



WESTERN AUSTRALIAN  
MARINE SCIENCE  
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**WESTPORT**

# RESEARCH

## *Highlights*



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# Hair dye and satellites tracking wandering sea lions



**Male Australian sea lions, fitted with satellite trackers and marked with numbers using hair dye, have been found to travel several hundred kilometres from their usual non-breeding season resting places around Perth.**

Scientists are studying male sea lions as part of the WAMSI Westport Marine Science Program.

Edith Cowan University is jointly leading the project with the Department of Biodiversity, Conservation and Attractions in collaboration with the Department of Primary Industries and Regional Development and Australian National University, with contributions from Werribee Open Range Zoo.

DBCA scientist, Dr Kelly Waples, said late last year the team used hair dye to mark almost 50 animals with numbers. Satellite tracking devices were fitted to more than one dozen.

*"The purpose of the study is to understand how many male Australian sea lions are using the Perth metropolitan waters and what areas are important to them."*

- Dr Kelly Waples (DBCA)

Dr Waples said it was male sea lions that used waters and islands around Perth for foraging and resting away from the breeding islands off Jurien Bay, 200 kilometres north of Perth. Not all sea lions made the journey south to Perth as the females, pups and some males remained near the breeding islands.

"We haven't analysed the data yet but one of the interesting things we have seen is some males have gone back and forth between Jurien Bay and Perth early in the non-breeding season. We are also seeing more longer-range movements than we expected with the tagged and marked sea lions. We have one male, who was tagged and marked at Seal Island near Rockingham, who we know has gone all the way to Cape Naturaliste and has been resting where fur seals haul out – or rest and socialise."

Dr Waples said several coloured hair dyes were tested on the sea lions and black was found to be the most visible and long lasting. The sea lions do moult between breeding seasons and the dye will either wear off or will be shed. The satellite tags were glued on to the sea lion's fur and can be remotely released, with the base plates being shed when the animals moult.



Associate Professor Chandra Salgado Kent of ECU said "These endangered sea lions have a slower reproduction rate than other seals and sea lions, and must travel long distances to find sufficient food to meet the energy demands required to survive and successfully breed."

"We need to understand their movement patterns and where they forage so we can make sure these foraging habitats are available to them," she said.

"The more we understand about the sea lions and how they use their habitat, the better informed we are to make management decisions that reduce impacts and pressures around them," Dr Waples said.



**Researchers at Curtin University are determining the hearing sensitivity of a local penguin species to marine noise pollution.**

The results could help determine to which anthropogenic noise frequencies little penguins ('fairy penguins') are most sensitive in the marine environment, with the aim of improving mitigation of noise pollution on local populations within Western Australia.

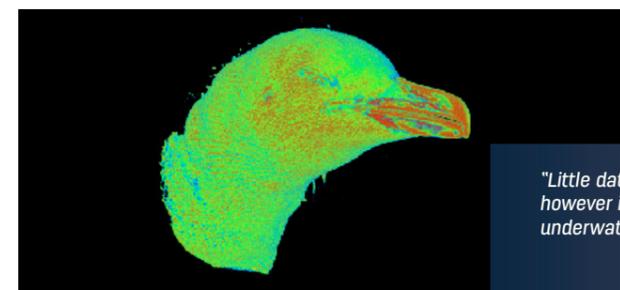
Sound pollution from shipping, near-shore construction, and other human activities can interfere with marine animals' communication and increase stress levels.



## CT scans to shed light on little penguin sensitivity



The computer simulations will be soon underway, with researchers using this model to study the sound reception process from the environment to the little penguin ear (i.e., outer, middle, and inner ear).



*"Little data currently exists on any penguin species' sensitivity to sound, however insights from other diving bird species show a response to underwater noise."*

- Dr Chong Wei (Curtin University)

## Cockburn Sound home to a surprising diversity of marine species



**Scientists on a project jointly led by Edith Cowan University and Murdoch University have found an unexpectedly diverse assemblage of marine life living on the seafloor in Cockburn Sound.**

The species were identified following surveys of benthic communities in soft sediment and naturally occurring hard substrate as part of a research project that seeks to better understand benthic biodiversity and mitigate environmental impacts in the area.

Project team members from the Western Australian Museum and Curtin University carried out a series of scuba-based visual surveys along the Kwinana Shelf, an area which had not been surveyed for some time.

At 12 sites sampled across two seasons, the researchers documented more than 2,500 individual specimens on belt transects, including the hairy and porcelain crabs, worm snails, hammer oysters, blue ring octopus and the starry octopus, *Octopus djinda*, along with purple sponge

barnacles, a range of urchins, sea cucumbers and sea stars, as well as eleven different species of scleractinian coral.

Thirty-five sponge species were identified, of which 21 have not been collected from Cockburn Sound. Every individual animal encountered was identified *in-situ* or collected for identification in the laboratory. Work on the specimens is ongoing, but currently, more than 200 species across eight major marine invertebrate groups have been identified.

Many of these specimens require genetic sequencing to confirm their identification and this is currently underway through the WA Museum's Molecular Systematics Unit.

Murdoch University and Edith Cowan University scientists have worked closely with the Museum with the processing of trawl samples that were collected in another phase of the project, and those samples will be used to assess the ecological values of the benthic community.

## Weather station installed at Cockburn Sound



Researchers from The University of Western Australia have installed a meteorological station at Cockburn Sound in the Cockburn Cement loading jetty to detect a range of atmospheric conditions.

Installation of first weather station in Cockburn Sound by researchers from The University of Western Australia's Oceans Institute and Edith Cowan University.



The weather station will be deployed for 12 months and measure wind speed and direction, air temperature, humidity, air pressure, solar radiation, precipitation and photosynthetically active radiation (PAR) at five-minute intervals.

This data will inform the analysis and interpretation of field measurements undertaken by different projects that include hydrodynamics and ecology.

A new project aims to identify the non-fishing activities in Cockburn Sound to assess the recreational use of the bay and the values it provides.

Project leader Murdoch University is working with The University of Western Australia and the Westport Program on the two-year project to better understand how the area is accessed and used, provide economic valuation for key recreational sites, and help inform future development plans.

Dr Milena Kim, from UWA's School of Agriculture and Environment, said Cockburn Sound was the most heavily used bay in Western Australia.

*"It hosts a huge range of activities and is highly valued by many different users, including for many types of recreational activity."*

- Dr Milena Kim (The University of Western Australia)

"While recreational fishing is an extremely important and well-known activity in Cockburn

## Survey to assess value of recreational activities in Cockburn Sound



Sound, less is known about how and why the bay is used for other types of recreational activity."

The research team is using an online mapping survey technique that asks the public to provide information about how and where they use the bay for recreation and the values people associate with the activities.

The survey will help inform future development by providing key data on recreational activity use, values, and spatial conflicts and how these may be influenced by further development in the bay.

Dozens of Perth divers and keen underwater photographers are helping research into the seahorses and pipefishes of Cockburn Sound and Owen Anchorage as part of a project which will also see water-borne DNA tested for evidence of the beautiful but elusive animals.

This project forms part of the WAMSI Westport Marine Science Program and Dr Glenn Moore, the Curator of Fishes at Western Australian Museum, is leading a research team looking into the diversity and distribution of syngnathids, a family of highly specialised and often cryptic fishes that also includes seadragons.

The fish have national protection under the Environmental Protection and Biodiversity Conservation Act 1999.

"They are one of the most challenging groups of fish to survey," Dr Moore said. "We can't run fine nets over the reef because they get caught up and the fish are difficult to spot diving, so we are using multiple methods including looking at historical records."

Dr Moore said citizen scientists had so far uploaded more than 1,000 images to an online portal along with the location where the fish were spotted.

He said one limitation of citizen scientists was they tended to head towards common dive areas where seahorses were well known but the information was still valuable. Environmental DNA (eDNA) testing will also start soon on water collected from Cockburn Sound to add to information about their distribution.

"We have done some water sampling and we will do eDNA work in the next few months. We have frozen water samples and these will be analysed at a specialist laboratory at Curtin University."

"We are hoping we can start to build a picture of their distribution and habitat preferences," Dr Moore said. He said part of the eDNA work involved building a DNA library.



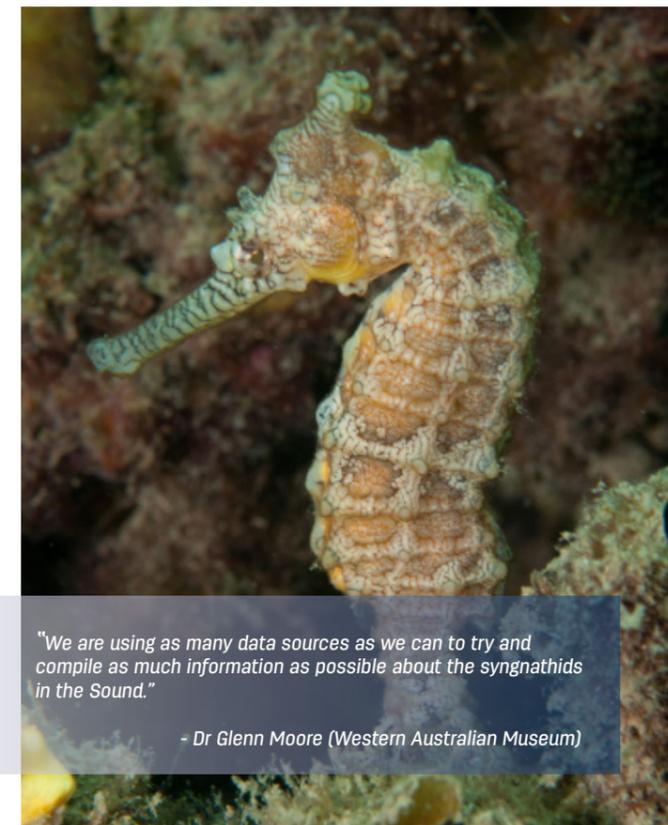
## Studying the elusive syngnathids of the Sound



"You need to have something to match the eDNA to when we are doing the analyses. We need to get DNA from specimens we are looking for and that is a challenge because we don't get to collect all the species we know are there."

Dr Moore said most syngnathids lived in shallow coastal waters and were especially reliant on habitats well represented in Cockburn Sound, including seagrass, filter-feeder communities, shallow detritus, reefs and artificial structures.

He said the distribution, habitat preferences and abundance, particularly of seahorses and pipefish, wasn't well known but the research aimed to find out more with the aim of improving their protection.



*"We are using as many data sources as we can to try and compile as much information as possible about the syngnathids in the Sound."*

- Dr Glenn Moore (Western Australian Museum)

# Big pods and 'fearless mums' among the dolphins of Kwinana Shelf



A dolphin with a distinctive white flash and a female bearing the scars of a shark bite, likely suffered while protecting her calf, were among about 120 individual dolphins recorded by researchers in the Kwinana Shelf area in 2022.

Dr Delphine Chabanne, from Murdoch University's Harry Butler Institute, is leading the project which forms part of the WAMSI Westport Marine Science Program and involves monitoring dolphin distribution from Woodman Point to James Point within Cockburn Sound.

The dolphins that were recorded included 24 calves under two years of age. The research team did the surveys from a boat travelling along parallel lines, 500 metres apart.

Dr Chabanne said 55 percent of the non-calf dolphins were re-identified from the last survey work between 2011 and 2015, indicating there were long term dolphin residents in Cockburn Sound.

*"The long-term connection with other resident communities is also supported with four of the Swan Canning estuary resident male dolphins observed interacting with dolphins in Cockburn Sound,"*  
- Dr Chabanne (Murdoch University)

The team photographed the animals, noted their GPS coordinates and recorded water temperature and depth at the locations.

"We were seeing 15 to 35 dolphins in a pod, sometimes breaking into smaller groups then re-joining before breaking again into smaller groups, all in less than 30 minutes. This fission-fusion behaviour is typical in bottlenose dolphins."

Dr Chabanne said 'Tippy', one of the adult females, had a damaged dorsal fin from a shark bite.

"The females are more vulnerable to being attacked because the sharks will often target the calves and the mothers will work very hard to protect them."

The first time 'Tippy' was recorded with fresh shark bites, her calf was only two-months-old. Two weeks later, 'Tippy' had suffered from further shark bites. The next time she was seen, unfortunately, her calf had disappeared.



*"One of the challenges was to make sure we have photographs for all dolphins when the groups are large."*  
- Dr Delphine Chabanne (Murdoch University)

Predation by other animals is not the only risk. Dr Chabanne said researchers spotted at least two calves with fishing lines around their bodies or pectorals.

Dr Chabanne said 'Tippy', was first recorded in the early 1990s and is believed to be close to 40 years old. In fact, several individual dolphins observed in Cockburn Sound during the last year were between 30 and 40 years old. Another female called 'Jinx', with a distinctive white mark on her back, is believed to be close to 30 years old and gave birth to a new calf this year.

Dr Chabanne said the average life expectancy for a female in the wild was 40 years. Males often didn't survive beyond 35 because of fighting and riskier behaviour such as venturing into less protected areas.

The researchers are looking at where the dolphins in the Kwinana Shelf area spend most of their time during the year and working out why they are in certain areas.



## Sediment sampling by scientists in Cockburn Sound and Owen Anchorage has uncovered thousands of tiny marine animals and more than 200 unique species.

Researchers from Edith Cowan University (ECU), Murdoch University (MU) and Western Australian Museum (WAM) found the animals, known as benthic invertebrates, living in and on top of sediment in 30 sites.

Professor Glenn Hyndes, from ECU, said the sediments were collected across two seasons

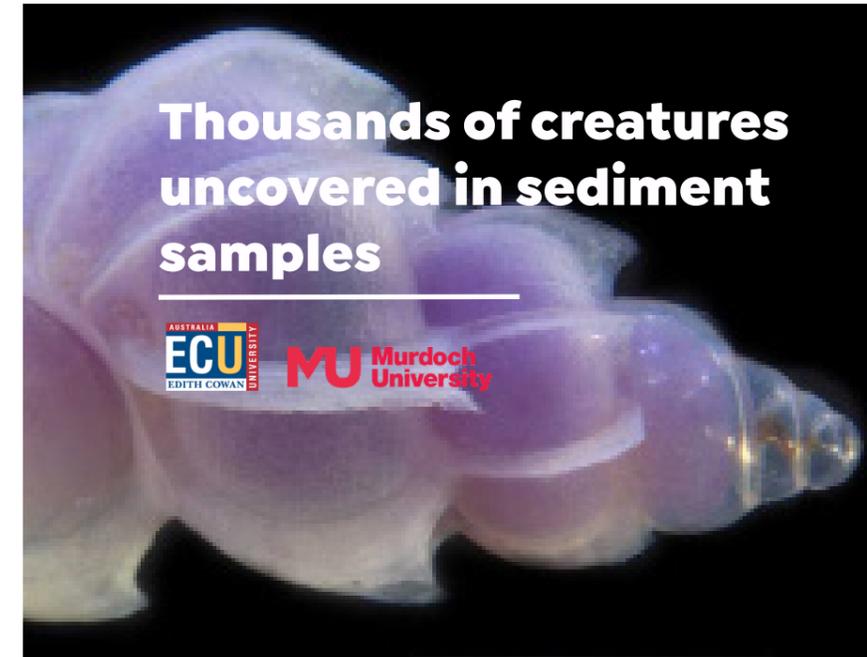
using a Van Veen Grab Sampler which was operated on a boat to scoop up sediment.

"Sorting and species identification is continuing but, at the moment, more than 17,000 individuals from eight major invertebrate groups have been found."

"Sediments from the sites were sieved to remove fine mud which left behind coarse sediment along with the animals," Professor Hyndes said.

"During hundreds of hours work we found animals such as adult worms, snails, crustaceans, urchins and bivalves which ranged from one to five millimetres in size," he said.

"We used tablespoons to locate and separate often fragile animals from the sediment. Taxonomists at WA Museum have been working constantly to identify the species characterising the hidden diversity of this urban seafloor habitat."



## Thousands of creatures uncovered in sediment samples



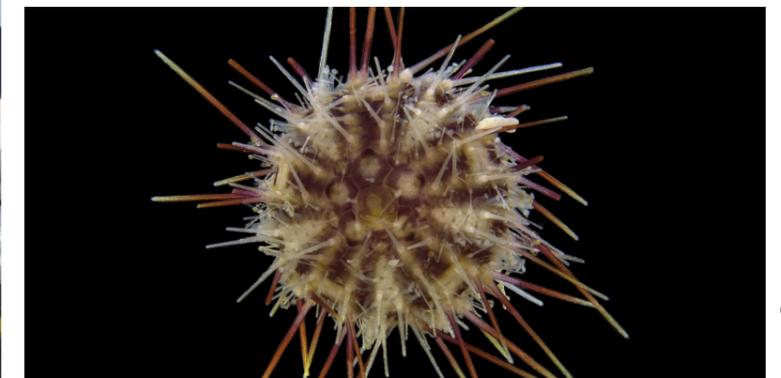
*"This is the first benthic survey targeting invertebrates to be carried out at this scale in the Cockburn Sound area and the sheer quantity and diversity of invertebrates has been an interesting and exciting discovery."*

- Professor Glenn Hyndes (Edith Cowan University)

"The data produced from this work will tie into similar projects focused on the abundance, diversity, distribution and diets of larger animals in Cockburn Sound and the ecosystem of which they are an important part."

Professor Hyndes is working on the project, conducted under the WAMSI Westport Marine Science Program, with Dr James Tweedley and Dr Sorcha Cronin-O'Reilly from MU, Henry Carrick and Leah Beltran from ECU, along with Dr Peter Middelfart, Dr Lisa Kirkendale, Dr Andrew Hosie, Associate Professor Zoe Richards, Oliver Gomez and Ana Hara from WAM.

As part of the project, researchers are also investigating the settlement of species on different hard substrates and under different conditions and locations. This forms part of the program and understanding how to improve the effectiveness of substrate in a concentrated area will help develop successful, large-scale initiatives.



# Underwater symphony of noisy shrimp and whistling dolphins



Waves crashing, boats motoring and seabirds squawking are what we typically hear at the beach.

But a WAMSI research team at Cockburn Sound is listening to the soundscape underwater and recording everything from the 'popping' noise of tiny snapping shrimp to fish sounds and whistling dolphins. Vessels travelling across the water are also picked up.

Dr Iain Parnum, from Curtin University's Centre for Marine Science and Technology, is part of a research team that has been using underwater microphones, known as hydrophones, which are linked to a recording device and lowered into the water.

"We put them in the water and leave them on the seafloor for several months at a time, so we have this continual data," Dr Parnum said.

"We are trying to understand the underwater soundscape of Cockburn Sound. We want to characterise different sounds that can be heard, how loud they are and how that soundscape changes through the year."

He said it was also useful for locating different species and information will be shared with other researchers involved in the WAMSI Westport Marine Science Program.

"Probably in coastal areas like this, one of the main sounds is anthropogenic or human caused."



"Everyone sees dolphins and it's always nice to see them, but you also hear them chatting away underwater."

"We need to understand what the baseline sounds in Cockburn Sound are."

The team is yet to record mulloway, but Dr Parnum said they're a fish that has a distinctive sound.

"Sometimes, if there's enough of them, they like to gather together to do choruses particularly after sunset. That is something we have heard in other sites," Dr Parnum said.

Other WAMSI Westport Marine Science Program scientists are doing related research on the hearing physiology of animals in the area including little penguins, and the behavioural response of fishes to underwater noise.



"We are monitoring places where they have typically been finding dolphins but also areas where they haven't. We want to know what the overall sound levels in those areas are, if they are overwhelming and making it difficult for dolphins to communicate."

- Dr Iain Parnum (Curtin University)

Researchers are looking at the foodweb of Cockburn Sound and Owen Anchorage to help identify critical species in the area.

Dr Roisin McCallum, a Research Associate at Edith Cowan University's School of Science, is a team member on the project as part of the WAMSI Westport Marine Science Program and said one element of the study involved looking at the gut contents of fish to see what they'd most recently ingested.

"This work, which is ongoing, has highlighted that crustaceans play a crucial role in the foodweb as they're consumed by most fish species and make a huge contribution to many, including baitfish," Dr McCallum said.

"Some species, for instance butterfish, are opportunists and feed on a very broad range of prey allowing them to tolerate shifts in prey abundance."

Along with gut content analysis, the team is using stable isotope analysis (SIA).

Dr McCallum said stable isotopes of a consumer will reflect those of its food sources ('you are what you eat') and provide a longer term understanding of energy transfer.

# Marine foodweb project identifies crucial species



"Understanding dominant food sources and the complexity of a foodweb helps us to determine important species which we can monitor during and post stressors such as underwater construction. This will provide information on the ecological health of the foodweb to management."

- Dr Roisin McCallum (Edith Cowan University)

"A large suite of fish, invertebrate and macrophyte species have been processed for SIA."

"Collaboration with other projects has allowed little penguins, dolphins and Australian sea lions to be included."

# 'Seeds for Snapper' 2022 Season Success

Scientists researching the seafloor of Cockburn Sound, as part of the WAMSI Westport Marine Science Program, are celebrating the success of a community-based seagrass restoration project supported by OzFish.

OzFish Seeds for Snapper recently reached a pivotal milestone with more than 1.2million seagrass seeds dispersed into the water, largely thanks to dedicated volunteers.



The project will now scale up its operations with funding support through the marine science program.



Dr McCallum said, once fully compiled, a statistical model would determine the dominant food sources, highlighting important pathways of energy throughout Cockburn Sound. It would also provide its first comprehensive foodweb.



## ACKNOWLEDGEMENT AND ARTICLE CONTRIBUTION

### HAIR DYE AND SATELLITES TRACKING WANDERING SEA LIONS (Page 1)

Australian sea lions in the Perth Metropolitan area (abundance: movement, habitat use and diet)

**Project Leaders:** Chandra Salgado Kent (ECU) & Kelly Waples (DBCA).

### CT SCANS TO SHED LIGHT ON LITTLE PENGUIN SENSITIVITY (Page 2)

Hearing sensitivity of Australian sea lions, little penguins, and fish.

**Project Leader:** Christine Erbe (CU).

### COCKBURN SOUND HOME TO A SURPRISING DIVERSITY OF MARINE SPECIES (Page 2)

Benthic communities in soft sediment and hard substrates: baseline data, pressure-response relationships of key biota for EIA, and mitigation strategies for artificial reefs.

**Project Leaders:** Glenn Hyndes (ECU) and James Tweedley (MU).

### WEATHER STATION INSTALLED AT COCKBURN SOUND (Page 3)

Hydrodynamics: provision of multi-decadal ocean boundary conditions and field measurements.

**Project Leader:** Chari Pattiaratchi (UWA).

### SURVEY TO ASSESS VALUE OF RECREATIONAL ACTIVITIES IN COCKBURN SOUND (Page 3)

Recreation, amenity and aesthetic values.

**Project Leader:** Michael Hughes (MU).

### STUDYING THE ELUSIVE SYNGNATHIDS OF THE SOUND (Page 4)

Spatio-temporal distribution of syngnathids in Cockburn Sound.

**Project Leader:** Glenn Moore (WAM).

### BIG PODS AND FEARLESS MUMS AMONG THE DOLPHINS OF KWINANA SHELF (Page 5)

Spatio-temporal distribution of key habitat uses and key prey species for Indo-Pacific bottlenose dolphins in Owen Anchorage and Cockburn Sound, including a fine scale understanding of the use of the habitats in the Kwinana Shelf.

**Project Leader:** Delphine Chabanne (MU).

### THOUSANDS OF CREATURES UNCOVERED IN SEDIMENT SAMPLES (Page 6)

Benthic communities in soft sediment and hard substrates: baseline data, pressure-response relationships of key biota for EIA, and mitigation strategies for artificial reefs.

**Project Leaders:** Glenn Hyndes (ECU) and James Tweedley (MU).

### UNDERWATER SYMPHONY OF NOISY SHRIMP AND WHISTLING DOLPHINS (Page 7)

Baseline soundscape, sound sources and transmission.

**Project Leader:** Christine Erbe (CU).

### MARINE FOODWEB PROJECT IDENTIFIES CRUCIAL SPECIES (Page 8)

Trophic pathways and food web structure.

**Project Leaders:** Glenn Hyndes (ECU) and James Tweedley (MU).

### SEEDS FOR SNAPPER (Page 8)

Seagrass restoration program.

**Project Leaders:** Gary Kendrick (UWA) and Jennifer Verduin (MU).

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