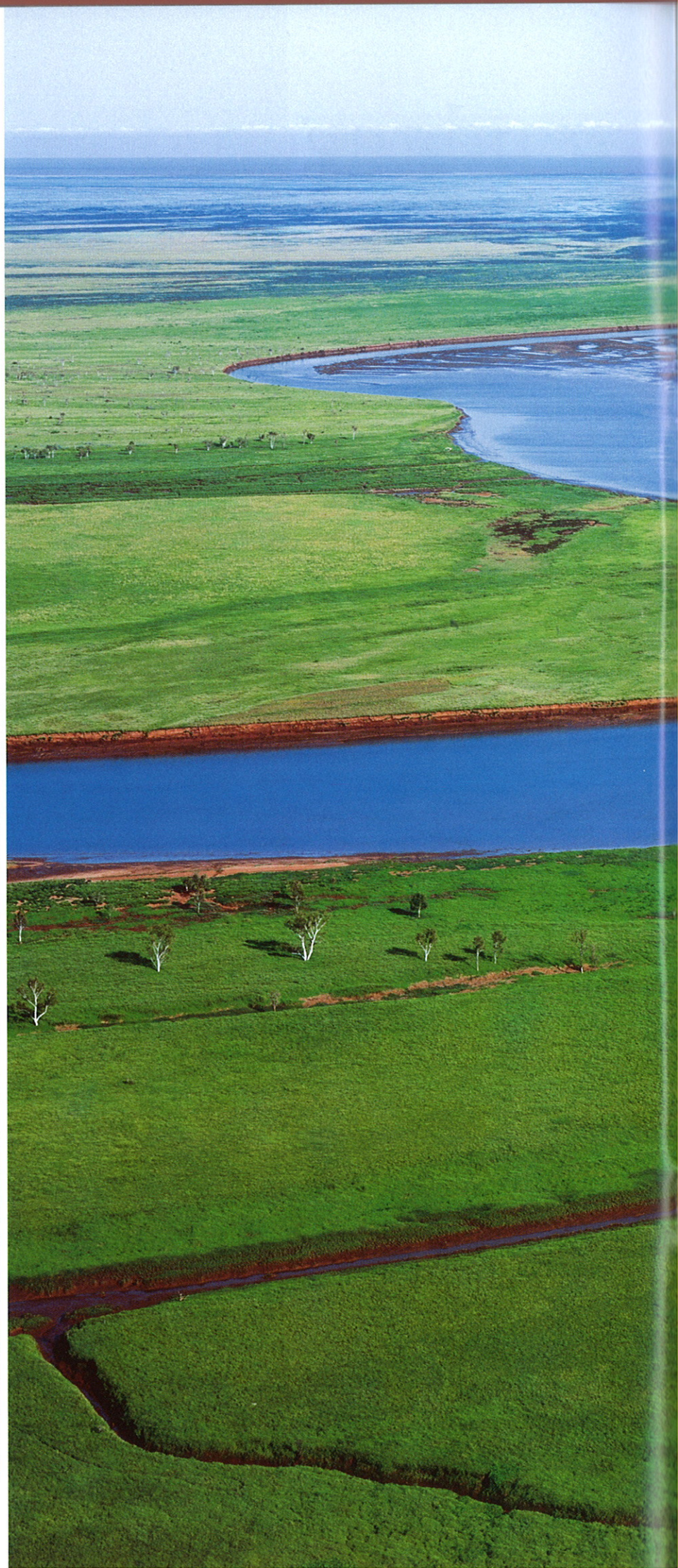
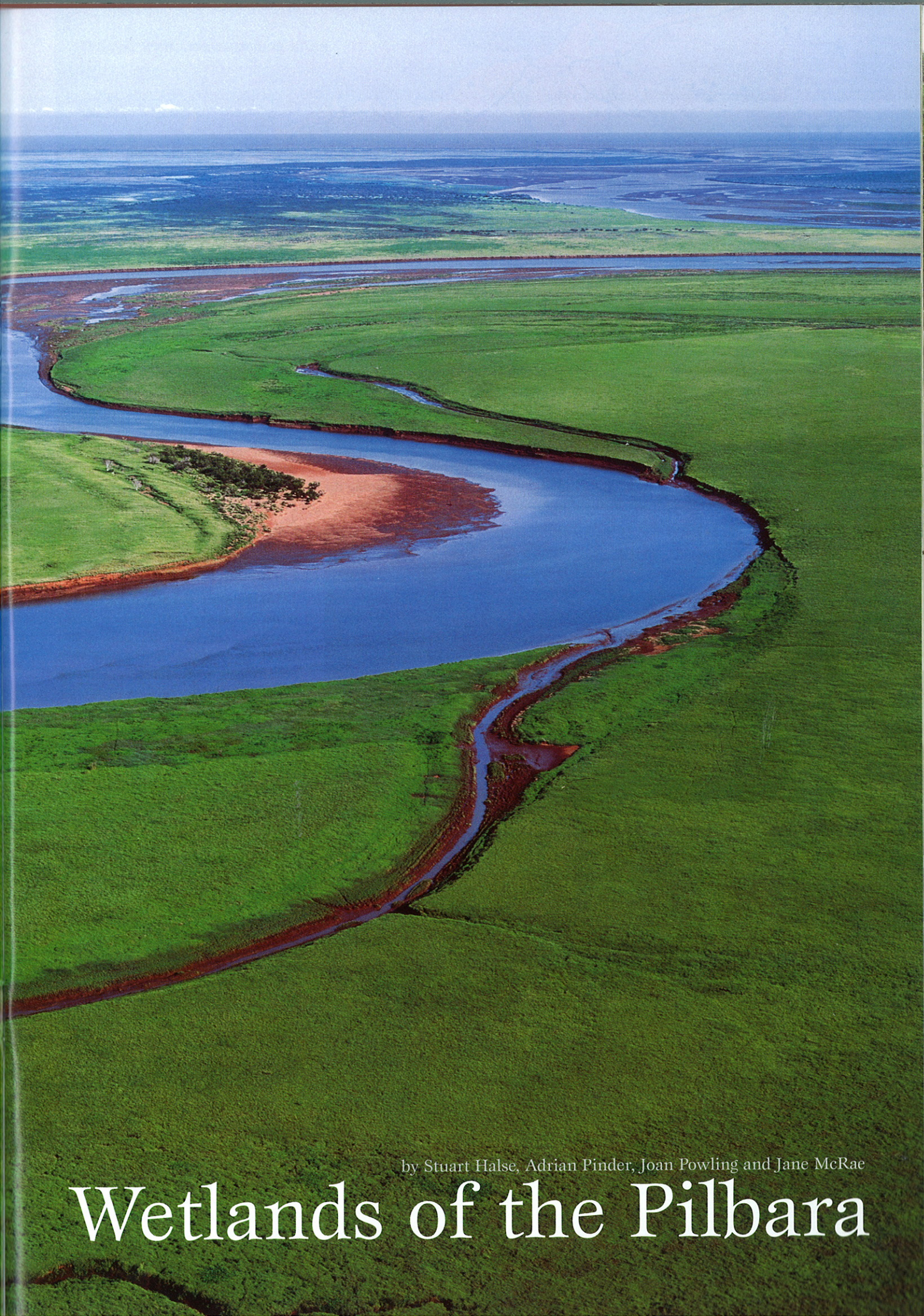
Though it is surprising given its arid setting, the Pilbara region contains some of the most biologically rich wetlands in Western Australia.





by Stuart Halse, Adrian Pinder, Joan Powling and Jane McRae

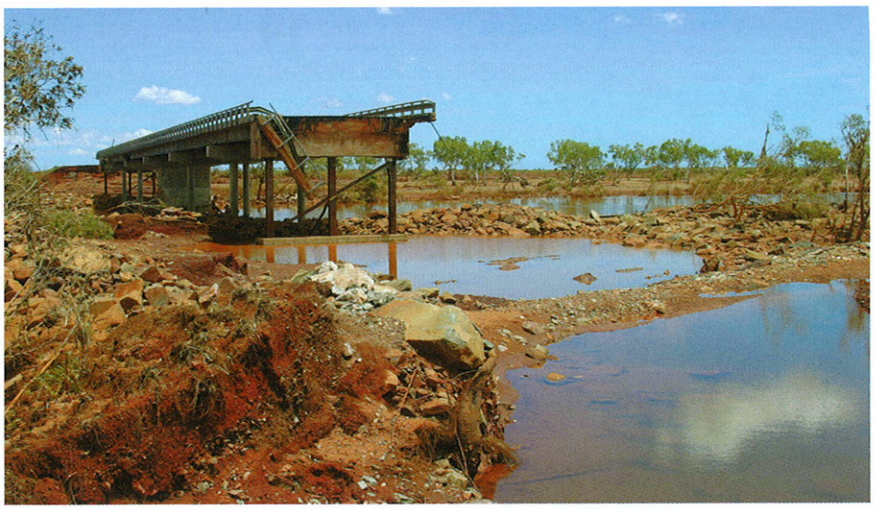
# Wetlands of the Pilbara

Whereas most people think of a wetland as containing still water, and perhaps being swampier than a lake, the scientific definition of wetland includes rivers, springs and groundwater, as well as lakes, swamps, claypans and rock pools. The Pilbara contains all of these wetland types.

A quick glance at any map shows that the Pilbara contains a number of large rivers, such as the Ashburton, Fortescue and De Grey, but these flow only for brief periods at intervals of one to three years. About once a decade in the southern Pilbara, and more frequently in the north, the flow events associated with very heavy cyclonic rain lead to widespread flooding and damage to infrastructure. An example is the damage caused to the North–West Coastal Highway around the bridge over the Maitland River south of Dampier in early 2004.

Most of the time, however, Pilbara rivers are dry along most of their length. Aquatic life is concentrated in the occasional permanent river pools that are maintained by groundwater flow. Sometimes this groundwater flow is in the form of obvious springs at the upstream end of the pool, but in other cases it is in the form of subtle inflow of water stored in the sandy riverbed. The pools themselves are scoured out by turbulent surface flow during flood events, which prevents sediment from the surrounding landscape slowly filling them. As well as maintaining the pools, the scouring action sometimes relocates them short distances downstream after flood events. This emphasises the dynamic nature of the Pilbara environment.

The biggest springs in the Pilbara occur at Millstream, on the lower Fortescue River, but springs occur on all Pilbara river systems and provide a variety of permanent aquatic habitats, even when they do not flow into river pools. Springs are often surrounded by relatively dense vegetation but can also emerge as seeps and very shallow, small pools on rocky, spinifex-covered hill slopes. In other situations, especially in gorges, springs and streams flow into deep rock pools. Circular Pool in Karijini National Park and Python Pool in Millstream-Chichester National Park are just two examples of spring-fed rock pools.



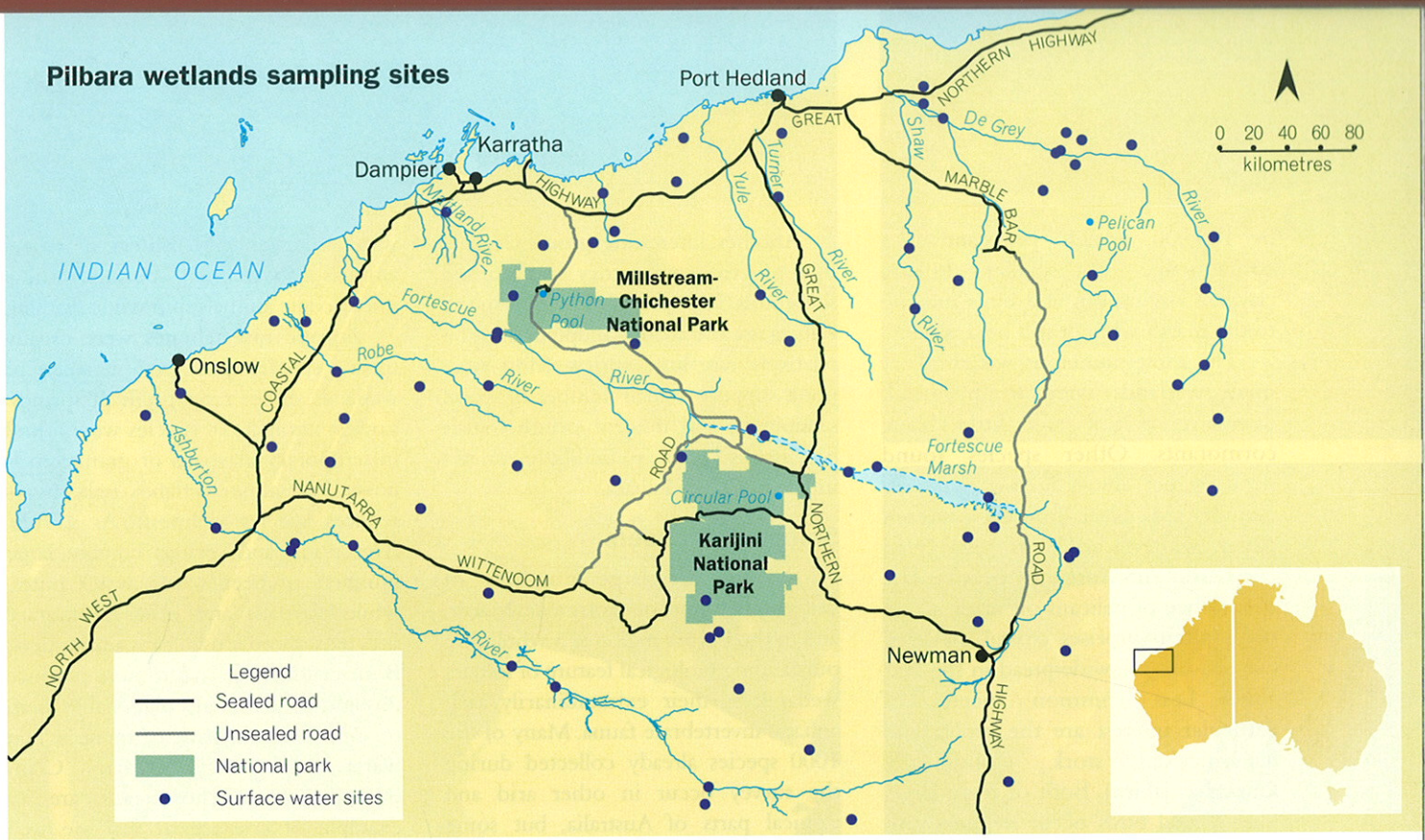
## Fortescue Marsh

At the other end of the spectrum in terms of water permanence, many claypans hold water for only a few weeks. As a result, they usually have little fringing vegetation. Most claypans fill irregularly after rain or, if they are on river floodplains, after river spates. The largest claypan in the Pilbara is Fortescue Marsh. It receives drainage from the upper part of the Fortescue River and floods every few years after major cyclones. It contains water for about six months after filling. The main waterbody of the marsh lies just north of Karijini National Park and stretches for 100 kilometres, from the

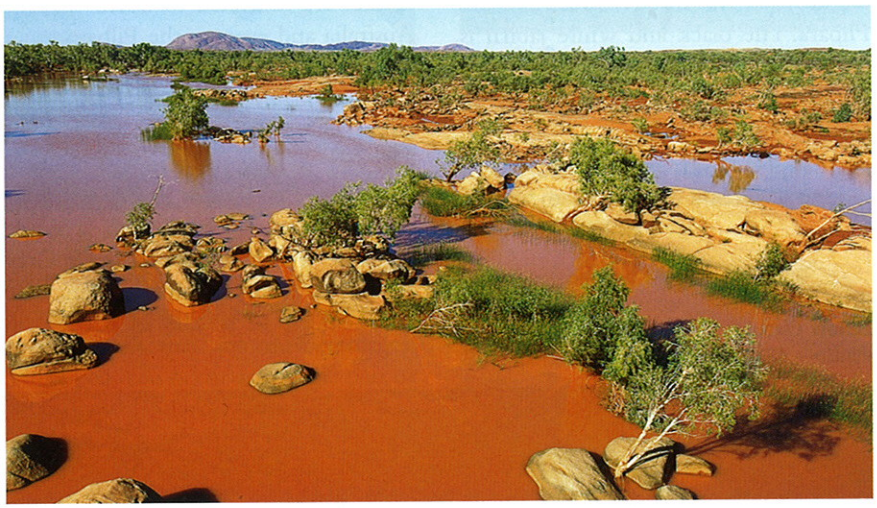
*Previous page*
**Main** De Grey River enters the ocean north of Port Hedland.
**Insets from top** Australian pelicans in flight.
*Photos – David Bettini*
A damselfly (*Agriocnemis kunjina*) alights on floating pondweed in a Robe River pool.
*Photo – Michael Lyons/CALM*

**Above left** The central span of the Maitland River Bridge was left standing after the road was washed away in 2004.
*Photo – Stephen van Leeuwen*

**Left** Fortescue Marsh as it dried in August 1999 with Karijini National Park in the background.
*Photo – Stuart Halse/CALM*




**Right** Ashburton River water carrying red mud after recent rains.
*Photo – Jiri Lochman*



Nullagine–Newman Road to BHP's Newman–Port Hedland railway line. On the western side of the railway line, the marsh extends for another 70 kilometres as a series of treed swamps, floodways and grassy pans.

Recognition of the biological importance of Fortescue Marsh and other Pilbara wetlands has come about only through the Pilbara Biological Survey (see 'Between rock and a hard place' on pages 12–19), which is currently being undertaken by the Department of Conservation and Land Management (CALM). This survey, across the whole Pilbara, is recording the waterbirds, aquatic invertebrates, algae and fringing vegetation at 90 surface-water wetlands. Fieldwork will not be completed until mid-2006, but results have already led to a major reevaluation of the importance of arid-zone wetlands for aquatic invertebrates. Groundwater systems in the Pilbara are included in the survey and have also been found to be extremely rich in species (see 'Beasts of the underworld' on pages 51–55).

## Birds, birds and more birds

The survey has shown that, as well as being the largest surface-water wetland in the Pilbara, Fortescue Marsh perhaps has the highest conservation significance. The marsh filled in 1999, 2000 and 2003 and received a small amount of inflow in 2004. Waterbird counts in August and September showed more than 250,000 waterbirds were present in each year it completely filled. Altogether, 50 species were recorded, with Eurasian coots (maximum count of 80,000 birds), three species of ducks (with up to 80,000 hardheads, 60,000 Pacific black ducks and 30,000 grey teal), little black cormorants (30,000) and black-winged stilts (25,000) being numerically dominant. Australian pelicans breed on the marsh in most years when it floods, and it was estimated that more than 1000 pairs of pelicans nested on islands in the eastern section in 2000.

Waterbird numbers are less impressive at other Pilbara wetlands, with the highest count being 536 birds at a claypan near the mouth of the De Grey River. Of another 165 surveys at 80 wetlands during the last few years, only 11 had more than 100 birds. The greatest number of species was 23 at a river pool south of Port Hedland. However, the value of the Pilbara for waterbirds is greater than results from these individual sites suggest because of the large number of river pools scattered across the Pilbara and, after cyclones, the abundance of small claypans. Some idea of how many waterbirds can occur on small claypans is given by the growth of counts at Fortescue Marsh between late May and August 2000. During these three months, waterbird numbers increased

by 180,000, or 270 per cent, as a consequence of smaller Pilbara claypans drying out and birds moving to the marsh while it still held water.

The most numerous waterbirds at small wetlands were Pacific black ducks, grey teal and little black cormorants. Other species found regularly, but always in low numbers, include the black-fronted dotterel, darter, white-faced heron, little pied cormorant and Australian pelican. The occurrence of pelicans on small inland pools often surprises coastal dwellers, but pelicans are widespread in the arid zone. Less common species of particular interest are the brolga and black-necked stork (colloquially known as jabiru). Both of these large, long-legged birds occur frequently in the Kimberley and occasionally in the Pilbara. The black and white jabiru is nearly always solitary, whereas the more gregarious brolga tends to travel in small groups.

Another interesting group is made up of the migratory palaearctic shorebirds. Two species of interest in the Pilbara are the wood sandpiper and the relatively rare little curlew. Most river pools support a small number of wood sandpipers, and diligent ornithologists will usually be able to find little curlews in the northern Pilbara.

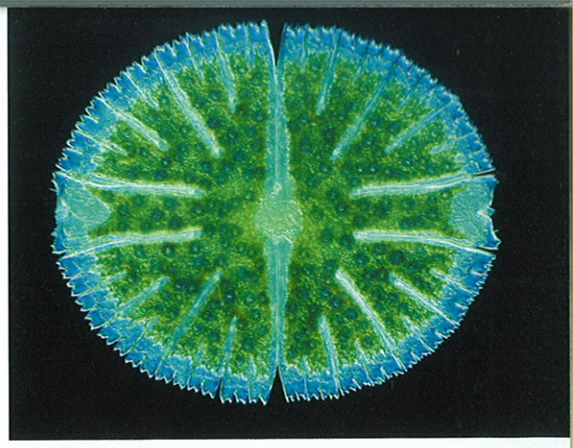
## Spineless wonders

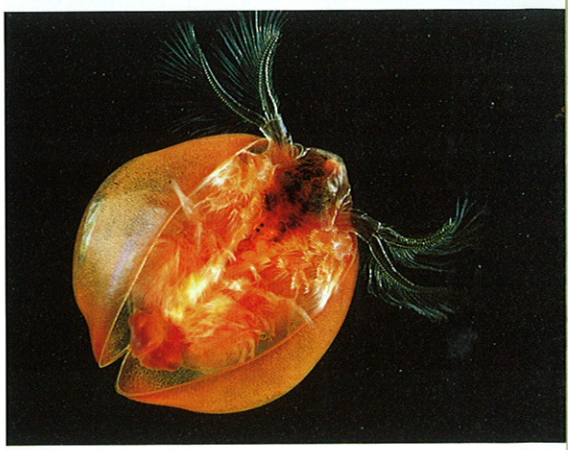
Despite the large numbers of waterbirds found on Fortescue Marsh, and in the Pilbara region as a whole, the outstanding biological feature of Pilbara wetlands is their extraordinarily rich aquatic invertebrate fauna. Many of the 1000 species already collected during the survey occur in other arid and tropical parts of Australia, but some species are restricted to north-western Australia and even to the Pilbara itself. An example of the latter is the black-and-gold damselfly (*Nosoticta pilbara*), larvae of which inhabit wetlands at Millstream. So rich is the Pilbara invertebrate fauna that 213 invertebrate species were collected from a single wetland—Pelican Pool on the De Grey River—in a single sampling event. The list included 42 species of beetles, 30 water mites and 30 rotifers, or wheel animals, so named because these microscopic animals spin while feeding.

Aquatic invertebrates were usually most species-rich at permanent wetlands, either river pools or springs. Lowest numbers of species were found in temporary claypans or granite rock pools and saline wetlands (salt always reduces species richness). As a rule, river pools and springs contain large numbers of beetles and water mites, while claypans and other temporary sites have more crustaceans and rotifers. Both crustaceans and rotifers produce drought-resistant eggs that enable them to survive in claypan sediments when water in the claypan dries. Clam shrimps, or conchostracans, are an example of crustaceans that are well adapted to arid environments. Their eggs hatch within days of wetlands flooding. The young feed on newly-wetted organic matter on the floor of the wetland, before laying their own drought-resistant spores within a couple of weeks, to ensure persistence of the species.

The one temporary wetland with high numbers of invertebrate species is the Fortescue Marsh. More than 130

**Below** Circular Pool in Dales Gorge.
*Photo – Michael Pelusey*





**Top** The desmid alga *Micrasterias thomasiana*.
*Photo – Jane McRae/CALM*

**Above** Clam shrimps (*Lynceus* sp.) lay drought-resistant eggs that hatch only after flood events.

**Left** Black-necked stork.
*Photos – Jiri Lochman*

**Below** Fortescue Marsh in 2000.
*Photo – Stuart Halse/CALM*

species were recorded there in late winter 2003. More than a third of these species were crustaceans or rotifers, and several new species were found that are currently being described. Four sites were sampled on Fortescue Marsh to capture the variety of this huge wetland, whereas only a single site was sampled at smaller wetlands. The extra sampling effort at the marsh is likely to be part of the reason such a high number of species were collected, but the good quality habitat within the marsh provides the main explanation. Thus, the invertebrate sampling reinforced the picture that waterbirds provide of Fortescue Marsh as an area of particular conservation importance.

## Array of algae

The biological values of Pilbara wetlands, however, are not restricted to waterbirds and aquatic invertebrates. Fish and frogs are widespread and many terrestrial animal species use the fringes of wetlands. Many plant and several hundred algal species occur in Pilbara wetlands. The algae include some of the most beautiful microscopic plants in the world, the brilliant green algae known as desmids. An example is *Micrasterias thomasiana*. Desmids are composed of pairs of cells that are mirror images. These cells can occur as a single pair or be united into larger colonies or long filaments. More than 100 species of desmids have been found during the survey, the most common being various species of *Cosmarium*.

Like aquatic invertebrates, algae are sensitive indicators. Some species, such as the desmids, occur only in clean water of low salinity, while other types of algae tolerate waters with high turbidity, high nutrient levels or increased salinity. Hence, species composition varies according to whether wetlands are in a relatively undisturbed condition or are heavily used by stock. Cyanobacteria, more commonly known as blue-green algae, are well known in other parts of Australia as indicators of waters containing a lot of nitrogen and phosphorus. Some of these cyanobacteria are toxic to stock when consumed in large amounts. So far in the Pilbara survey only one, very disturbed, wetland has been found to contain these organisms.

Stuart Halse is a CALM Senior Principal Research Scientist based at Woodvale. He is coordinating the aquatic component of the Pilbara Biological Survey.

Adrian Pinder, a Research Scientist based at Woodvale, is undertaking the surface-water component of the Pilbara Biological Survey.

Joan Powling, a freelance algologist based in Melbourne, is identifying algae collected as part of the Pilbara Biological Survey.

Jane McRae is a Senior Technical Officer based at Woodvale and is undertaking the surface-water component of the Pilbara Biological Survey.

Stuart, Adrian and Jane can be contacted on (08) 9405 5100.