Science for sustainable water development in northern Australia

Project team

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Timeframe

2005-ongoing

Project description

Northern Australia has an abundance of freshwater leading to the claim that this region will provide Australia's new food bowl. However, in order to prevent a repeat of the mistakes of the past where water resources have been overexploited and the environmental adversely affected, e.g. Murray-Darling Basin, science is needed to determine sustainable levels of water exploitation. Most of northern Australia is in the wet-dry tropics, meaning that rainfall only falls over a few months each year, and there is high interannual variability in the rainfall. Summer monsoonal rainfall may result in major flooding which is an important driver of healthy functioning of the marine and freshwater environments. These aquatic systems and the species that live in them are highly adapted to this variation, but vulnerable to changes that reduce the availability of freshwater.

Water resource development can involve both water extraction, e.g. irrigated agricultural needs, and flow regulation, e.g. building of dams and weirs. Both have significant effects on the availability of refuges for freshwater fisheries, supply of nutrients for productivity downstream in marine and freshwater, and accessibility of habitats for migrating species.

Our research has focussed on the role of freshwater flows in sustaining freshwater and marine habitats, and the associated fisheries. It is not just the quantity of freshwater that is important, water quality is also an important consideration for the healthy functioning of ecosystems. Our work has also examined how high nutrient loads from human activities can detrimentally impact the health of coastal environments.

Outcomes

Our research shows that freshwater flows and their associated floods are critical to sustaining coastal fisheries in northern Australia. We show that a major fishery in the Gulf of Carpentaria, the banana prawn fishery, relies on the freshwater flows in the wet season to drive the juvenile prawns out of the estuaries and into the deeper waters where they are caught in the fishery. The effect is both physiological, i.e. shrimp are stressed by the low salinity, and nutritional, i.e. the preferred food source disappears in freshwater. If prawns remain in the estuary, they are eaten and never contribute to the next generation.

Freshwater flooding also creates new aquatic habitats, such as saltflats and floodplains, which are normally dry. Our research has shown that saltflats can be major contributors of resources (carbon and nitrogen) to coastal environments, fuelling productivity of fish and other species. Additionally, freshwater species and those species that can live in both marine and freshwaters, e.g. barramundi, move downstream onto saltflats, into estuaries and out to sea when the floodplume discharged from the river drops salinities dramatically.

We demonstrate that changes in freshwater flow due to water extraction are likely to affect prawn catch, especially during medium to low flow years. This research provided key information for Commonwealth Government reviews of development in northern Australia, and has helped to inform water resource plans in the Queensland government. The fishing industry has used the information to help lobby government to ensure that new water licences for agriculture do not impact negatively on the fishery.

Our research has also identified that permanent waterholes within rivers are critical refuges for maintaining biodiversity and a healthy ecosystem in the dry season. Excessive pumping of this water will impact on the whole river system and will severely limit the benefits of floods in stimulating fish production and reproduction. This information has been used in a range of regional assessments by the Queensland Government.

We have also examined the ecosystem health of a tropical harbour and its creeks, i.e. Darwin Harbour, and the impacts of excessive nutrients. Our work was a critical baseline study for monitoring to determine the impact of a major dredging project in the harbour in order to build a pipeline and gas processing plant. It resulted in Prof Burford being invited onto a scientific expert panel informing the Northern Territory and Commonwealth Governments to ensure that environmental impacts of the dredging were minimized. The research on the effect of excessive nutrients, i.e. sewage discharge, demonstrated major impacts on water quality and resulted in the announcement of an upgrade of the relevant sewage treatment plant by the plant operators. We also demonstrated that reducing sewage discharge and its associated nutrients can result in measureable improvements to water quality.

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Publications

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