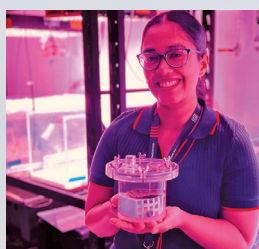


from the field **MARDIE**

JULY 2025



News from WAMSI's Mardie Offset Marine
and Intertidal Research Program



WESTERN AUSTRALIAN
**MARINE SCIENCE
INSTITUTION**

Vast West Pilbara coast the focus of major research program

Program Leader: **Kelly Waples** | Department of Biodiversity, Conservation and Attractions

The Mardie Offset Marine and Intertidal Research Program, has provided the opportunity to study aspects of Western Australia's West Pilbara coastline in unique detail.

The offset program, which is led by the Western Australian Marine Science Institution was established to develop an understanding of the West Pilbara's intertidal habitats, with a focus on mangroves, microbial mats and salt marsh, and the changes these habitats may face in the future due to climate change and salt project developments. It is supported by BCI Minerals as part of Ministerial conditions.

Dr Kelly Waples from the Department of Biodiversity, Conservation and Attractions, who is the scientific coordinator for the Program, said researchers were gathering data in locations and on topics that had previously not been studied. This would help inform decision making and management of important intertidal habitats and the Pilbara region for the future.

"There were specific knowledge gaps that needed to be addressed so development proposals such as those for large-scale solar salt projects could be more thoroughly evaluated, supporting sustainable ecosystems alongside development" Dr Waples said.

She said the area had remarkable ecosystems with extensive tidal creeks, tidal flats, cyanobacterial mats, mangroves, salt marsh and other low-lying coastal landforms. These ecosystems support a broad range of biodiversity including invertebrate communities, fish communities and protected and threatened species such as marine turtles, sawfish and migratory shorebirds.

The research themes, set up under the program included habitats and ecosystems and key fauna they support (shorebirds and green sawfish).

"Three of the Mardie projects have involved improving our understanding of the intertidal and coastal habitats of the Pilbara, their importance, ecological role and extent. This has included mapping the different coastal habitats and understanding how they have changed over time, including predicting the potential implications of sea level rise from various climate change scenarios," Dr Waples said.

"Scientists have already created a broadscale intertidal habitat map of the region and are working up a finer scale one that will support decision-making."

Additional research has focused on investigating the ecosystem role and function of these habitats to highlight their importance to the broader coastal and marine environments.

Two additional projects look at specific biodiversity groups, namely green sawfish and migratory shorebirds to understand their distribution and abundance across the Pilbara and in critical habitat areas.

"Additional research has focused on investigating the ecosystem role and function of these habitats to highlight their importance to the broader coastal and marine environments."

Each of the projects has two leaders and teams of researchers from the WAMSI partnership.

Dr Waples said the projects were at various stages.

"Main components of the three original projects are nearing completion, however additional work for these and the two new projects will extend the program into 2026."

"The progress has been really strong, especially given the remote and challenging conditions for the fieldwork including the terrain and cyclones."

She said findings were being passed on to the Department of Water and Environmental Regulation and the federal Department of Climate Change, Energy, the Environment and Water as the program progressed.



Department of **Biodiversity, Conservation and Attractions**



Sawfish tracked as part of project to better understand the vulnerable 'rhinos' of Australian wildlife

"Over 40 countries have lost at least one species of sawfish so this area is a lifeboat for three to four species globally."

Project Leader: **David Morgan** | Murdoch University

The fantastically efficient inbuilt weapon sawfish use to attack prey is also their undoing, according to researcher Associate Professor David Morgan who has studied the fish for several decades.

"The saw-like rostrum on their heads is a morphological marvel," Dr Morgan said.

"The rostrum is used to hunt, to strike food and for their own defence, but it also makes sawfish extremely vulnerable to being entangled in net."

Sawfish are critically endangered around the world and the rostrums used to be cut off and collected as grim trophies. They became protected in Australia in 2006.

"They are the rhinoceros of Australia," he said.

David Morgan is an associate professor at the Harry Butler Institute at Murdoch University's Centre for Aquatic Ecosystems.

He is the lead sawfish investigator on the Mardie Offset Marine and Intertidal Research Program.

While coastal development and net fishing have taken their toll on the world's five sawfish species, Dr Morgan said the remoteness of Western Australia's Pilbara coast had helped the area's dominant species, green sawfish.

"Over 40 countries have lost at least one species of sawfish so this area is a lifeboat for three to four species globally."

Dr Morgan said the research project had involved genetic studies from tissue sampling to establish family trees



as well as tagging linked to acoustic monitors which helped establish the population and range of green sawfish.

"One thing we have found as part of this work is that the mouth of the Ashburton River is an important pupping site for sawfish, in other words where the females come to give birth."

The study has shown that green sawfish have at least five pups in a litter.

"Our research has shown between 50 and 60 females use the Ashburton area to pup and the young stay in this area until they reach about three metres and move further offshore," Dr Morgan said.

"We know they will keep returning to this site and our studies have shown once the female pups have matured, they will also return to the area to give birth."



Shorebirds travelling thousands of kilometres to Pilbara on aerial highway

Project Leader: **Sora Marin-Estrella** | Edith Cowan University

The Pilbara coast is on a record-long travel route, traversed not by vehicles but by migratory shorebirds that fly up to 20,000 kilometres over 22 countries.

Scientist Dr Sora Marin-Estrella from Edith Cowan University, who is researching migratory shorebirds as part of the WAMSI managed Mardie Offset Marine and Intertidal Research Program, said the East Asian-Australasian Flyway between the Arctic and Australia was the biggest of the world's nine flyways and many of the birds that use the 'aerial highway' stop on the Pilbara coast to forage. More than 15 species of migratory shorebirds are found on the remote Western Australian section of coast. Exmouth Gulf is an internationally important area for grey-tailed tattler, ruddy turnstone and the critically endangered far eastern curlew.

Researchers working on the migratory shorebird project have used several methods to collect data, including leg banding and deploying cameras to capture the birds' movement, habitat use and estimated numbers.

"In November last year, ahead of the arrival of the migrating birds, we put out 22 cameras at various locations," Dr Marin-Estrella said. "We left them out for four months and removed them in mid-March."

She said it is well known that many birds use the intertidal areas, including mangroves but the cameras showed they were also using the land behind the mangroves.

"The early findings indicate that the area is important for feeding and roosting."

"We also found the far-eastern curlew mainly have fiddler crabs in their regular diet."

The study showed the areas dominated by cyanobacterial mat behind the mangroves had a huge density of fiddler crabs and may be an important foraging habitat for these seasonal visitors.

Dr Marin-Estrella said the Pilbara coast's bird life hadn't been as well studied as areas further north, renowned for birdlife.

"Around Broome, there has been a lot of work done on migratory shorebirds, but there's been less work done on those that use the Pilbara coast, so this is important research."

Populations declining

The East Asian-Australasian Flyway extends over the most populated places in the world, which puts pressure on the birds that use it.

"This flyway is used by the highest number of waterbirds on Earth, but the populations of many migratory shorebirds are declining," Dr Marin-Estrella said.

"The populations of some species have dropped by half because of human-caused pressures including habitat destruction."

Cyclone observations

Cameras set up to monitor bird activity also captured dramatic water level movement in the mangroves when Tropical Cyclone Sean formed off the WA coast.

Dr Marin-Estrella said water that was about knee-deep was seen rising to about 1.3 metres as the storm moved along the coast.

Researchers were forced to leave the area for their safety ahead of the storm's arrival. Four cameras were inundated during the weather event and one camera was lost.

All the data from the remaining cameras was retrieved and has helped to build a picture of bird activity around the cyclone event.



Mapping the remote, 'dynamic' habitats of the Pilbara coast

Project Leader: **Sharyn Hickey** | The University of Western Australia

Researchers have carried out the first-ever comprehensive mapping of the Pilbara's remote coastal habitats, shedding light on the ecological diversity of one of Western Australia's least explored regions.

Led by Dr Sharyn Hickey from The University of Western Australia as part of WAMSI's Mardie Offset Marine and Intertidal Research Program, the team mapped intertidal and coastal environments across the northwest coast – from Exmouth Gulf to Karratha.

An uncharted range of habitats was captured, including algal mats, saltmarsh and mangroves. The team uncovered five times more saltmarsh than initially expected, and found that algal mats covered an area twice the size of mangroves.

Dr Hickey said the work revealed the incredible extent of ecological features in the region, as well as the condition and connectivity of the habitats at various timepoints.

"Mapping can be quite static, yet this environment is incredibly dynamic," said Dr Hickey. "As soon as you add water, it gets complicated."

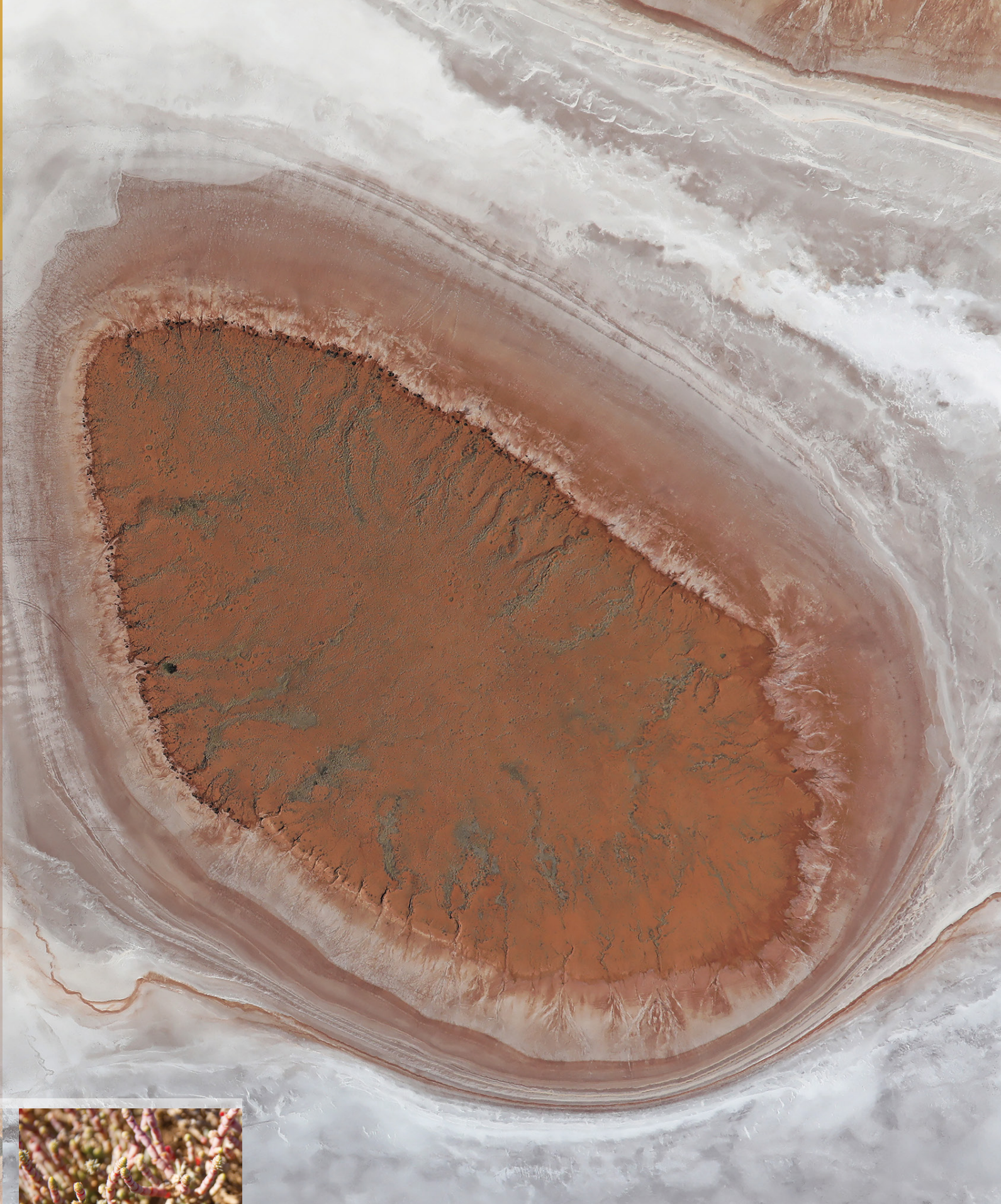
Utilising aerial and satellite imagery, and field-based surveys to label 3000 points along the coastline, researchers pieced together a detailed picture of these unique habitats despite the challenges posed by limited historical data.

The Pilbara's rugged terrain presented further obstacles, with fieldwork requiring researchers to navigate knee-deep mud while carrying heavy equipment.

"Most of your time is spent knee-deep in mud, or walking across the salt flats, with a laptop attached to your front and a spectral sensor pack on your back," Dr Hickey explained. "It's challenging, but these insights are invaluable."

The mapping effort highlights the transitional nature of these habitats over time while providing a critical foundation for understanding how they respond to natural events and human pressures.

The team plans to further refine its research through finer-scale mapping of the area and compare previous data and historical records to study seasonal trends and natural variability across the Pilbara's intertidal habitats.



"Mapping can be quite static, yet this environment is incredibly dynamic..."



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Military-like preparations, good gear and games all part of Pilbara field trips

Project Leader: **Shannon Dee** | Edith Cowan University

The Pilbara coast, with its multitude of creek systems branching out to the ocean, has become the focus of extensive fieldwork.

“You see the coastal cyanobacterial mats after a downpour go from brown to bright green and they’re literally bubbling with oxygen,” researcher Dr Shannon Dee said.

Dr Dee, from Edith Cowan University’s School of Science, works on the ecological component of the WAMSI-led Mardie Offset Marine and Intertidal Research Program. The broad ranging project includes research on coastal plant and animal life and habitats from the ocean and mangroves to samphire plains and cyanobacterial mats with their dense layers of microbes.

“The reason this project is incredible is this whole coastline is largely unstudied because it is so remote,” Dr Dee said.

The remoteness, rugged terrain and extreme temperatures are tough, but the research field trip teams are well prepared.

“These areas are extremely challenging to work in.”

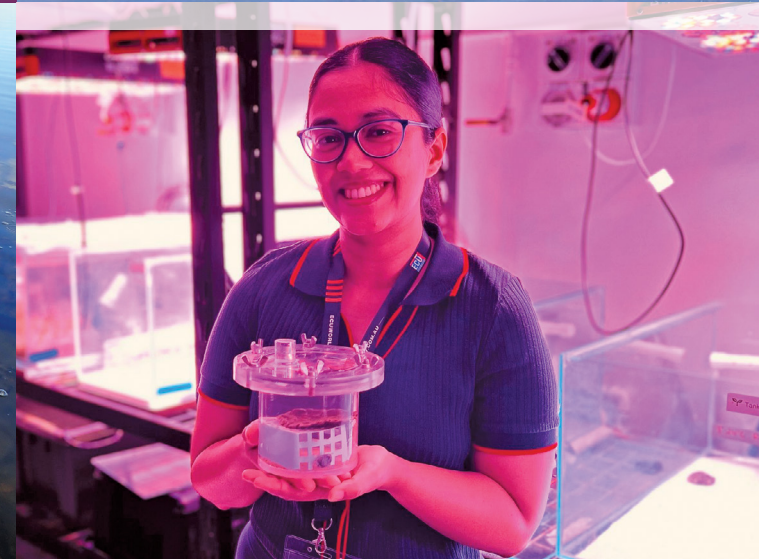
“The areas where we are doing ecosystem studies are four-wheel drive access to a certain point and then we use light-weight 8-wheeler vehicles to get across mud and soft sand.”

“These have the advantage of being less likely to bog but they also cause minimal damage to the environment,” she said.

Emergency equipment such as inflatable vehicle jacks, satellite phones, handheld radios and Emergency Position Indicating Radio Beacons (EPIRBs) are always taken on field trips.

The often intense heat means water, sunscreen, good protective clothing and rehydration sachets are also crucial.

“Also, games to keep morale up when the work is over for the day.”



Dr Dee said as well as equipment that allows the teams to safely access the coastal ecosystem, a lot of scientific gear is taken on the trips.

There are specific protocols for collecting different samples.

“We have collected core samples of the cyanobacterial mats for experiments on chlorophyll levels and DNA.”

“These are wrapped in foil and frozen straight away.”

Other experiments require a different approach.

“For experiments in chambers, we need to keep the samples under natural conditions, so we put them in containers with air holes and have them under ambient light as much as possible.”

Looking at the role of food webs and the role of migratory shorebirds has involved analysing droppings and doing stable isotope analysis on the collected samples.



Traditional knowledge and marine science unveil 150 years of environmental change in the Pilbara



Project Leader: **Mick O'Leary** | The University of Western Australia

Traditional ecological knowledge combined with historical archives and western marine science is extending the timeline of environmental change on the west Pilbara coast, offering crucial insights beyond satellite imaging and western science alone.

As part of the Mardie Offset Marine and Intertidal Research Program, scientists from the Western Australian Marine Science Institution are working with First Nations' Knowledge holders to better understand how much the environment has changed over the course of their lifetimes.

This combined approach allows researchers to track and interpret habitat changes over 150 years, from a starting point closer to its natural pristine state, instead of the 35-year window provided by satellite datasets.

Associate Professor Mick O'Leary from The University of Western Australia facilitated workshops with Wirrawandi Aboriginal Corporation in Karratha and the Buurabalayji Thalanyji Aboriginal Corporation in Onslow, gathering firsthand perspectives on environmental shifts.

During these sessions, rangers and senior Elders used large-scale maps of the Pilbara coast as a focal point for discussion, identifying and speaking about places where they had observed significant environmental changes over their lifetimes. These conversations guided subsequent on-Country visits by researchers who observed these locations firsthand, to deepen their understanding of how the natural landscape had evolved.

"Scientists fly in and fly out of research areas, collecting data before leaving. First Nations people, however, live on Country, are great observers of nature, share knowledge through generations and intimately understand how the environment has shifted," said Associate Professor O'Leary.

"Satellite imaging of the Pilbara has produced comprehensive habitat maps spanning the past 35 years, however Traditional knowledge can provide an additional level of detail, including insights into the long-term environmental impacts of pastoralism, mining, and the development of dams and other infrastructure."

Water availability and habitat loss due to climate and development were identified as major concerns, with Elders highlighting a rapid acceleration in changes over the last decade.

"The Mardudhunera and Yaburara People have observed surface water and flows along the Fortescue River changing dramatically and have observed these changes occurring faster in recent years, particularly during the last decade," Associate Professor O'Leary said.

He said the process captured details that may otherwise be missed to create the scientific narrative.

"Taking the time to go on Country, to talk to Elders and listen to what they say is changing on their Country, and seeing these changes in parallel with western science, significantly enhances our understanding of the region."

By combining firsthand observations, historical records, and scientific analysis, the project provides a broader environmental baseline, critical for understanding development impacts from Exmouth Gulf to Karratha.



Cyclone Sean timeline photos

Sora Marin-Estrella | Edith Cowan University

Take a look at the water levels in this Pilbara mangrove area when Cyclone Sean moved along WA's coast in mid-January.

The footage was captured by wildlife cameras, on the south west coast of Exmouth Gulf, which were set up to monitor shorebird movement as part of the Mardie Offset Marine and Intertidal Research Program.

Researcher Dr Sora Marin-Estrella from WAMSI partner Edith Cowan University said the water level rose from knee-deep to about 1.3 metres as the storm rolled past.



Acknowledgement and article contribution

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– Program Leader Dr Kelly Waples, Department of Biodiversity, Conservation and Attractions

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Front cover: Researcher holding segment of dense cyanobacterial mat. Shannon Dee

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Western Australian Marine Science Institution (WAMSI)
Indian Ocean Marine Research Centre
64 Fairway, Entrance 4, Crawley WA 6009
+61 8 6488 4570
info@wamsi.org.au | www.wamsi.org.au