

**AN ORGANIC CARBON BUDGET FOR MANGROVE-FRINGED SAWI BAY,
SOUTHERN THAILAND**

D.M. Alongi¹, G. Wattayakorn², T. Ayukai³, B. F. Clough¹, E. Wolanski¹ and G.J. Brunskill¹

¹*Australian Institute of Marine Science, PMB No. 3, Townsville MC., Queensland 4810, Australia*

²*Department of Marine Science, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand*

³*DP Information Services Pty Ltd, Townsville, Queensland, 4814, Australia*

ABSTRACT

A carbon mass balance was constructed for Sawi Bay, a moderately impacted, mangrove-fringed embayment in southern Thailand. The budget identified major sources and sinks of organic carbon to determine if the entire bay is net heterotrophic or net autotrophic. Total input of organic carbon to Sawi Bay from creeks and small rivers, from the Gulf of Thailand, and from carbon fixation of mangroves and phytoplankton averaged $15.5 \times 10^9 \text{ mol C yr}^{-1}$. Total mangrove canopy production averaged $13.4 \times 10^9 \text{ mol C yr}^{-1}$ and was the largest source (86% of total input) of carbon in the entire bay. Phytoplankton production in the bay was the second largest source of organic carbon ($2.1 \times 10^9 \text{ mol C yr}^{-1}$), followed by phytoplankton production ($4.0 \times 10^7 \text{ mol C yr}^{-1}$) in, and tidal export ($3.3 \times 10^6 \text{ mol C yr}^{-1}$) from, creeks and small rivers. Water-column respiration was the largest sink of carbon ($6.0 \times 10^9 \text{ mol C yr}^{-1}$), followed by tree respiration ($4.3 \times 10^9 \text{ mol C yr}^{-1}$), sediment respiration ($1.2 \times 10^9 \text{ mol C yr}^{-1}$) and burial in sediments ($0.6 \times 10^9 \text{ mol C yr}^{-1}$). There was some carbon export to the Gulf of Thailand ($0.6 \times 10^9 \text{ mol C yr}^{-1}$) and export of particulate carbon from the bay proper into the tidal creeks ($7.0 \times 10^5 \text{ mol C yr}^{-1}$). Sawi Bay waters are net heterotrophic, but the mangrove estuaries bordering the bay are net autotrophic. On balance, the entire Sawi Bay ecosystem is net autotrophic with an average P/R of 1.4 - sources of organic carbon exceeded losses by $2.9 \times 10^9 \text{ mol C yr}^{-1}$. Most of this excess carbon is probably accumulating in tree biomass as most mangrove forests lining the bay are young, with most stands < 15 yrs old. This scenario is in contrast to Hinchinbrook Channel in northeastern Australia where most mangrove forests are mature, and where most carbon in excess of respiration and burial is exported. Nevertheless, both mangrove-dominated ecosystems are net autotrophic, producing more organic carbon than they are consuming.