Impacts of agriculture and restoration of the habitat values, water quality and fish assemblages of a tropical floodplain.

Thesis submitted by

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Abstract

Fish assemblages in two floodplain sub-catchments of the Burdekin River, north Queensland, were examined over two years, in relation to habitat condition water quality and the effects of habitat rehabilitation. The main study sites were located along Sheep Station Ck and Warren's Gully which are overflow channels or sub-catchments of the Burdekin delta. Artificially high flows are maintained in these streams as water from the Burdekin River is pumped through them to supply downstream irrigation needs. In general, the study sites were moderately to highly impacted by riparian clearing, modified flow regimes and weed infestations. Weed infestations appeared to be linked with the imposition of a modified flow regime as remnant sites had far less cover of weeds than sites with modified flow. Sites in the upper floodplain, Burdekin River and Barratta Ck had highest habitat values.

Water quality was highly variable across sites, streams and over time. Oxygen concentration was identified as a major determinant of fish diversity, so the dynamics of dissolved oxygen were a major focus of this study. Flow, habitat condition and weed infestation were identified as the main drivers of oxygen in the streams. The introduced Water hyacinth (*Eichhornia crassipes*) had a major impact on oxygen as it essentially blocks oxygen exchange with the water. Modified flows appear to benefit weed growth, through continuous nutrient supply. Loss of riparian habitat improves growing conditions for weeds and increases water temperature, further impacting oxygen content in the water.

Habitat condition had a major influence on fish assemblages. Species richness and abundance were highest in sites of good habitat condition. Sites within the distribution systems (Sheep Station Ck and Warren's Gully) had the most impacted fish assemblages. The abundances of exotic species (both real and relative) decreased with increase in habitat condition. The most abundant fish species were (i) small, highly tolerant gudgeons, (ii) the introduced Mosquito fish (*Gambusia holbrooki*) and (iii) larger Tarpon (*Megalopes cyprinoides*), which is a facultative air breather. The small species appeared to favour degraded lagoon habitats but it appears that as habitat condition improves and more predatory species occur, the abundance of these small species decreases.

During the sampling period a local project was initiated using an aquatic weed harvester to remove weed infestations from lagoons on Sheep Station Ck Weeds were harvested from Payard's Lagoon in August 2000. Three samples were taken before weed removal and six after weed removal to examine temporal changes in fish assemblages and water quality. There was an immediate improvement in oxygen content in the month after weed removal and this

improvement persisted for a further year. The abundance of native fish species increased rapidly after weed removal. Gudgeons were the most abundant. Over the study period these abundances gradually declined due largely to the re-colonisation by predators, previously excluded from the lagoon by poor habitat and water quality condition. A number of species moved into the experimental site from a refuge site in the inlet and during a flood event. The most notable of these species is Bony bream (*Nematalosa erebi*), a species that is very intolerant of hypoxia. As more natural native habitat conditions re-established, the abundance of exotic species (*G. holbrooki*) decreased. However, fish assemblages could not fully return to natural because of combined barriers to access by estuarine species (e.g., flow control devices, bund walls and hypoxic lagoons), and poor linkage to remnant refuges.

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