DRAFT SUMMARIES OF PAPERS PRESENTED

Why is the Torres Strait important?

- People live there and depend on its resources for their livelihood and culture.
- There are important fisheries in the Torres Strait, both commercial and traditional.
- It is important biologically and ecologically.

What are Heavy Metals?

- They are naturally occuring elements which can be found in rocks, attached to sediments, dissolved in water, attached to rotting vegetation.
- They are found naturally in marine plants and animals.
- The amounts of heavy metals found in marine plants and animals can vary significantly between individuals of the same species of plants and animals, between different groups of plants and animals, between different places and different times. There can also be significant differences between levels of heavy metals in different parts of a single plant or animal.
- It is usually difficult to measure accurately the amount of heavy metals in the plant or animal.
- Some metals are important in low concentrations for growth in plants and animals (e.g. copper and zinc). The same metals are poisonous to the same plants and animals if they are absorbed at levels which are too high for the animal or plant to tolerate. Mercury, lead and cadmium have no known use for plants or animals and can also be poisonous.
- People have always eaten food containing heavy metals. When levels are raised above 'normal levels' then we need to find out whether this will affect the health of the people, plants and animals which are absorbing the heavy metals.

What do we know already and what do we need to find out?

- Ok Tedi Mining Ltd. and Porgera Joint Venture are discharging wastes from mining operations into tributaries of the Fly River. These wastes consist of large amounts of sediments and contain heavy metals, particularly copper from Ok Tedi Mine. The wastes are washed down the Fly River to the delta at the mouth.
- Most of the sediment and the heavy metals probably settle at the mouth of the Fly River.

- The water that discharges from the mouth of the Fly River moves in a number of directions. Most of the water flows eastward to the Gulf of Papua. Some of the water flows westward along the coast of Papua around Daru and Saibai Islands and into the Torres Strait via the Great Northeast Channel. The water contains some sediments and heavy metals.

- We do not know how much sediment and heavy metal is transported into the Torres Strait, how they are transported, where they end up or which plants and animals absorb them.

Keynote Address

Sustainable Development for Traditonal Inhabitants of the Torres Strait Region, *Graeme Kelleher* (page 15)

- Term *Baseline Study* is misleading because the study will commence after discharge of mine sediments into the Fly River has begun.

- The main industry for the Torres Strait for both Islanders and Papuans is fishing, which is an unpredictable industry.

- Development of the Region must be sustainable ecologically, socially and economically.

- Baseline Study is a Commonwealth funded project for 3-4 years, commissioned in response to concerns by Torres Strait Islanders, commercial fishermen and scientists.

- TSBS is consistent with current world trend towards ecologically sustainable development.

Reply from Chairman of the Island Coordinating Council, Chairman of Yam Island Community Council, *Getano Lui, Jnr.*

- Torres Strait Islanders form part of the environment and have historical and cultural ties to the marine environment.

- Survival of the Torres Strait Islanders as a race of people is dependent on maintaining a traditional lifestyle.

- Torres Strait Baseline Study is seen as recognition of the need to protect a separate race of people.

- Sustainable economic development for Torres Strait Islanders is essential.

- Torres Strait Islanders recognise the need for PNG development but also need protection and development of their own resources.

Reply from the President of the Kiwai Local Government Council, *Clement Hesaboda*

- Concerned about impacts from Ok Tedi, Porgera and Kutubu. Matters of importance to Torres Strait Islanders are also of importance to Kiwai people.
- Kiwai people believe that changes have occured to fish and crocodiles since Ok Tedi Mine commenced.
- PNG also needs to make a commitment to environmental protection.
- Kiwai people do not understand why a tailings dam was not built for Ok Tedi Mine.

Physical Environment of the Torres Strait Region

Planning & Management of the Great Barrier Reef Marine Park, *Wendy Craik* (page 25)

- Great Barrier Reef Marine Park is managed through a zoning system which relies heavily on public input in the preparation of plans.
- Compulsory pilotage of all ships calling at Australian ports will be made law soon under the Great Barrier Reef Marine Park Act.
- Great Barrier Reef Marine Park is a multi-use marine park which provides for a range of uses in different areas.

The Impacts of Projected Climate Change on Coastal Land Use in Papua New Guinea, *Marjorie Sullivan* (page 33)

- Climate changes from global warming will affect PNG.
- Estimates of sea level rises range from 30cm to 1.5m, possibly over the next 40 to 50 years.
- Greatest effect likely on those people least likely to be able to afford to deal with it (e.g. traditional inhabitants of the coastal strip). The loss of land from sea level rising will be catastrophic because all other other land is already owned.
- There will be effects on water supplies, coral reefs, increased humidity and flooding. Some small islands will be lost.
- The highlands will be able to grow crops higher up; this may mean the loss of montane forest.

Sedimentation at the Juncture of the Fly River Delta and Northern Great Barrier Reef, *Peter Harris* (page 59)

- Eighty-five million tonnes of sediment enters the Fly delta each year. Two percent goes into the Torres Strait. Fifty percent goes into the delta. The remainder either goes into the Gulf of Papua or along the southern PNG coast to the west.
- Westward flow of water via Missionary Passage is important from April to November. This includes the time when the flow of water from the Fly River is at its highest.
- The central Torres Strait basin is scoured clean of fine sediments leaving a gravel surface with undersea dunes which move.
- The main area where fine sediments are known to be deposited is around Yorke Island.

Copper and Zinc Distribution in the Sediments of the Fly River Delta and Torres Strait, *Elaine Baker* (page 87)

- High levels of zinc and copper were found in sediments associated with runoff from the Fly River. Zinc is found with sediments which come from the land so it should be a good indicator of sediment transport pathways from the Fly River.
- Levels of metals declined with distance from the mouth of the river.
- Higher metal levels are found in samples with higher levels of fine particles.
- Layers from sediment cores may represent periodic, possibly yearly deposition and hence form an historic record which could be tested for changes in metal levels with time. Initial tests showed no obvious connection with the beginning of mining.
- Copper appears to be transported more easily. More work is needed to find out how it moves with sediments and water.

Environmental Investigations on the Effects of the Ok Tedi Copper Mine in the Fly River System, *Murray Eagle* (page 97)
Biological Investigations into the Impacts of the Ok Tedi Copper Mine, *Ross Smith* (page 261)

- OTML has conducted environmental investigations programs since 1981, investigating the chemistry, biology and hydrology of the Fly River system.
- In 1989, OTML implemented programs of investigation and research in the Fly estuary, Gulf of Papua and the Torres Strait.

The Water Circulation in the Torres Strait, *Eric Wolanski* (page 133)

- The movement of water and the shape of the sea bed in the Torres Strait is very complex. This makes it difficult to understand how sediment and heavy metals move into and around the Torres Strait.
- Currents in the Torres Strait are mainly driven by tides. Most of the movement is back and forth with little movement through the Straits.
- Freshwater from the Gulf of Papua enters the Torres Strait.
- Water flows around islands and reefs may be different from the overall waterflow in the general area.
- There is a lot of information which could be used to predict where the water is likely to flow in the Torres Strait.

South Pacific Regional Environmental Program Marine Coastal Pollution Study (STREP-POL), *Nicholas Currey and Walter Benko* (page 143)

- The National Analysis Laboratory is equipped to handle all the analyses needed for the TSBS.

Australian and Some International Food Standards for Heavy Metals, *George Rayment* (page 155)

- The maximum permitted concentration of heavy metals in foods are set by some countries, including Australia, to protect people from food which might injure their health.
- Cadmium, lead and mercury are the metals of most concern but agreement has not been reached on internationally applicable standards for these environmental contaminants.
- Selling food with higher than the maximum permitted concentrations of heavy metals is illegal but not necessarily unsafe because people eat different amounts and react differently to the levels of metals in the food.

Processes Influencing the Fate of Trace Metals in Torres Strait: A Review of Current Data and Concepts, *T. David Waite and Ron Szymczak* (page 165)

- If we want to understand how metals move into the Torres Strait and how to predict where they might end up we need to understand what controls the processes of transport.
- heavy metals from rivers may enter the sea in different ways by being released from sediments in dissolved form and attaching to other metals (e.g iron). Is this an important process for transporting metals into the Torres Strait? If so, how long does it take? Are these metals able to be absorbed by plants and animals?

- We need to know a lot more about how much heavy metals are concentrated in the sea at different depths, especially at the surface, and in what forms the metal exists there (i.e. is it dissolved, in particles or joined together with other metals).

- We need to know if metals attached to sediments are able to be taken in by plants and animals.

Biological Environment of the Torres Strait Region

The Status of the Dugong in Torres Strait, *Helene Marsh and Keith Saafeld* (page 187)

- The Torres Strait is one of the most important dugong habitats in the world. There are at least 12,000 dugong in the Torres Strait.

- Because dugongs live a long time and breed slowly they can suffer from over-exploitation.

- We will not know whether the present level of exploitation is too high for some years yet, because it takes about ten years to notice any effect.

- Management options include public education, additional sanctuaries and managed areas (e.g. Buru Island).

- Further surveys to check numbers and the geographic limits of the Torres Strait stock are planned.

- We need to know how many dugong are being caught by traditional fishermen (Horace Nona program).

A Review of Queensland Department of Primary Industries' Research on Commercial Prawn Species in Torres Strait, *Clive Turnbull* (page 195)

- The basic life history and the migration pathways of the brown tiger prawn are now known.

- This knowledge helps fisheries managers in deciding which areas to close to protect small prawns and when to close areas to increase catch.

- The seasonal closure now seems to be too late. This information was determined from following tagged prawns.

- Future research will assess the effectiveness of closures and provide similar information on other important prawn species.

Biological Oceanographic Measurements in the Torres Strait and Far Northern Great Barrier Reef, *Miles Furnas* (page 197)

- Very little is known about the biological and chemical processes in the water column in the Northern GBR and the Torres Strait.
- Dissolved nutrient levels in the Torres Strait and the Northern GBR are slightly higher than elsewhere in the Coral Sea, possibly due to intense mixing of nutrients by water movement and by biological activity.
- Marine plants (e.g. algae and seagrasses) may contribute to productivity in the water column.
- Silicate may be a useful indicator of freshwater penetrating into the Torres Strait.

Torres Strait Marine Turtle Resources, *Jeff Miller and Col Limpus* (page 213)

- Three species of turtle live in the Torres Strait (Hawksbill, Flatback and Green). Green turtles are most important to people of the Torres Strait Region. We have most information about Green Turtles.
- These turtles use many areas for feeding but only a few areas for nesting.
- Like dugongs, turtles are long-lived and can suffer from overfishing. The number of green turtles available to be caught can be influenced by weather.
- Recent research has suggested that there are separate stocks of turtles from the Southern GBR, Northern GBR and Western Australia. Turtles nesting in the eastern Torres Strait are part of the breeding stock from the Northern GBR.
- Green turtles which breed in the Torres Strait feed in many places including Indonesia. People from Indonesia, Papua New Guinea and the Torres Strait catch turtles from the northern GBR breeding stock.
- Conservation of turtles is an international conservation issue involving at least Australia, Papua New Guinea and Indonesia.

Ciguatoxin in the Marine Biota as a Model for the Movement of Metals, *Michael Capra, Andrew Flowers and Scott Hahn* (page 227)

- Ciguatera poisoning occurs in humans after eating certain tropical fish.
- The poisoning is due to poisons produced by single-cell organisms (epiphytic dinoflagellates)
- Ciguatera poisoning occurs at different times at at different places in tropical waters.
- Ciguatera poisoning could occur in the Torres Strait and become a significant problem.

- By studying the movement of ciguatera poisons in marine animals we might be able to also follow the movement of heavy metals through those animals in the Torres Stait.

Australia's Fisheries Research in the Torres Strait Protected Zone, ***Geoff Williams and Derek Staples*** (page 229)

- Fisheries research is coordinated through the Torres Strait Fisheries Scientific Advisory Committee.
- Fishermen, Torres Strait Islanders and researchers can suggest research needs to the Committee.
- Research is funded by Commonwealth (DPIE and CSIRO) and Queensland (DPI) agencies.
- Current research covers Tropical Rock Lobster, prawns, traditional fishing, seagrass habitat monitoring, catch statistics, turtles and dugong.
- Future research will be on the above and also heavy metals and oil spills.

The Artisanal Turtle Fishery in Daru, Papua New Guinea, ***Donna Kwan*** (page 239)

- Turtles are important for Kiwai people for income and dugongs are important for food and cultural needs.
- There is an increase in the proportion of turtles sold for non-traditional purposes.
- Flatback, green, loggerhead and hawksbill turtles are all caught. Between 900-1300 turtles are caught each year.
- Daru seems to be a turtle 'hotspot'.
- Indonesian take of turtles is very high. Turtles come from the same stock as those taken at Daru.

Benthic and Pelagic Processes in the Fly River Delta and the Nearshore Gulf of Papua, ***Alistar Robertson and Dan Alongi*** (page 241)

- Because the Fly River discharges very large amounts of freshwater and sediments, this is likely to have a big effect on the food chains in the Gulf of Papua and maybe in the Torres Strait.
- The Fly river has extensive and highly productive mangrove forests which produce large amounts of carbon which is transported into the Gulf of Papua. Carbon is essential for the growth of plants and animals.
- Unvegetated intertidal mudbanks do not generally have high numbers of animals living in the mud, but do have hi~h levels of bacteria which use the

carbon at a high rate. There is little transport of dissolved nutrients from the mudbanks.

- Subtidal sediments in the Fly delta and the nearshore Gulf of Papua generally have low levels of copper in particle form, although the levels in the southern channel are slightly higher. There is little measurable release of dissolved copper from the sediments to the water.

- Carbon in particle form is rapidly used in the water column and in the sediments of the Fly Delta and in the nearshore Gulf of Papua.

Research for Sustainable Development of the Tropical Rock Lobster Fishery in Torres Strait, *Roland Pitcher* (page 253)

- Tropical rock lobsters migrate across the Gulf of Papua and into the northern GBR to breed.

- There could be potential for increased yields from the Torres Strait rock lobster fishery.

- Restrictions on minimum size and closed seasons will not increase the size of the total catch.

- Young lobsters are collected to estimate the expected size of next year's catch when they will be adults. This can also give an early warning of problems.

- Further research is needed on the size and extent of the breeding lobsters, where they go when breeding has finished, the size of the catch and the behaviour of young lobsters.

Torres Strait Fisheries Management, *Mark Elmer* (page 283)

- Commercial fisheries in the Torres Strait is worth about $25 million p.a.

- Tropical rock lobster, prawns, mackeral, pearl shell, turtles, and dugong are managed under the Protected Zone Joint Authority (PZJA).

- The Torres Strait Fisheries Management Committee which reports to the PZJA receives advice from the Torrres Strait Fisheries Industry and Islander Consultative Committee (TSFIICC) and the Torres Strait Fisheries Scientific Advisory Committee (TSFSAC).

- A range of management measures are used for the fisheries, including licence limitations, closures for prawns, gear limitations, and minimum legal size for lobsters.

- Other fisheries including trochus, reef fish and recreational fishing are managed by the Queensland Fish Management Authority (QFMA).

- Future work includes monitoring fishing effort and education/extension.

Rock Lobster Fisheries: Enhanced commercial yeilds by artificial shelters? ***Bruce Phillips and Chris Crossland*** (page 295)

- Artificial shelters similar to those used in Cuba and Mexico could increase lobster catches in the Torres Strait.
- Shelters are easy to construct and use.
- However because they might only be aggregating lobsters rather than increasing their numbers, they may lead to over-exploitation.
- Shelters may also damage seagrass beds.
- More research should be carried out before they are used in the Torres Strait.

Trace Element Profiles of Clams (*Tridacna crocea*) gathered from various sites in Torres Strait, ***Gerry Murphy, Clive Turnbull, Robert Manning and Robert Pearson*** (page 303)

- Burrowing clams collected from eight sites in the Torres Strait showed levels of the metals cadmium, copper, lead, zinc and mercury of less than 1/10 the Maximum Permitted Concentrations for food for human consumption.
- The levels found were also found to be environmentally low and not biologically significant.
- In general levels were lowest in the clam muscle and highest in the visceral mass (for example, the kidney, stomach and liver) with the mantle tissue in between.
- There was not much variability in the levels measured.

Tridacna: **Sentinels of Heavy Metal Pollution in Torres Strait Waters – a Critical Evaluation,** ***Gary Denton and Leroy Heitz*** (page 311)

- An organism, to be suitable to be used as an indicator of water pollution, must have a well defined set of properties.
- The clams *T.crocea* (the burrowing clam) and *T. maxima* have these properties, especially the kidney.
- *T.crocea* accumulates mercury better than lead or cadmium but all show a linear rate of accumulation with time but a slow loss rate.
- Because of this we can use this clam to roughly predict future metal levels in the clam kidney when there is known metal levels in the water and vice versa.
- This can help us decide how often to sample the clams.
- For good results we need clams which are the same size and age and not too old. Clams grown on a farm may be useful to put out on the reef for a fixed time to then be collected and tested.

Human Environment of the Torres Strait Region

Maza: A Legend about Culture and the Sea, *Judith Fitzpatrick* (page 335)

- Strong connection exists between sea territories and culture in Western Torres Strait Islands.
- A myth about Aukum who symbolizes fertility in the reef exemplifies this relationship with the sea.
- People's lives are dependent upon the vitality of the reef (maza).
- Cultural identity is based on historical, symbolic and social association with the sea and use of marine resources.

The Eastern Islands of the Torres Strait, *Jeremy Beckett* (page 347)

- Eastern islanders of the Torres Strait have strong sense of place.
- Cultural knowledge still important.
- Eastern islanders still practice subsistance horticulture and have strong identity with their land.

Wopkaimin Landowners, the Ok Tedi Project and the Creation of the Fly River Socio-ecological Region, *David Hyndman* (page 355)

- Mt Fubilan is the sacred mountain of the Wopkaimin people.
- Mining requirements for capital, labour and food for workers integrated the surrounding indigenous peoples into a single ecological/economic region.
- There have been few benefits to the Wopkaimin and the mine has been an ecological disaster.
- Mine employment has been limited and social protest is spreading around the indigenous people of the region.

The Subsistence Economy of the Kiwai-speaking People of the Southwest Coast of Papua New Guinea, *David Lawrence* (page 367)

- Coastal Kiwai people live on the sandy foreshore between the sea and coastal swamps.
- Limited gardening land but access to Torres Strait has meant that they remain subsistence fisherman.
- Associations with Torres Strait Islander people has been long and Torres Strait Islanders taught the Kiwai fishing and hunting skills.