Daly River fish and flows project: an environmental flows study

This is the first in a series of newsletters to provide information about a new research project on fish and environmental flows in the Daly River in the Northern Territory

May 2007

Australian Government Land & Water Australia
Charles Darwin University
Griffith University
CSIRO
Northern Territory Government
Wadeye Guwardagiin Rangers
TRaCK Tropical Rivers and Coastal Knowledge
Natural Heritage Trust Helping Communities Helping Australia

Why do we need to learn more about fish and their water needs in the Daly?

Australia's tropical rivers account for about 70% of the country's total runoff. With water becoming an increasingly valuable resource in southern Australia, there is growing interest in the water resources of the north, particularly for irrigated agriculture. There is also recognition that tropical river systems sustain important fisheries, and underpin a wealth of other natural and cultural assets valued by society.

The need to understand how our river systems work is particularly pressing in the Daly River catchment in the Northern Territory. Most of the Northern Territory's current irrigation activity is found in the Daly, and it is a region likely to experience further agricultural development, due to its reliable groundwater reserves and relatively good soils. The Daly River is also recognised for its high conservation values, especially the large and permanent river flows.

The ecological impacts of changes in river flows are poorly understood, especially in the wet-dry tropics. Previous environmental flow studies in the Daly River have examined the water requirements of plants growing in and alongside the river, algae and the pig-nosed turtle. However, the river also supports nearly 50 species of freshwater and estuarine fish, including some endangered and vulnerable species, but little is known about their environmental water requirements.

The Daly River Fish and Flows project aims to address this knowledge gap.

This project is a collaboration between Charles Darwin University, Griffith University, CSIRO Sustainable Ecosystems, the Northern Territory Government, the University of Washington, Wagiman people and the Guwardugan Rangers and the Wardaman Aboriginal Corporation. The project is funded by Land and Water Australia, the Natural Heritage Trust and TRaCK (Tropical Rivers and Coastal Knowledge research hub).

The broad aims of the project are to investigate variation in fish distribution and ecological requirements in the Daly River, as well as to document Indigenous knowledge and learn about the cultural significance of fish. This information will be combined to produce models relating fish ecology and flow, which can be used in water planning. The knowledge gained will also be applicable to other river systems in northern Australia and for future planning processes.

This project commenced in the dry season of 2006 and with additional funding from TRaCK it will continue until 2009.

Clayton Muggleton and Liz Sullivan fishing at Claravale.

What is an environmental flow study?

It is generally accepted by scientists and river managers, and increasingly by the general public, that the amount of water within a river and the timing of river flows (i.e. when floods occur, how long they last, whether floods are followed by drought periods etc) are both important for maintaining river health and for meeting the needs of the plants and animals that occur in rivers. Water is also important for meeting the needs of the people that live within a river's catchment (e.g. supply of water for the irrigation of crops or provision of drinking water for stock, domestic and industrial supply, tourism, and maintenance of Indigenous customary values). Unfortunately, environmental and human needs can sometimes be in conflict as the use of water for one purpose may reduce the amount of water available for others.

Environmental flow studies are needed when such conflicts occur or when there is a potential for conflict to arise. Their main aim is to ensure that different users of river water, including the environment, are treated fairly and that damage to the environment is kept to a minimum or to a level that is acceptable to all members of the public with an interest or stake in the catchment. As an example, if too much water was removed from a river to meet the needs of some users, then there might be too little available for irrigation or there might be too little to support healthy and abundant fish communities. In northern Australia, changes in the amount of water in a river might also adversely affect Indigenous land-owning communities.

There are many different ways to do an environmental flow study depending on the financial capacity of the funding bodies (which may determine the level of detail used or the duration of scientific investigation), the types of planned or existing water use (e.g. dry season abstraction or wet season flood harvesting), planned or existing infrastructure (e.g. dams or weirs) and the environmental asset of particular concern (e.g. fish, water birds, estuarine fisheries production etc.). However, the need for information or data to guide the process is common to all approaches.

How do we do an environmental flow study in the Daly River?

We have designed the study to make use of information that may already exist in the Daly and other nearby catchments, as well as collecting new information during field studies in the Daly River catchment. A conceptual diagram of the project design is presented in Figure 1. Existing scientific knowledge concerning fish/flow relationships is scant but studies done in nearby catchments such as the Alligator River may be used to provide some indication of how fish respond to or rely on different parts of the flow regime. Knowledge gained from traditional owner groups and other long-term residents on ecological aspects such as fish distributions and reproduction will also be gathered.

Jessie Brown holding a garfish.

Environmental flow study – Daly River

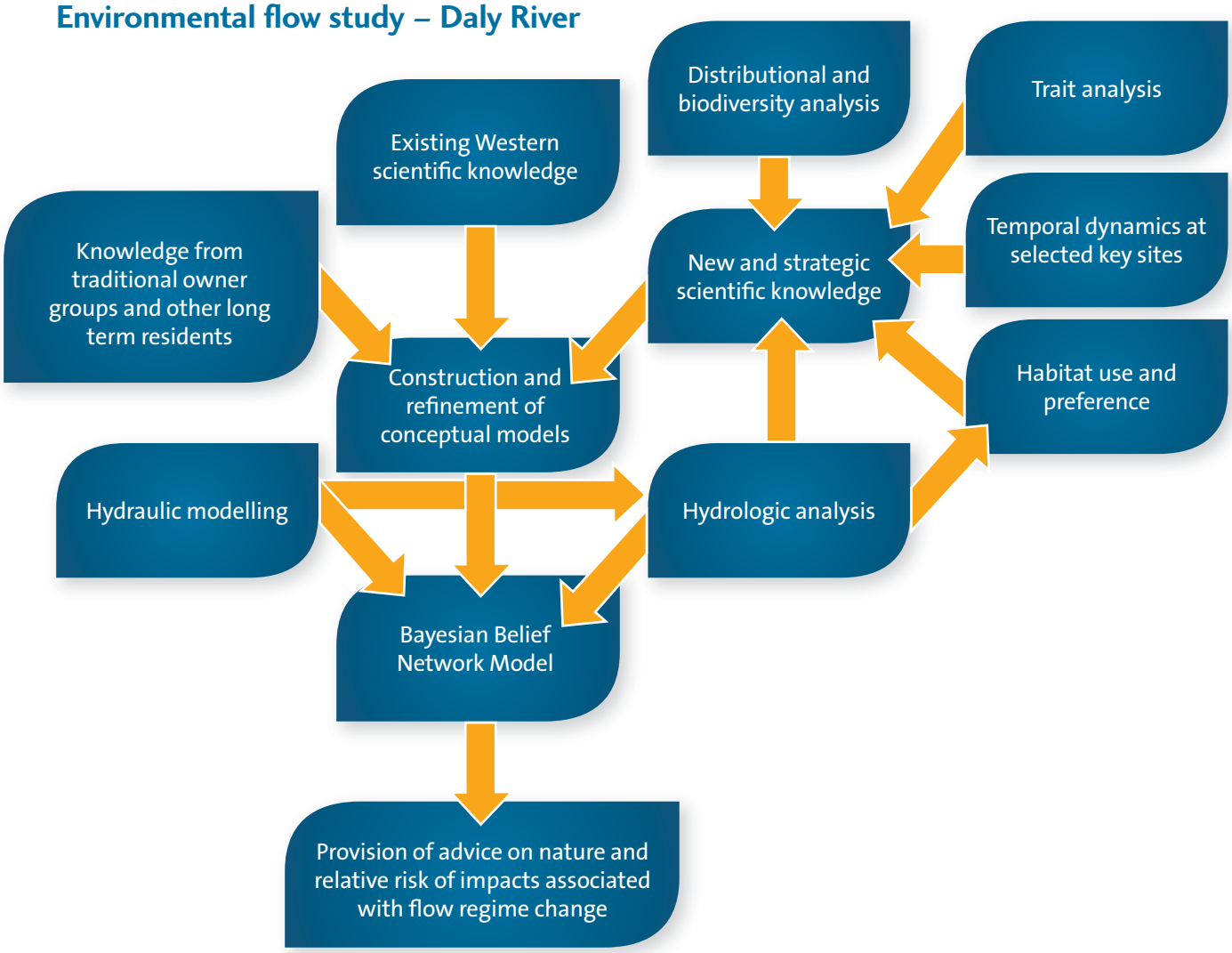

Figure 1. *Flow diagram illustrating the design of the Daly River Fish and Flows project showing how use will be made of different sets of information to predict the types and risks of impacts associated with changing the flow regime of the Daly River.*

Museum records can also be used to provide background information on the distribution of different species and this can be combined with data gathered during targeted field surveys (see Figure 2). We are monitoring seasonal (early dry season and late dry season changes) changes in fish communities and habitat at a number of locations in the catchment (see Figure 2). Data collected during these field surveys include information on fish species composition and abundance, fish lengths, fish microhabitat use, and also hydraulic habitat availability (i.e. fine scale mapping of water depth and velocity). These datasets will be used to develop predictive models of fish species distributions and relationships with habitat and flow conditions. We will also collect information on the ecological traits of different species (e.g. age structure, age and size at first breeding, fecundity, spawning habits, feeding habits, migration patterns). This information will be brought together to provide a better understanding of the mechanisms that influence seasonal changes in fish distributions and abundance.

We will hold a scientific workshop in late 2007 to capture the existing knowledge of fish in the Daly River. During the workshop, we will construct a conceptual model of how we think the fish communities and habitats respond to seasonal changes in the flow regime. This information will form the basis of a decision support system and predictive computer model (known as Bayesian Belief Network) that will allow us to evaluate the possible future impacts on fish communities if we change the natural dry season flows the Daly River.

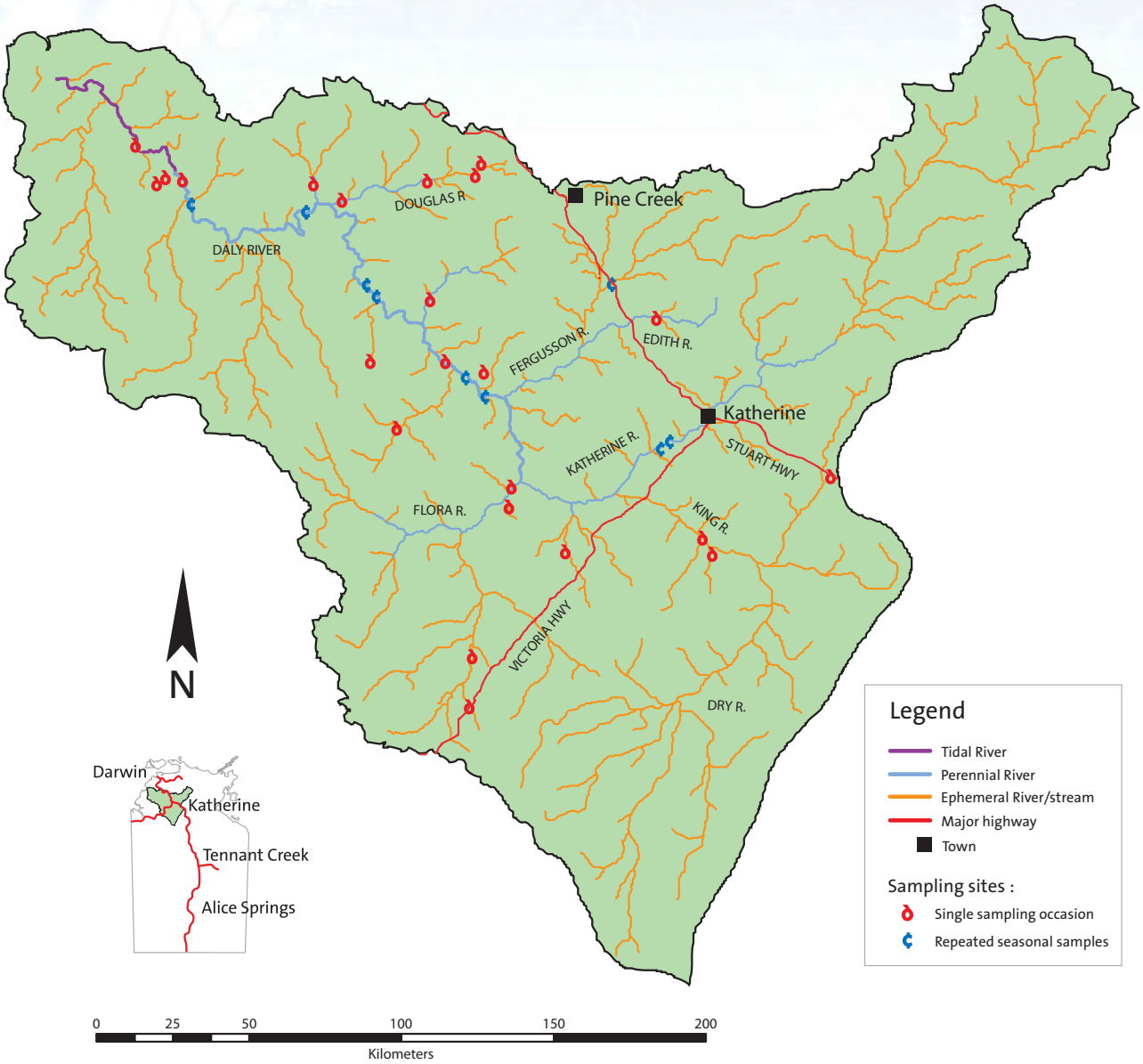

***Figure 2**. Map of the Daly River catchment showing the study sites sampled during 2006.*

How do we sample fish communities in the river?

A large part of this project will involve sampling fish communities at different locations throughout the catchment (A list of fish species recorded from the Daly River catchment can be found in the flyer accompanying this newsletter). The main technique we use is called electrofishing. This involves passing a pulsed DC electrical current through the water. Fish within the electrical field are momentarily stunned and able to be collected in a landing net. They can then be identified, measured and returned alive to the point of capture. Electrofishing is a very useful technique as it is non-destructive, can be used to sample different types of habitats effectively, and allows application of a standardised sampling protocol.

In deeper sections of the river or in areas where we might encounter estuarine crocodiles, we use a boat mounted electrofisher (belonging to NT Fisheries) powered by a generator.

In shallow streams, we use a backpack electrofisher powered by batteries. The operators are protected by rubber gloves and waders.

How will we engage with traditional owners in the region?

The project obtained the consent and involvement of the appropriate Aboriginal traditional owners from the relevant sections of the Daly River during preliminary meetings in 2005. A plain English story book describing the project was produced to ensure a good understanding of the research project in the Aboriginal community, and importantly, its management context.

A research agreement was negotiated with the Wagiman (Guwardugan) Rangers in early 2006. A similar agreement will be finalised with the Wardaman Association in 2007. These agreements guide the conduct of research activities, the communication of results and protection of intellectual property. The project has also received approval from Charles Darwin University's human ethics committee.

Aboriginal participation will be facilitated through regular communication and periodic face-to-face consultation with traditional owners, as well as through fish sampling activities. Time has been factored into the fish surveys for in-field explanations, demonstrations and training of Aboriginal assistants in fish sampling and recording methodologies. Two elders from Wagiman (Mona Liddy) and Wardaman (Bill Harney) language groups are members of the Project Steering Committee and contribute to oversight of the entire project.

Members of the research team with Wagiman Rangers at Chilling Hole, Daly River.

Wardaman traditional owners and members of the research team at the Flora River.

Collection of traditional ecological knowledge started with the first round of fish surveys held in 2006. The accounts given of fish, their ecological requirements and cultural significance are being recorded. Video documentation may be of use to the communities concerned and training will be provided to those interested. Other communication products may also be generated.

In the next newsletter we will report on the findings from the first round of sampling conducted during 2006.

Research Team:

Michael Douglas, Eric Valentine (Charles Darwin University)

Mark Kennard, Brad Pusey, (Griffith University)

Sue Jackson (CSIRO Sustainable Ecosystems)

Helen Larson, Steve Tickell, Simon Townsend, (NT Department of Natural Resources, Environment and the Arts)

Quentin Allsop, Blair Grace, Poncie Kurnoth (NT Department of Primary Industry, Fisheries and Mines)

Julian Olden (University of Washington)

For more information please contact:

Michael Douglas, TRaCK
Charles Darwin University
Ph: 08 8946 7261
Email: Michael.Douglas@cdu.edu.au

Mark Kennard, ARI
Griffith University
Ph: 07 3735 7401
Email: m.kennard@griffith.edu.au

Design and layout: First Class in Graphic Design. Images: CDU, CSIRO and fish images by Neil Armstrong