

Seed dispersal by freshwater turtles in northern Australia

R. Kennett^{1,2} and Jeremy Russell-Smith³

¹Conservation Commission of the Northern Territory, P.O. Box 496, Palmerston, NT 0831

²Faculty of Science, Northern Territory University, P.O. Box 40146, Casuarina, NT 0811

³Australian Nature Conservancy Agency, G.P.O. Box 1260, Darwin, NT 0801

INTRODUCTION

Despite the importance of chelonians in many ecosystems in terms of population size and biomass (Iverson 1982; Congdon *et al.* 1986; Congdon and Gibbons 1989) and the large number of species that are herbivorous or frugivorous (Pritchard 1979; Ernst and Barbour 1989), documented examples of seed dispersal by chelonians are rare (e.g., Auffenberg 1969 in Diemer 1986; Lagler 1943 in Congdon and Gibbons 1989; Rick and Bowman 1961). In this note we describe an example of a freshwater turtle (*Elseya dentata*) from tropical northern Australia dispersing seeds of riparian rainforest trees. Freshwater turtles may be the major animal seed dispersers for the ubiquitous semi-aquatic *Pandanus aquaticus*, providing a means by which these waterborne seeds may be dispersed upstream.

THE SITE AND THE TURTLES

The Douglas River in the Northern Territory, Australia (131°12'E, 13°50'S) is a permanently flowing river lined by riparian monsoon rainforest. The river supports a large population of Northern Snapping Turtles *Elseya dentata*; with 100 turtles per km of river, (R. Kennett, unpubl. data). *E. dentata* is largely herbivorous with over 80 per cent of its diet (by weight) composed of fruits that fall into the water from the surrounding vegetation (R. Kennett, unpubl. data).

As part of a broader study on their reproduction (Kennett, in prep.), specimens of *E. dentata* were captured in the Douglas River and transported to Darwin, where groups of up to six turtles were held for several days in large aquaria. Seeds of *Terminalia erythrocarpa*, *T. microcarpa*, *Syzygium forte*, *Nauclea orientalis*, *Ficus racemosa*, *Canthium schultzei* and *Pandanus aquaticus* were collected from the water in which the turtles were held. Seeds were planted in sterile sandy loam potting media under 50 per cent shade cloth and watered twice daily. Although not quantified precisely, over 90 per cent of seeds of all species germinated.

RESULTS AND DISCUSSION

Windfall fruits from riparian vegetation are consumed by at least three species of freshwater turtle in northern Australia (*Elseya dentata*, *Carettochelys insculpta* and *Emydura australis*; this study, Georges and Kennett 1989; Legler 1976) and similar examples have been recorded from the tropical rivers elsewhere in the world (Ernst and Barbour 1989; Moll 1989; Pritchard 1979). While most of the seed species we examined could also be ingested and dispersed by avian and mammalian herbivores, the high germination success rate we demonstrated, coupled with the large quantities of fruit consumed by the turtles, make turtles potentially important seed dispersers for some riparian trees.

Freshwater turtles spend most of their time in the water, hence are less likely to deposit seeds directly into suitable germination sites than avian or mammalian seed dispersers. Terrestrial forays for nesting, basking or movement between habitats (Gibbons 1970, 1986) may provide opportunities for seed dispersal on land, but more important is the upstream transport of seeds that would otherwise float downstream. Freshwater turtles also spread out into floodplain forests during wet season flooding (Ernst and Barbour 1989; Georges and Kennett 1989) and dispersal of seeds by turtles away from the usual river course is likely at these times.

We suggest that freshwater turtles may be major animal dispersers of *Pandanus aquaticus* seeds. *P. aquaticus* is a common, widely distributed semi-aquatic tree of northern Australia. It grows most commonly at the waters edge. Fruiting in the wet season (December–March), it produces large (2–3.5 cm × 1 cm), fibrous seeds (Brock 1988) that are carried downstream as rivers flood. We know of no records of intact *Pandanus* fruits in bird diets (J. Woinarski, unpubl. data), presumably because of their large size, and ingestion by rodents invariably results in the destruction of the seed (J. Woinarski, pers. comm.). However, several species of turtle consume large quantities

of whole *Pandanus* fruits (*Elseya dentata*, *Carettochelys insculpta* and *Emydura australis*; this study; Georges and Kennett 1989; Schodde *et al.* 1972; Legler 1976), and subsequent defecation of the seeds after the turtle has travelled upstream would enable the seeds to reach germination sites that are upstream of the parent plant. Such upstream dispersal of seeds by turtles may well be significant in the maintenance of *P. aquaticus* populations.

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