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ECOLOGICAL VALUES OF THE FITZROY RIVER WITH LINKS TO INDIGENOUS CULTURAL VALUES

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INTRODUCTION

Worldwide, there is growing concern over the extent of dams and river regulation (ARMCANZ/ANZECC 1996, Arthington 1998, Bunn and Davies 2001, Edgar 2001). This also applies to rivers of northern Australia, where plans for resource developments are typically made in the context of limited ecological information. The Fitzroy River, in the Kimberley region of north-western Australia, is one of the few remaining major free-flowing (*viz.* unregulated) river systems in Australia. There have, however, been proposals to dam the river for irrigated agriculture and, more recently, to divert water through pipelines or canals to satiate the thirst of Perth in the southwest of the state.

Proposals for impounding the Fitzroy River have raised concerns over impacts on the various values supported by the system (i.e. ecological, Indigenous cultural, social and economic). Although indigenous cultural values have been documented, relatively little is published on the ecological values of the Fitzroy River. The Western Australian State Department of Environment (DoE) is responsible for managing and allocating the States water resources, which requires balancing ecological, cultural, social and consumptive uses. Developing an allocation plan for the Fitzroy River was limited by the current state of knowledge for the system. Therefore, in November 2000 the DoE funded a qualitative field assessment of the environmental values of the Fitzroy River and major tributaries. The study (Storey et al. 2001) was conducted in conjunction with an anthropological study (Toussaint et al. 2001) and involved collaboration with Indigenous groups at Bayulu, Djugerari, Jarlmadangah, Kupungarri, Looma, Mimbi and Yakanarra communities along the Fitzroy River. The aims of the studies were to assess water dependent ecological and cultural values, and links between them. An outcome of this assessment was to identify potential impacts of flow regulation and outline knowledge-gaps limiting successful water allocation planning.

ECOLOGICAL VALUES

The upper Fitzroy River (upstream of Fitzroy Crossing) has a catchment area of 46,300 km², divided into the sub-catchments of the Margaret and Fitzroy rivers. Downstream, the Fitzroy is comprised of a sinuous main channel which has some braiding, floodplain channels and significant floodplain storage. Long-term annual rainfall for the area is highly unpredictable, influenced by tropical monsoons and cyclonic activity. As a result, river-flow is highly variable and unpredictable. The long-term mean annual discharge of the upper Fitzroy River is about 6,150 GL (at Fitzroy Crossing). Since 1968 (corresponding to a “wet” period), mean flows have increased to over 7,000 GL per annum. Flood peaks of approximately 30,000 m³/s have been recorded in downstream reaches (25,000 m³/s at Fitzroy Crossing was recorded in 1983; Storey et al. 2001).

Overall, the riparian vegetation of the Fitzroy valley was considered to be in “good” condition although some areas of high livestock impact were characterised by extensive weed invasion. The area has a history of rangeland grazing; even so, a number of riparian species

including *Acacia gloeotricha*, are on the CALM Declared Rare and Priority List as Priority Species.

The significance of the aquatic invertebrate fauna of the Fitzroy system is difficult to assess in a regional context due to the paucity of detailed studies in the Kimberley. However, analysis of the aquatic macro-invertebrate fauna from 14 sites in the Fitzroy indicated good ecological “health” using the national AusRivAS models. Key macro-invertebrate taxa included two species of *Macrobrachium* prawns, which were considered likely to be important to fish foodwebs. Previous sampling of subterranean species (stygo/cave fauna) showed an as yet undescribed family of flabelliferan isopod, with the high likelihood of other endemic taxa (Bill Humphreys, WA Museum, pers. comm.). However, the extremely limited sampling of this component of the fauna makes an assessment of the conservation significance of the Fitzroy subterranean fauna difficult.

In contrast, the fish fauna of the Kimberley in general, and specifically the Fitzroy system is reasonably well-known. About 48 freshwater fish are known from the Kimberley, of which 18 are endemic to the region. Thirty species from 21 families have been recorded from the Fitzroy. Of these, about a third are likely marine opportunists but with limited freshwater distribution, and at least three are endemic to the Fitzroy systems. Overall, the Fitzroy is characterised by a diverse fish fauna with many unique species (Doupé and Lenanton, 1998). Recent surveys of the Fitzroy River by Murdoch University, in association with the Kimberley Land Council, and with funding from NHT have extended our knowledge of the fish fauna to 40 species from 23 families, of which 24 are primarily freshwater and 16 of estuarine/marine origin (Morgan et al. 2004). Similarly, recent surveys of the system have established that the Fitzroy River is a stronghold in the Kimberley for the Freshwater Whipray (*Himantura chaophraya*) listed as Vulnerable by the IUCN (2002), Freshwater Sawfish (*Pristis microdon*) listed as Endangered by IUCN (2002) and Critically Endangered by Pogonoski (2002), and Dwarf Sawfish (*Pristis clavata*) listed as Endangered by Pogonoski (2002) and IUCN (2002). In addition, the Northern River Shark (*Glyphis* sp. C), listed as Critically Endangered (IUCN, 2002) was collected from King Sound (Thorburn *et al.* 2003).

The Fitzroy River floodplain supports substantial ecological values on seasonally inundated wetlands and in permanently inundated channels and billabongs. In particular, Camballin floodplain constitutes an important waterbird habitat (about 67 species recorded) and meets criteria for listing as a Wetland of International Importance (Ramsar). Many of the waterbirds are listed under the Japan-Australia and/or China-Australia Migratory Birds Agreements (JAMBA/CAMBA). The floodplain supports a number of Western Australian Priority Species including Freckled Duck. Other extensive floodplain regions (e.g. the wetlands of Mallalah and Sandhill Swamp) are also considered important waterbird habitats when flooded.

For the maintenance of biodiversity and dominant ecological processes, the linkage between the river and its floodplain are critically-important. As well as structuring habitat (i.e. the morphology of the system), connection during floods results in significant exchange of energy (carbon) and nutrients between channel and floodplain, and provides access to nursery habitat for fish. Therefore, water harvesting that reduces the strength of the river-floodplain connectivity may have a substantial impact on habitat structure, food-webs and ultimately biodiversity.

LINKS WITH CULTURAL VALUES

Toussaint et al. (2001) noted that the Indigenous communities living along the Fitzroy River consider water a major focus of their culture and the basis of many Dreamtime stories. The river provides sites of learning, for passing down information from generation to generation, places of shared memory and history (Toussaint et al. 2001).

Storey et al. (2001) and Toussaint et al. (2001) showed that most locations along the river have traditional names, many of which are associated with Dreamtime stories. To Indigenous communities, the riparian zone represents a concentration of food, medicine and other resources. For example, leaves and bark from certain trees are used for cooking to provide flavour, edible nuts are gathered from riparian plants, i.e. the fringing Pandanus Palm *Pandanus spiralis*. The bark of the paperbark trees is used to make containers for carrying food; specific riparian plants are used to make poisons to capture fish; some riparian plants, such as the Freshwater Mangrove *Barringtonia acutangula*, provide medicinal remedies for different complaints; some riparian plants can be burnt to provide smoke for ritual healings; vegetation can be used practically to build rafts, make light-weight fishing spears and containers; and the phenology of flowering and fruit production is used to determine the reproductive cycle, and thus best hunting time, of riverine fauna. The river and billabongs provide a reliable subsistence food source. Most aquatic fauna (fish, crocodiles, turtles, prawns, frogs, and waterbirds) are used as a food source, therefore providing a means of economic support. At certain ceremonial times there are special food taboos during which only fish can be eaten. Other foods provide medicinal values, such as river mussels which, when cooked slowly, produce a milky liquid used to alleviate cold symptoms. It was observed that Aboriginal hunting seasons corresponded to the known lifecycle of the target species, which reveals a strong association between Indigenous culture and the ecology of the river system (Storey et al. 2001; Toussaint et al. 2001).

Through their long and continued association, Aboriginal people have a good understanding of life cycles of aquatic species and issues such as the importance of floodplain inundation (e.g. to restock billabongs with barramundi). The Aboriginal groups consider permanent pools in the Fitzroy as "living water". Ecologically, permanent pools are important refuges for aquatic species enabling them to survive the harsh dry season. Therefore, any process which impacts on pools (e.g. infilling by catchment-derived sediment or de-watering through abstraction), can have substantial impacts on fauna. The Aboriginal people emphasise that in-filling made pools unsuitable for fishing and that floods are critical to flush these pools and "cleanse the country". The strong link between ecology and culture is seen in Dreamtime stories which featured many water dependent plants and animals. Overall, there is an extremely clear linkage between ecological and cultural values of specific freshwater habitats, particularly permanent riverine pools.

LESSONS TO BE LEARNT

Comparisons with the regulation of the Ord River, and to a lesser extent, the failed Camballin Project on the Fitzroy provide clues to the possible consequence to ecological and cultural values of damming reaches of the Fitzroy River. Impoundment of the Ord River and the constant releases for irrigation and hydropower generation, has resulted in simplification and narrowing of downstream riparian zones, loss of inundation of the floodplain, reduced variability in river-flows, loss of migratory species from upstream of the dams, isolation (physical and genetic) of many fish and crustaceans above the dams, modification of sediment delivery to the lower reaches and build-up of sediment in the estuary. Loss of these ecological values has concomitantly undermined cultural values dependent on the various plants, animals and processes (Storey et al. 2001).

The reservoir produced by Argyle Dam is an ideal habitat for mosquitoes, which include the vectors for several human viruses (Ross River and Murray Valley Encephalitis). The barrage associated with the Camballin Project has re-directed flows to previously lesser-inundated regions of the floodplain (with resultant erosion) and interrupted upstream migration of many important species including the Cherabin prawn and various fish species. Overall, the major consequence of river regulation is the loss of connectivity in three dimensions: upstream-

downstream, river-floodplain, and surface to groundwater. The loss of these connections would have major ecological consequences. These changes affect ecological values, many of which underpin Indigenous cultural values.

CONCLUSION

On the basis of the studies detailed in this review, it is considered that the Fitzroy River and its floodplain still support substantial ecological and cultural values. There appears to be a strong linkage between ecological values (e.g. biodiversity) and cultural values (e.g. living waters). Unregulated floodplain rivers worldwide, and in Australia are increasingly “rare” and, with the intensification of resource development in northern Australia, require a detailed understanding of linkages between hydrology and ecology, and between ecology and Indigenous cultural values. Many of the cultural values were dependent upon ecological values (i.e. species of plant and animal), that were in turn dependent on the hydrology and morphology of the river system.

Management of such a rich and diverse system requires a sound understanding of the ecology and how it functions. However, in the absence of this detailed knowledge, it is difficult to assess the ecological consequences of flow regulation and hence it is suggested that a “precautionary approach” to water resource development be adopted. This is supported by Principle 2 of the ARMCANZ/ANZECC (1996) document which states that allocation of water should be set using the best scientific information available. At present, the knowledge of biodiversity and ecological processes in the Fitzroy River is limited.

Management of the Fitzroy River should aim to maintain the natural flow regime (i.e. natural frequency of floods and dry periods). Floodplain flooding is an essential process and dams/flow regulation can alienate the river from its floodplain. Any new developments need to be economically viable, socially (culturally) acceptable and ecologically sustainable (the concept of the “triple bottom line”).

In some instances, high conservation rivers and their floodplains need to be protected from resource development. This was recognised by Professor Peter Cullen, winner of the Prime Ministers 2001 Environmentalist of the Year Award. He noted that billions of dollars are spent trying to repair catchments and their rivers, yet little effort has been made to prevent degradation and further loss of biodiversity of rivers that are presently in good ecological condition (*The Australian*, 3/8/01). The solution proposed was national heritage listing of river reserves, similar to National Parks where further extraction of water should be prohibited. Professor Cullen named six rivers in Australia worthy of heritage listing due to their relatively undamaged state, one of which was Western Australia’s Fitzroy River.

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