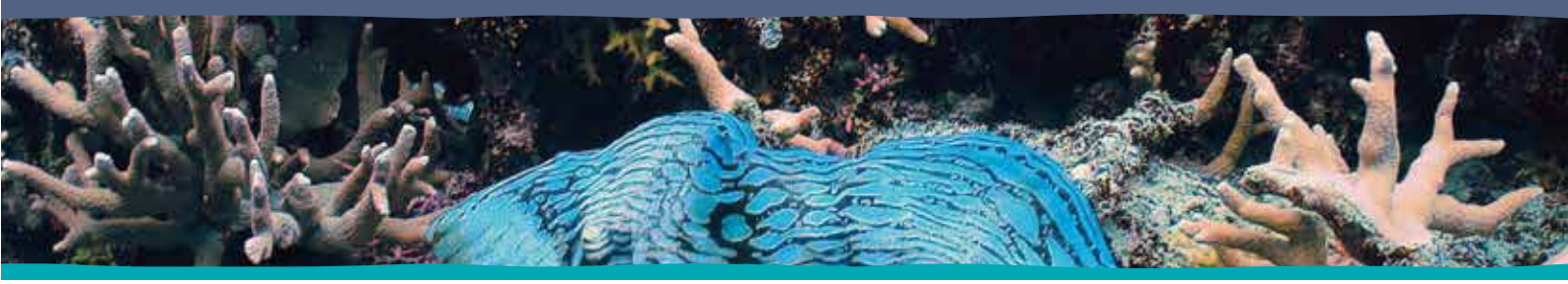


Figure 5 Annual monitored total nitrogen (a), dissolved inorganic nitrogen (b) and particulate nitrogen (c) loads for 2015–2016. Natural Resource Management regions are grouped by colour.



Phosphorus

The combined monitored annual load of total phosphorus was 2300 t (Figure 6) with the largest contributor being the Fitzroy (910 t) catchment. Moderate loads were also delivered by the Burdekin (460 t), Johnstone (210 t) and Normanby (120 t) catchments. All remaining catchments contributed less than five per cent of the combined monitored annual load of total phosphorus.

The combined monitored annual load of particulate phosphorus was 1600 t, which accounted for 71 per cent of the total phosphorus monitored annual load. The largest monitored annual loads of particulate phosphorus were derived from the Fitzroy (750 t), Burdekin (250 t), Johnstone (130 t) and Normanby (95 t) catchments. The remaining catchments each produced less than five per cent of the combined monitored annual load of particulate phosphorus.

Tully River at Euramo. Image: Queensland Department of Science, Information Technology and Innovation

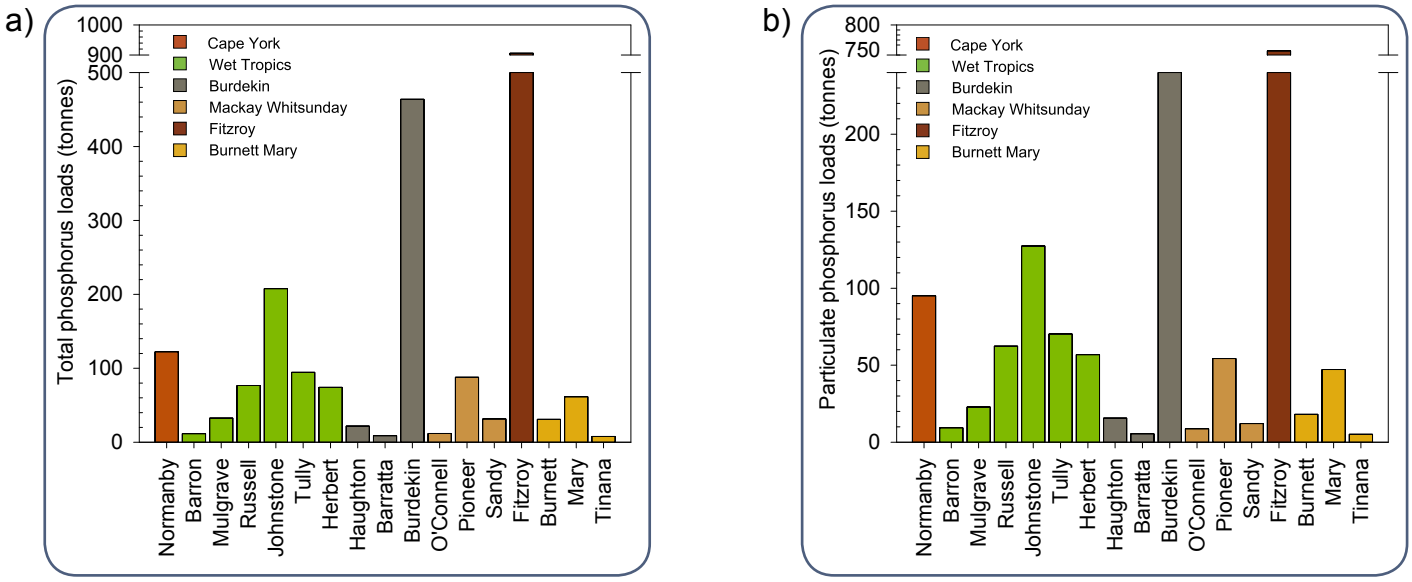
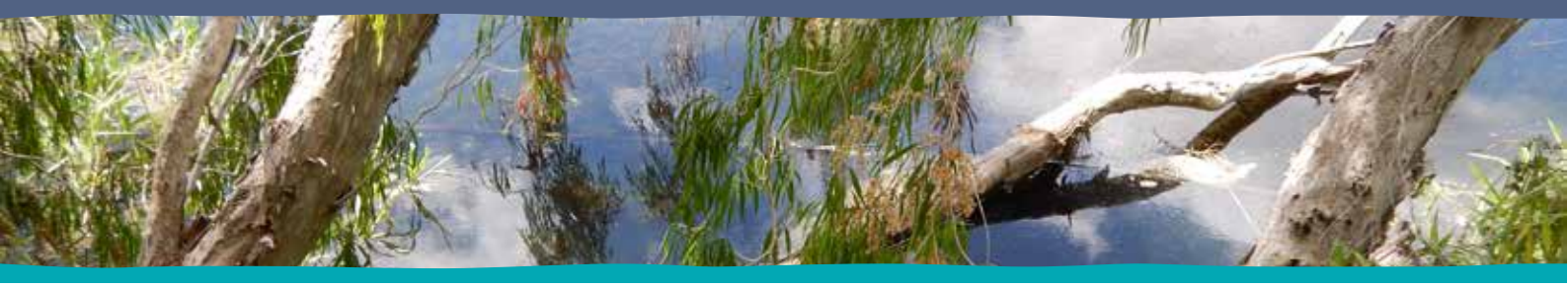


Figure 6 Annual monitored total phosphorus (a) and particulate phosphorus (b) loads for 2015–2016. Natural Resource Management regions are grouped by colour.

Image: Queensland Department of Agriculture and Fisheries



Pesticides

The total monitored annual load of the five photosystem II inhibiting herbicides (ametryn, atrazine, diuron, hexazinone and tebuthiuron) exported past the monitoring sites were (from largest to smallest): 1000 kilograms (kg) of tebuthiuron; 790 kg of total atrazine; 660 kg of total diuron; 260 kg of hexazinone; and 7 kg of ametryn (Figure 7). Atrazine and diuron were the only photosystem II inhibiting herbicides consistently detected in every monitored catchment. Hexazinone was detected in all catchments except the Haughton and Burdekin catchments. Ametryn was detected in the Mulgrave, Russell, Barratta, O'Connell, Pioneer, Sandy and Tinana catchments. Tebuthiuron was detected in the Haughton, Barratta, Burdekin, O'Connell, Sandy, Fitzroy, Burnett and Mary catchments.

Toxic load

The toxic load of photosystem II inhibiting pesticides is the sum of the toxic loads of ametryn, atrazine, diuron, hexazinone and tebuthiuron. The toxic load of a pesticide is its load (mass) multiplied by a toxic equivalency (Ŧ) factor – this accounts for the relative toxicity of the pesticide compared to diuron. The monitored annual toxic load of photosystem II inhibiting pesticides for the end-of-catchment sites was equivalent to 750 kilograms of diuron (750 kg $Ŧ_{diuron}$). Diuron accounted for 82 per cent of the annual toxic load.

The catchments with the highest toxic loads were the Pioneer (180 kg $Ŧ_{diuron}$), Tully (150 kg $Ŧ_{diuron}$), Russell (91 kg $Ŧ_{diuron}$) and Fitzroy (84 kg $Ŧ_{diuron}$) (Figure 7).

The toxicity equivalency factors used in the calculation of toxic loads are currently being revised. The updated toxicity equivalency factors will be applied in the calculation of future toxic loads.

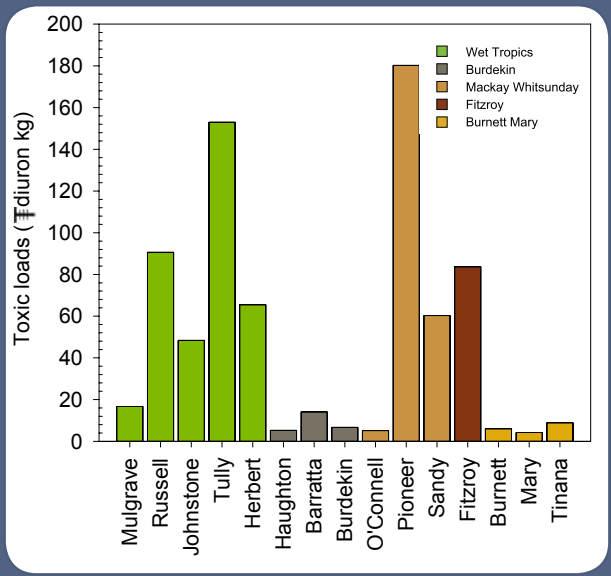


Figure 7 Annual toxic loads (diuron equivalent kg) for 2015–2016. Natural Resource Management regions are grouped by colour.

Acknowledgements

This Program was primarily funded by the Queensland Government. The Program would not be possible without the support of Queensland Government hydrographers and all the organisations and individuals that collected water samples.

Further information

More information on pollutant loads and yields (load divided by land surface area) are available in the report:

R. Huggins, R. Wallace, D. N. Orr, B. Thomson, R. A. Smith, C. Taylor , O. King, R. Gardiner, B. Ferguson, S. Preston, S. Simpson, J. Shanks, M. St. J. Warne, R. D. R. Turner, R. M. Mann. 2017. Total suspended solids, nutrient and pesticide loads (2015–2016) for rivers that discharge to the Great Barrier Reef – Great Barrier Reef Catchment Loads Monitoring Program. Department of Science, Information Technology and Innovation. Brisbane.

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http://www.reefplan.qld.gov.au/measuring-success/paddock-to-reef/catchment-loads/