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River Pesticide Loads and GBR Lagoon Pesticide Data (2006-2007)

Report to:
Great Barrier Reef Marine Park Authority

National Research Centre for Environmental Toxicology (EnTox)

Great Barrier Reef Water Quality Protection Plan (RWQPP) – GBR Monitoring Partnership (2006-2007)

Preliminary deployment of silicon based samplers in addition to semipermeable membrane devices showed that the new samplers can be used to collect a broader range of chemicals more effectively. In addition, this study lead to the introduction of new QCQA techniques such as the use of a plaster-based flow monitor that should improve the accuracy of passive sampler based water concentrations.

field (Huckins, personal communication), indicates the PRC technique to date is unreliable for in-situ calibration of polar samplers that use sorption phases such as the poly(styrenedivinylbenzene) co-polymer (SDB-RPS). The Plaster Flow Monitor (PFM) has recently been developed and introduced at EnTox to aid in the extrapolation of sampler kinetics from laboratory and semi-controlled field calibrations, towards use in routine field application of the devices. The devices aim to provide quantitative information on the effect of flow and turbulence on the kinetics of the ED passive samplers (O'Brien and Mueller, in preparation). The PFM's are constructed from dental plaster and cast into a polymer holder that is deployed alongside the passive samplers. Throughout the deployment period the calcium dissolves from the exposed surface at a rate determined by environmental factors such as flow/turbulence and also salinity and temperature. At present, the total loss of plaster from a PFM provides only an indication of the average flow during the deployment. Calibration studies are underway to allow accurate determination of passive sampling rates from total loss of plaster in the PFM's. Consequently, the PFM data are reported but not used at this time for recalibration of sampler uptake rate. A re-calculation of the data using PFM based corrections is planned once the calibration is completed.

Routine passive sampling results are available from 12 inshore reef sites and 2 river mouth sites. In total 39 polar and 32 non-polar successful sampling periods for passive samplers at inshore reefs and river mouth sites were undertaken. Polar samplers were analysed for a suite of 10-12 herbicides including 2 degradation products whereas non-polar samplers were analysed for more than 50 pesticides including degradation products (this number only includes pesticides that are known to accumulate in SPMDs and will not be eliminated as a result of the sample purification).

mouth over the wet season was approximately 500 ngL^{-1} (0.5 ugL^{-1}). Average diuron concentrations over the deployment periods (generally approximately 1 month, see Table A1.5 for more detail) ranged from 8.2 ngL^{-1} to over 1700 ngL^{-1}. In addition to diuron, a wide range of other herbicides were detected at the river mouth sites during different sampling periods. These herbicides included simazine, tebuthiuron, atrazine, hexazinone, ametryn, prometryn, bromacil and flumeturon. Additionally, through the deployment of SPMDs, the sequestration of nonpolar pesticides such as chlorpyrifos, dieldrin and prothiophos allowed dedection and estimation of trace levels of these chemicals in the water during various deployment periods.

In addition to the routine monitoring, flow events were monitored in the Tully, Pioneer and Fitzroy Rivers, using both passive sampling and snap shot samples. These samplers revealed substantial concentrations of herbicides were mobilised during these flow events (Figures 16-18). The main herbicide detected in the Tully and Pioneer River flow events was diuron, which reached concentrations of greater then 3600 ngL^{-1} in the Tully River and over 1000 ngL-1 in the Pioneer River. The other predominant herbicides detected in the Tully and Pioneer Rivers were atrazine and hexazinone. In the Fitzroy River tebuthiuron was the predominant herbicide at concentrations of up to 700 ngL^{-1} with atrazine and simazine also detected.

Comparisons have been made between wet and dry season measurements for most sites, with the wet season generally having much higher concentrations at both inshore reef and river mouth sites. Observations between Natural Resource Management (NRM) regions have also been made.