INTRODUCTION

The Torres Strait Baseline Study (TSBS) was instigated in response to concerns that discharge from mining developments in Papua New Guinea was impacting levels of heavy metals in the Torres Strait marine environment. Besides providing an assessment of levels of metals present, an overriding objective of the TSBS was to provide sound baseline data as a foundation for ongoing monitoring. More specific objectives of the TSBS scientific program are detailed in Dight (1991). The TSBS comprised four component programmes, each addressing metal levels in a discrete and important aspect of the Torres Strait marine environment. The results of three of these (Community Fisheries, Marine Sediments, Indicator Organisms) were reported in Dight and Gladstone (1993) and Gladstone (1996). This report presents the results of the fourth component - Torres Strait commercial fisheries.

Prawns and crayfish are the two most important fisheries in Torres Strait, and hence are the focus of this study. Of the $20–30 M worth of fishery products harvested from the region annually, the prawn catch accounts for $17–20 M and is caught by commercial trawlers which are based at ports outside of Torres Strait. The crayfishery is worth $4–5 M annually (Elmer and Coles 1991), but is socially and economically more important to the region as most of this is caught by locally based commercial or community fishermen. Both fisheries are economically important on a national scale, as much of the product is exported. Other commercial fishery species in the area include mackerel, barramundi, reef fish and mud crabs. Due to the lower economic and socio-economic importance to the region of these minor fisheries however, they are excluded from the present study. Some of these species were included in the community fishery component of the TSBS (Dight and Gladstone 1993, Gladstone 1996).

A pre-requisite of any investigation into metal levels in organisms is a consideration of how those organisms deal with metals. Levels of heavy metals observed are the net result of that organism's accumulation strategy - that is, the difference between rates of uptake and storage, and excretion (Depledge and Rainbow 1990, Rainbow 1990, Rainbow 1991). Uptake can either be passive, whereby the rate of uptake is governed by the bioavailability of the dissolved metal in the environment, or via active transport pumps (Rainbow 1991, Depledge and Rainbow 1990, Rainbow et al 1990).

Iron, zinc, selenium, copper, manganese, nickel, cobalt, chromium and possibly arsenic, are all metals thought to be essential in at least trace concentrations to at least some organisms (Rainbow and Furness 1990). Decapod crustaceans are generally thought to regulate the concentration of essential elements in a reserve 'pool', available for metabolic requirements and accumulate the non essential ones (Rainbow 1990, Rainbow et al 1990). Regulation of zinc, copper, manganese and iron, and accumulation of cadmium, has been demonstrated or supported by many workers with evidence of either strategies observed in laboratory studies, or comparative studies of organisms collected from a range of sites of suspected differing metal bioavailabilities (Bryan 1968, White and Rainbow 1982, 1987, Nugegoda and Rainbow 1988, Martin 1974, Ray 1984, Ieely and Nott 1980, Rainbow 1985, Darmono 1990). However, all metals, including the essential ones, are toxic beyond a threshold concentration. To avoid toxic effects, excess levels of these elements must be bound in metabolically inert complexes such as metallothieneins or other high metal affinity ligands, for either long-term storage or excretion (Depledge and Rainbow 1990, Engel 1987, Rainbow 1991, Rainbow et al 1990).

The Torres Strait Baseline Study's pilot results (Dight and Gladstone 1993, Gladstone 1996) indicate that the Fly River is an important source of aluminium, arsenic, cobalt, chromium, copper, iron, mercury, manganese, nickel, lead and zinc in Torres Strait surface sediments.

Sediment sampling sites close to the Papua New Guinea mainland contain higher levels of these metals and were characterised by a higher proportion of fine organic carbon sediment of terrigenous origin. Conversely, cadmium and selenium appear to not be associated with Fly River runoff. Cadmium was associated with carbonate sediments of marine origin, while there was no particular association with sediment type in selenium levels.

Gladstone (1996) concluded that Fly River sediments extend southward into Torres Strait to a line between latitude 9°12'S and 9°08'S, although the influence of smaller coastal rivers to the west may extend further south and occasional events of more extensive intrusion may occur.

This study approaches the issue of metal levels in prawns and crayfish in Torres Strait from two angles. Firstly, under the umbrella of the TSBS, a major objective was to quantify levels of trace metals in commercially important prawn and crayfish species in Torres Strait. In this regard, an aim was to understand the influence of environmental and biotic factors on metal levels. Secondly, in response to previous evidence of unacceptably elevated levels of some metals in one prawn species in Torres Strait (Mariarth 1991, Schneider 1990), a further objective was to assess metal levels with respect to health and trade issues. Hence, some factors investigated were chosen for their accessibility to management control and an emphasis was placed on edible tissues.