RESEARCH
Highlights

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WESTPORT

Studying the sizes, seasons and whereabouts of Cockburn Sound's squid

Department of Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA

Innovative research in Cockburn Sound is looking at the distribution, abundance and seasonal habits of squid – a popular catch for recreational fishers.

The project is part of the WAMSI Westport Marine Science Program and designed to better understand the population of squid in the area. It is one of the first projects in Australia to try to determine localised habits of southern calamari – the main squid species in Cockburn Sound.

Dr Daniel Yeoh from the Department of Primary Industries and Regional Development, who is part of the research team, said scientists had been doing monthly sampling at up to 30 sites from Fremantle to Rockingham.

"We are looking at which areas of the Sound are most important to squid, including specific habitats and depth."

- Dr Daniel Yeoh (DPIRD)

"Certain habitats like seagrass generally have higher catch rates than bare sand."

He said the exact location and depth of every squid caught was recorded using a GPS. Squid were then quickly measured and their sex noted before being released. A range of environmental parameters were recorded on each sampling occasion, including temperature, water clarity, weather and sea conditions.

"Scientists are finding out what factors influence the distribution and abundance of squid and how this is affected by environmental conditions such as temperature and water clarity. A range of biological information has also been gathered to improve the understanding of squid life cycles in Cockburn Sound," Dr Yeoh said.

The sites selected for sampling ranged in depth from two to 15 metres and contained areas with dense seagrass meadows, areas with sparse seagrass coverage, and sandy areas with little or no vegetative cover.

"Studies in the eastern states have shown certain species of seagrass are more important for breeding and squid to lay their eggs on, so not all seagrass is the same."

He said the research was ongoing but there were seasonal trends emerging.

"We started this research in August 2021 and the catches were moderate and then they declined in spring and summer. By the next autumn, catch rates increased."

"Over summer the young squid grow and by the following autumn they reach a size where they can be caught, so catches increase."

"Squid have a very short life cycle and only live for about one year. Their peak spawning is during spring when the large adult squid lay eggs and then die-off."

Dr Yeoh said most of the squid caught by the researchers were released but they were initially kept in holding tanks on the research vessels.

"Because we do not want to catch the same squid twice, we put them in an aerated holding tank and we have found they release well. They do not tend to release well if they are kept in a bucket."

Seagrass put to test to find best species for withstanding climate change impacts

AUSTRALIA ECU EDITH COWAN UNIVERSITY

Researchers looking at the possible impact of climate change on seagrass have tested the tolerance of the plants to rising temperatures after collecting samples at locations spanning 600 kilometres.

Nicole Said, a research associate from Edith Cowan University who is part of the WAMSI Westport Marine Science Program project, said six seagrass species were collected within Cockburn Sound and one, *Posidonia sinuosa,* was collected along Western Australia's coast from Geraldton to Geographe Bay.

The samples, which represent species that are all found in Cockburn Sound, were then put in chambers and subjected to incremental increases in water temperature from 15 to 43 degrees over 12 hours.

Oxygen changes in the water were measured to calculate the plant's photosynthetic rate or the rate at which light energy was converted into chemical energy during photosynthesis. The experiments allowed researchers to understand at what temperature the plants thrived or were stressed.

"It appears from the species that we looked at in Cockburn Sound, the one most at risk from rising temperatures was *Zostera nigricaulis* which is commonly known as eel grass," Ms Said stated.

Halophila ovalis, a species found in temperate to tropical areas and commonly known as paddle weed, spoon grass or dugong grass, was most able to withstand the higher temperatures.

Other species tested were *Amphibolis griffithii, Posidonia sinuosa* (the most widespread species in Cockburn Sound), *Posidonia australis* and *Amphibolis antarctica*, which are larger plants than the other two species assessed.

The research team found a heatwave in Perth that produced temperatures between three and four degrees higher than average summer temperatures would be likely to have a negative impact on the larger species which are generally able to withstand pressures for a greater duration than smaller species but, once damaged, take longer to recover.

Heatwaves are predicted to become more frequent and more intense under climate change. An extreme marine heatwave in 2010 and 2011 saw a large area of seagrass in Shark Bay destroyed.

"With increasing ocean temperatures and an increase in marine heatwave events, seagrass species living close to their thermal limits are at risk from rising temperatures. There is limited temperature threshold information for seagrass species, which is critical information and can forewarn both present and future vulnerability to ocean warming."

"There are other researchers around the world looking at climate resilience, but we have been missing this key baseline data to look at the physiology of seagrasses and how they may respond to these climate scenarios."

ECU's Associate Professor Kathryn McMahon, who co-leads the research on seagrass resilience said the findings were significant.

"These findings are really exciting as they indicate there are differences among seagrass species and population along our WA coast to ocean warming. We can harness these differences and take actions to try and build resilience into our spectacular seagrass meadows."

- Associate Professor Kathyrn McMahon (ECU)

From sonar to drones: Fishing around for best research results

Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

Researchers are using everything from sonar and baited cameras to traps and drones as part of a project looking at the distribution and abundance of key fishes and invertebrates in Cockburn Sound.

The Department of Primary Industries and Regional Development's Dr Danielle Johnston said a range of methods were being used to monitor larvae, juveniles and adults of commercially, recreationally and ecologically important species. They were being sampled in various habitats and depths. Dr Johnston leads the project on spatial distribution and temporal variability in life stages of key fish species.

"February this year marked the end of 18 months of field work, including 220 days sampling with more than 300,000 individual fish and invertebrates identified. This represented 244 taxa from 88 families," Dr Johnston said.

She said using many methods for monitoring and assessing distribution of various species meant researchers needed to spend a lot of time in the field.

"Spring 2022 was the busiest field season to date, with 56 days of sampling, including intensive spawning biomass and larval surveys for snapper and blue swimmer crab."

DPIRD Scientist Dr Daniel Yeoh, who is part of the WAMSI Westport Marine Science Program team and coordinating field surveys for the project, said drones were being tested to determine if they could be used for surveying changes in abundance of snapper in spawning aggregations.

"Snapper are a bigger fish and can form very dense schools near the surface, so we are trialling drone surveys to see if we can survey them from the air."

Sonar was proving useful for detecting schools of snapper further below the surface and the technology was also being used to study schools of smaller forage or bait fish such as sardines and anchovy.

"The acoustics work is being done in collaboration with a CSIRO team in Hobart, who are leaders in these acoustic surveys."

"There are five main species of bait fishes we are looking at, including pilchards or sardines and scaly mackerel."

Dr Yeoh said while recreational fishers were sometimes less interested in bait fishes, they were a crucial part of Cockburn Sound's ecology.

"Some of these species are caught for human consumption or bait, but they are particularly important as prey for penguins and dolphins and we have been providing other researchers with samples and data to use in their projects," Dr Yeoh said.

> **"We are also checking key water quality parameters such as temperature, salinity, dissolved oxygen and turbidity during most of our sampling."**

He said baited remote underwater video stations, which provided researchers with a close-up look at fish, will be put out at more than 150 locations this winter.

"We are looking at what species of fish are found in Cockburn Sound and how their abundance and distribution changes throughout the year."

The project is a collaboration with Murdoch University, Curtin University, Edith Cowan University and CSIRO.

Snapper research helping to evaluate hatchery release programs

Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

Researchers are working on non-lethal ways of evaluating the success of programs that release hatchery-reared snapper fingerlings into Cockburn Sound.

The WAMSI Westport Marine Science Program project, led by the Department of Primary Industries and Regional Development, involves analysing photographs of hatchery snapper to ultimately determine any physical differences with wild snapper.

DPIRD's Dr David Fairclough, who is working on the project, said the release of hatchery-reared juvenile snapper was perceived as a positive way of improving wild stocks but it was not always clear whether the fish thrived or how long they survived.

> **"Such information is crucial to assess how hatchery-reared fish may contribute to stocks,"** Dr Fairclough said.

The project also involves research scientists from Murdoch University and Flinders University.

"For the research, photographs of the hatchery-reared snapper are imported into a computer program that allows 16 physical features on the fish to be assigned and the distances between them measured," Murdoch University's Dr James Tweedley said.

The same process will be conducted on juvenile snapper collected from Cockburn Sound but these fish will also be dissected and have their otoliths – a bone in their ear – removed to determine whether they were grown in the hatchery. A non-toxic substance is used to stain the otoliths of live hatchery snapper before their release, allowing them to be identified later in biological samples.

"If significant differences end up being detected then, in future, citizen scientists or recreational fishers could become involved in monitoring released snapper by providing photos of their catches for analysis," Dr Tweedley said.

The project is also investigating whether snapper from inside Cockburn Sound are genetically different than snapper in the open ocean outside the Sound. In addition, it will test if hatchery-reared juveniles contain the same levels of genetic diversity and are as well adapted as those found in the wild population in Cockburn Sound.

"The role of Cockburn Sound as a spawning and nursery area for snapper is well recognised. However, the level of contribution made by those fish to the population and associated fishery along the lower west coast is not fully understood. Information from this project will help with future identification of where hatchery-reared fish move to, either in Cockburn Sound or along the west coast," Dr Fairclough said.

Fish frames donated to DPIRD as part of its 'Send Us Your Skeletons' citizen science project, would give researchers an understanding of where hatchery-reared fish move by removing their otoliths to see if they are stained.

Study examines 30 years of seagrass restoration to determine best methods

THE UNIVERSITY OF WESTERN AUSTRALIA

Murdoch University

A major review of seagrass programs in Cockburn Sound has helped identify the best methods for restoring large scale seabed meadows and found community involvement was a key to success.

Seagrass meadows were decimated from the 1950s and restoration attempts in the past three decades have included everything from sprig and seed-based methods to mechanical plantings, seagrass in sandbags being placed on the seabed and wire coils being used to fix small plants into the sediment.

The project, which is part of the WAMSI Westport Marine Science Program, looked at more than 110 restoration efforts since the 1990s and re-visited 31 sites to assess their success.

The study was led by Professor Gary Kendrick from The University of Western Australia and Professor Jennifer Verduin from Murdoch University.

Professor Verduin said sprig-based programs, where mature seagrass shoots were collected by divers from natural meadows, were found to have achieved high transplant success rates.

"Survival was as high as 90 percent on larger scale sprig-based restoration trials of up to three hectares," Professor Verduin said. "We found over a period of 15 to 20 years, the growth of sprigs resulted in the formation of new meadows."

The study found both sprig-based restoration and seeding programs, such as Seeds for Snapper, had developed viable methods for revegetating large areas of bare seafloor. But large-scale sprig-based restoration programs, while labour intensive, were particularly efficient in quickly stabilising the sediment and creating almost instant meadows. This accelerated the formation of natural meadows.

"Cockburn Sound and Owen Anchorage suffered a major loss of seagrass from the 1950s to the 1990s and while there had been dozens of programs since to rehabilitate the area, there has been limited follow-up to gauge their success," Professor Verduin said.

"Restoration programs are important and contribute to the rapid natural recovery of seagrass habitats by ameliorating loss and supporting the recovery of grasses."

Professor Verduin said.

"Some of the projects in the past have been on areas of no more than three hectares and we wanted to see if we could recommend a restoration package that could be scaled up to ten times that area to enhance restoration success."

Dr Delphine Chabanne, from Murdoch University, is a keen observer of Cockburn Sound's wildlife and takes a lot of photos as part of her work studying bottlenose dolphins.

The WAMSI Westport Marine Science Program researcher shared these photos which show cormorants, dolphins hunting fish and an Australian sea lion catching a ray.

The photographs, taken by Dr Chabanne, were captured during her teams' dolphin population surveys in Cockburn Sound in mid 2023.

Researchers have used data from hundreds of community surveys to create 'heat maps' showing the popular spots for 31 recreational activities in Cockburn Sound.

Bird watching, kayaking, jet-skiing and snorkelling were among the many uses identified by almost 600 people who responded to questions as part of the WAMSI Westport Marine Science Program project, which looked at community values in the Sound.

Beach activities, walking, running and swimming were commonly reported forms of recreation and the survey revealed recreation in Cockburn Sound was most highly valued for its contribution to people's ability to have fun, improve their physical health, socialise with others, and relax.

Dr Abbie Rogers, a Premier's Mid-Career Fellow from The University of Western Australia School of Agriculture and Environment who is leading a theme of socio-economic research for the program, said Cockburn Sound was one of the most intensively used bays in WA.

"The Sound is highly valued by the community for its ecological and recreational values and it hosts a vital part of the State's economy," Dr Rogers said.

Woodman Point Reserve, at the northern end of the study area, was found to be the most frequently visited location and beach.

The results were used to create 'heat' or kernel density maps that show activity density or occurrence using circular patterns. Economic valuations were also calculated for recreational use of various sites.

Murdoch University's Dr Michael Hughes, the project's lead investigator, said the area was important for recreation.

"The variety of non-fishing recreational activities and associated values that coexist in the Sound highlights their importance to the public," Dr Hughes said.

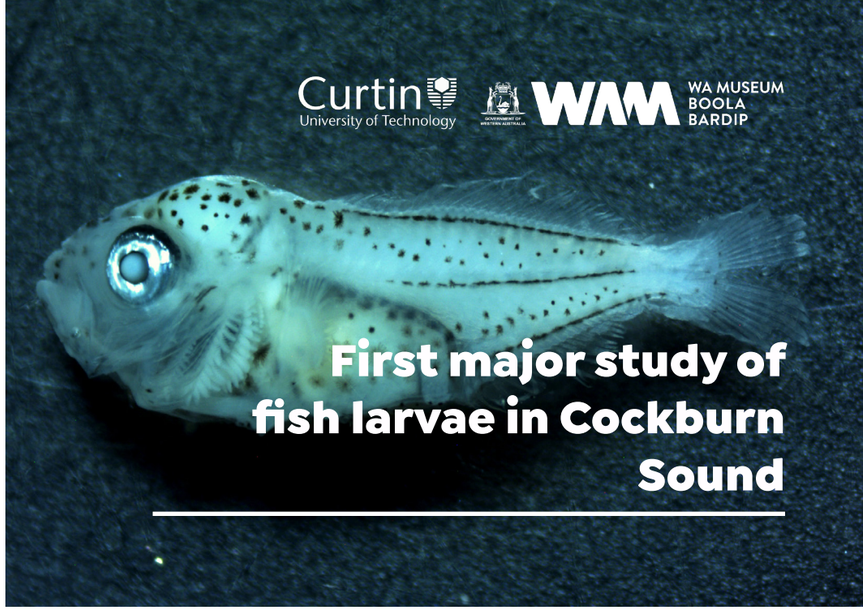
The area studied included the shore and waters between Woodman Point and Cape Peron along with Garden Island and Carnac Island. The entire study area was associated with one or more recreational activity values.

"Understanding how people use marine coastal areas for recreation and the values associated with such uses, are important considerations for the development and management of these areas," Dr Rogers said.

Dr Hughes said the ability of the Sound to host such a diverse range of recreational activities suggested the social and physical carrying capacity was considerable. "Furthermore, management decisions and planning will require engagement with a wide range of recreational activity representatives," he said.

Of the recreational activities identified and mapped, 16 were land based and 15 water based. They did not include recreational fishing, which is the focus of another project in the program.

Other socio-economic projects are measuring the Perth community's values for Cockburn Sound's natural environment and ecology.

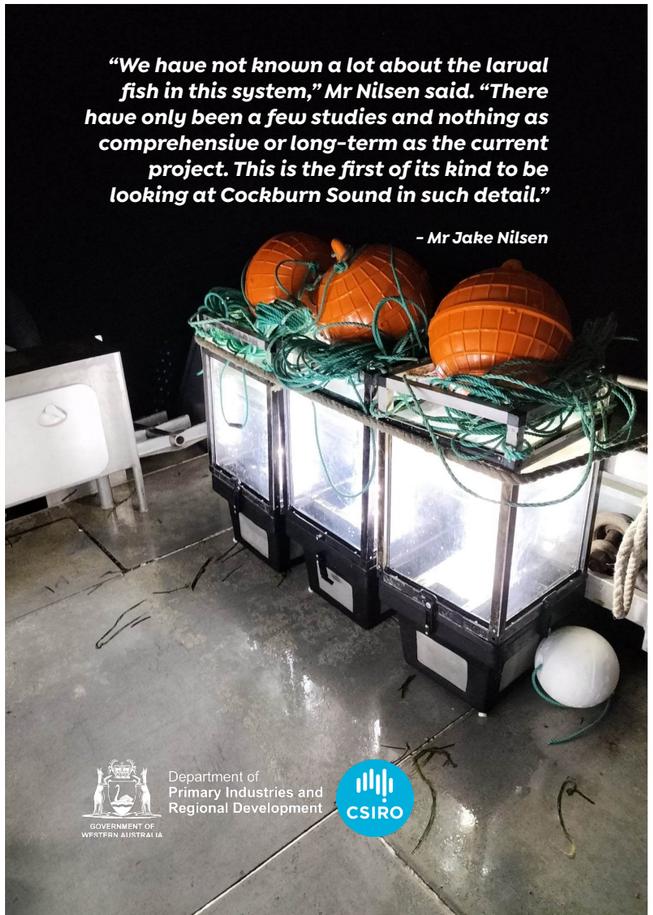


While fishers head out into Cockburn Sound in search of prized catches such as pink snapper, a team of scientists has been targeting fish larvae to better understand which species are in the area during their earliest life stage and where they are most abundant.

Since late 2021, they have recorded more than 12,000 larvae during monthly sampling.

The researchers say while Cockburn Sound is known to be an important spawning ground for key fishes such as pink snapper, local studies on the larval stage of their development have been limited.

Jake Nilsen, a research assistant at Curtin University, is part of the team working on the project which also involves scientists from WA Museum Boola Bardip, CSIRO and the Department of Primary Industries and Regional Development.



He said of the thousands of larvae recorded, the most abundant were baitfish, dragonets and filefish, which have to be individually identified to species using a microscope.

"Important fishery species have also been common, including whiting, trevallies and flatheads, which is exciting as it gives new information about their early life stages we did not previously understand," Mr Nilsen said.

"Pink snapper larvae abundance has been relatively low compared to previous studies but recent observations indicate their abundance is likely to increase following the spawning in October of this year. We are seeing spikes in the number of pink snapper larvae in the most recent samples over the summer period."

"We know pink snapper use these areas for nurseries and that has been backed up by the data we are collecting for the fish larvae. Cockburn Sound is proving to be really important for fish larvae and they are quite vulnerable to environmental stressors."

Mr Nilsen said two methods were being used to sample larvae including bongo tows.

"In collaboration with DPIRD, we are also using light traps over summer to capture larvae. A promising finding from the light trapping method is the exceptionally high number of invertebrate larvae captured including the larvae of the blue swimmer crab."

"Work is underway to use that information to determine the abundance of the early stages of this species, which remains largely unstudied."

"We want to determine in which area of the Sound the blue swimmer crab spend their larval stages and why, and in which areas they are most abundant".

"Findings from this work may prove useful in restoring that fishery, which remains closed in Cockburn Sound because of concerns about declining numbers."

ACKNOWLEDGEMENT AND ARTICLE CONTRIBUTION

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