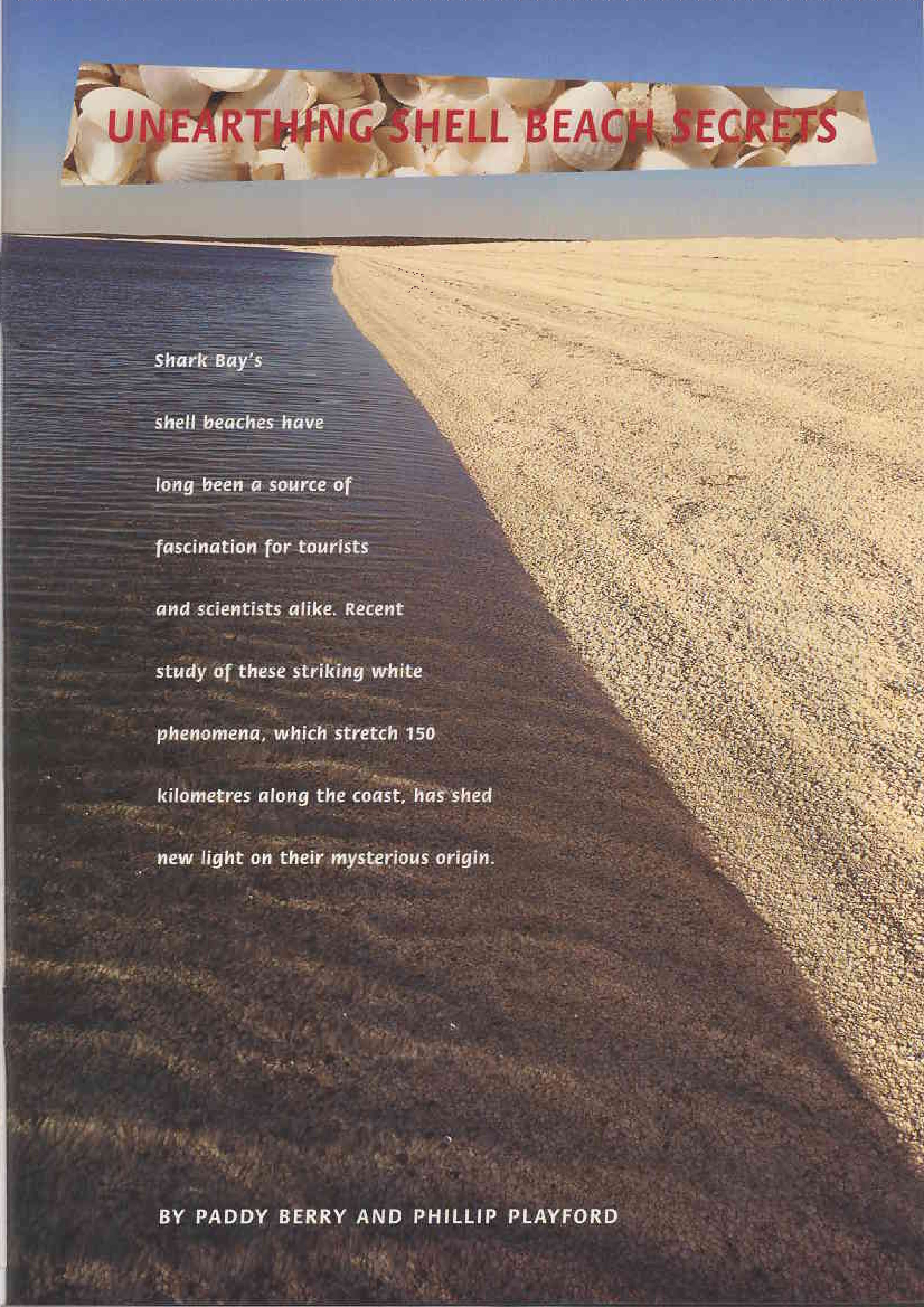
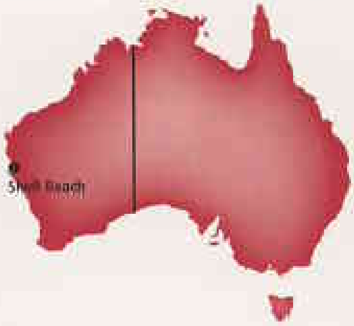


UNEARTHING SHELL BEACH SECRETS

Shark Bay's shell beaches have long been a source of fascination for tourists and scientists alike. Recent study of these striking white phenomena, which stretch 150 kilometres along the coast, has shed new light on their mysterious origin.

BY PADDY BERRY AND PHILLIP PLAYFORD

Shell beaches are one of many unique features to be found in the Shark Bay World Heritage Area. They are formed almost exclusively from the tiny shells of a single species of cockle—*Fragum erugatum*. Billions of these shells accumulate around the shores of Hamelin Pool and Lharidon Bight, forming what is known to geologists as the Hamelin Coquina. Recent studies of the beach ridges, which extend parallel to the shore in strips up to one kilometre wide and four metres thick, indicate that it is a process that has been taking place for about 5,000 years.



SAFETY IN NUMBERS

The mind-boggling quantity of *Fragum* shells leaves many visitors wondering why this particular cockle is so abundant and what causes its death and deposition on the beach. A look at the area's recent geological history provides some of the answers. Radiocarbon dating of the shell ridges suggests that *Fragum* started collecting about the same time the extensive sand bank known as the Faure Sill was formed. This bank restricted the flow of water into Hamelin Pool and Lharidon Bight and led to their becoming hypersaline (almost twice as salty as normal seawater).

While *Fragum* can withstand highly saline conditions, its normal predators, such as mollusc-eating fish, skates and crabs, are not as well adapted and are absent or only occur in relatively low numbers. As a result, densities of the potentially edible cockle increase and have been measured at around 400 per square metre in Hamelin Pool and 4,000 per square metre on the shallow, gently sloping subtidal platforms of Lharidon Bight.

SOLAR POWERED

Another reason this cockle thrives relates to the plant cells called zooxanthellae it has embedded in its tissues. While the water of the 'closed' bays is deficient in nutrients and the plankton that filter-feeding bivalves such as *Fragum* traditionally survive on, it is relatively clear and allows good penetration of sunlight. A symbiotic relationship with its zooxanthellae means that *Fragum* directly benefits from the products of sunlight-driven photosynthesis, while the zooxanthellae benefit from use of the nitrogenous and other waste products produced by the cockles.

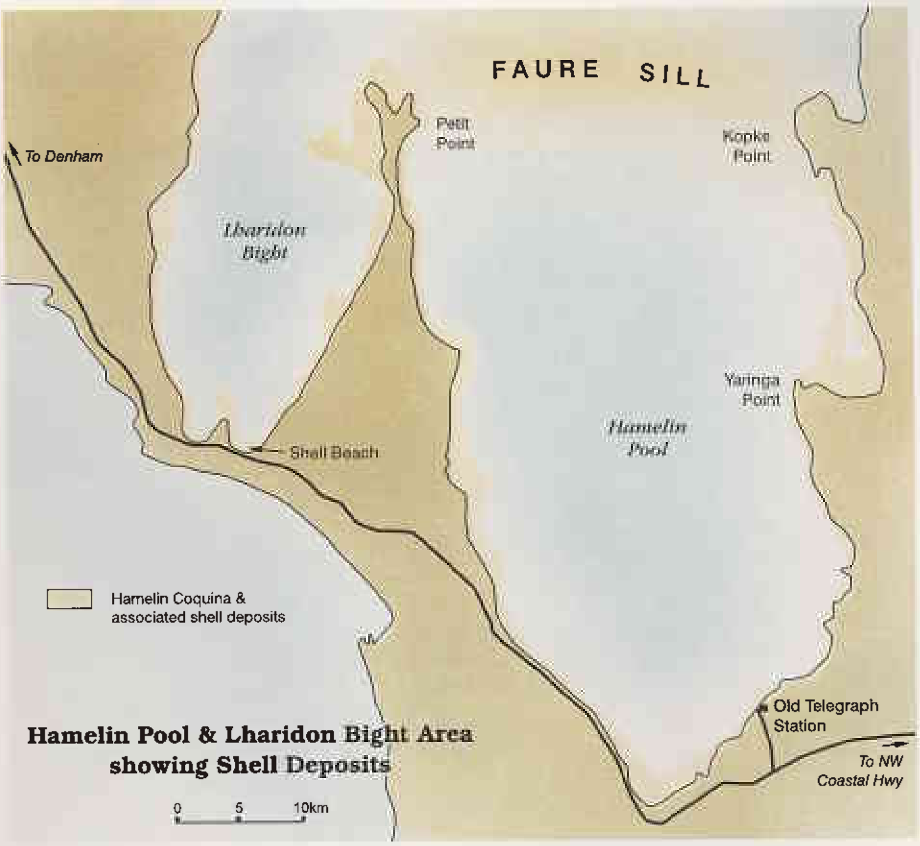
The cockles achieve surprisingly high rates of biological productivity—shell production rates of 50 grams per square metre per year have been recorded at Hamelin Pool and 400 grams per square metre per year at Lharidon Bight. When you consider the total area of subtidal platforms where *Fragum* grows (262 square kilometres at Hamelin Pool and 110 square kilometres at Lharidon Bight) the enormity of this solar-driven phenomenon is put into perspective.

Previous page
Where the water meets the beach of massed shells.
Photo – Marie Lochman

Top: Live *Fragum erugatum* nestle on a layer of dead shells up to 30cm thick.
Photo – Clay Bryce/WA Musuem

Above: A photomicrograph of the unicellular green algae (zooxanthellae) which live within the tissue of *Fragum erugatum* in a symbiotic relationship.
Photo – WA Musuem

Left: Aerial view of the beach showing Flagpole Landing, the old telegraph station, the brilliant white modern beach, and the succession of old beach ridges built up over 5,000 years.
Photo – Phillip Playford



Fragum is a synchronous hermaphrodite—male and female gametes mature at the same time and are released into the water, where fertilisation occurs externally and larvae develop. There is one major spawning each year, generally in winter or spring, followed by settlement of the larvae two months later. Most animals live for one or two years.

RIDGES TELL STORY

While some of the *Fragum* shells that are washed ashore come from recently dead animals, it seems that most remain on the bottom, sometimes accumulating in situ for many years. As a result, a layer up to 30 centimetres thick builds up on

Top: Close-up of *Fragum erugatum* shells in a modern beach ridge.

Above: Some *Fragum erugatum* shells are washed ashore closed.
Photos – Phillip Playford

Right: Landsat image of Hamelin Pool (right) and Lharidon Bight (left) showing the shallow Faure Sill which restricts water movement and causes hypersalinity.
Landsat imagery provided by Australian Centre for Remote Sensing (ACRE), Auslig, Canberra.

BUILDING BLOCKS OF LIFE

The Shell Beach ridges are made of single, loose shells (coquina) and as you move further inland they become progressively cemented together to form what geologists term 'coquinite'. Many of Shark Bay's historic buildings have been made using blocks of the cemented shell limestone taken from Hamelin Pool. This activity is now strictly controlled and blocks can only be cut to repair existing shell-block buildings. Loose shells, however, are being extracted from Lharidon Bight for shell grit for poultry and a variety of other purposes. Both beach ridges and quarries for building blocks can be seen near the stromatolite viewing site at the Old Telegraph Station at Hamelin Pool.

Above left: Quarry near the old telegraph station.

Left: Many of Shark Bay's historic buildings were built with blocks of cemented shell deposit (*coquinite*).
Photos – Jiri Lochman

the subtidal platforms of Hamelin Pool and Lharidon Bight. Some of these shells remain closed, and their valves become lightly cemented together over time.

The beaches fringing Hamelin Pool and Lharidon Bight are extended during periodic storms, when large numbers of shells are washed ashore from the subtidal platforms. The sequence of parallel low beach ridges that form are later destroyed by cyclones, which heap the loose shells into high beach ridges several metres above sea level. These major ridges provide an interesting record of cyclonic activity in the area during the past 5,000 years. Radiocarbon dating has shown that, on average, a big cyclone has passed through Hamelin Pool about every 50 years. The last of these was Cyclone Hazel, on 13 and 14 March 1979. If the average 50-year cycle holds true, scientists face a long wait before they can witness the stormy delivery of the next major ridge.

Below: The opaque, unpigmented shells allow sunlight to penetrate through them.
Photo – Paddy Berry

Above: Small beach ridges of Hamelin Coquina are created during winter storms. They become major beach ridges when they are heaped up during periodic cyclones.
Photo – Bill Bachman

Left: This succession of major beach ridges reflects cyclone activity. On average, major cyclones occur about once every 50 years.
Photo – Phillip Playford

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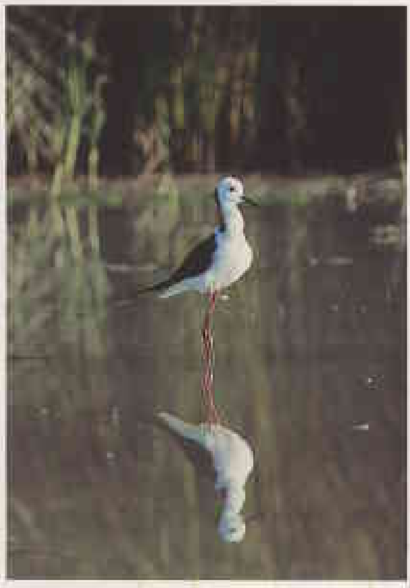
LANDSCOPE

VOLUME FOURTEEN NUMBER 1, SPRING1998

Can WA's sharefarming plantations also help fight greenhouse gases? See 'Farming Carbon' on page 17.

With increased numbers of travellers, the Canning Stock Route is in need of some TLC. See 'A Track Winding Back' on page 10.

The job of a CALM Wildlife Officer is as much about dealing with people as it is about protecting our native wildlife. See 'On the Wild Side' on page 23.



The Esperance Lakes Nature Reserves are a haven for water birds and a significant international wetland. See 'Picture the Lakes' on page 36.

There are billions of tiny white shells lining the 150-km Shell Beach in Shark Bay. But why are there so many concentrated here? Find out more on page 49.

FEATURES

REGULARS

COVER

Two years into the Western Shield program and already three Western Australian native species have been brought back from the edge of extinction, and others are growing in abundance. 'Bouncing Back', on page 28, looks at the successes of the first two years and at where we hope to be at the turn of the century.

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