Charles Sturt University

Foundation Trust

Catch with Confidence:

Monitoring and protecting Kingfish

Rural and regional communities embody a spirit of resilience, resourcefulness and innovation that sustains our economy, culture and heritage. With your support today, we will unleash this spirit for the benefit of all.

Charles Sturt University - Case for Support

Advancement Office
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Catch with Confidence:
Monitoring and protecting Kingfish

Yellowtail Kingfish (*Seriola lalandi*) are an iconic and highly valued species along Australia's coastline, supporting vibrant marine ecosystems, commercial fisheries, recreational fishing communities and a significant angling-related economy.

Yet, a largely invisible threat is emerging beneath the surface: a parasite associated with "Mushy Flesh Syndrome", compromising flesh quality, angler and consumer confidence and is documented to cause food-borne illnesses in Japan.

With your support, researchers at Charles Sturt University researchers will advance critical understanding of the presence, distribution, and spread of this parasite. We will deliver an affordable, point-of-collection biosurveillance platform designed for recreational anglers and citizen scientists. This tool enables rapid, on-site detection of parasites in fish and seawater and will turn insight into immediate decision-making that reduces waste, safeguards fish populations, and strengthens the resilience of fisheries and coastal communities. Furthermore, the diagnostic platform will inform the application of a novel food-safe biochemical intervention to prevent the development of mushy flesh in infected fish known as the Sashimi Shield.

Kingfish and Coastal Ecosystems

Kingfish play an important role in Australia's marine food webs. As a highly mobile predatory species, they help regulate prey populations and act as indicators of broader ocean health.

Healthy Kingfish populations are also central to:

- Recreational fishing experiences and participation (the NSW recreational sector is bigger than the largest commercial sector in the country)
- Commercial fishing sector (NSW is the largest in the country)
- Coastal tourism and regional economies
- Trust in the sustainability and safety of wild-caught fish

When disease or parasites go undetected, impacts extend well beyond individual fish, affecting ecosystems, fishing behaviour, public confidence and in instances documented overseas, can result in food-borne illnesses.

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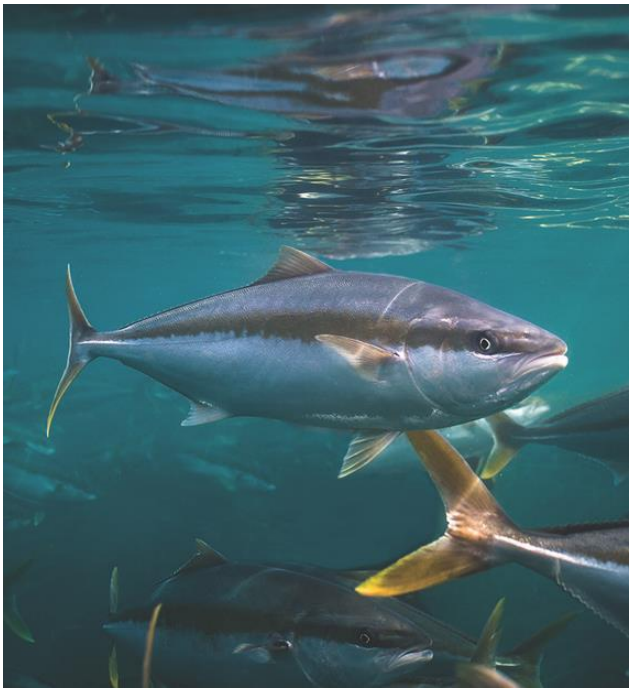


Why they need help

Reports of Mushy Flesh Syndrome in Kingfish are an increasing concern among recreational anglers and fisheries stakeholders. While the condition does not present obvious external symptoms, it significantly affects flesh integrity after capture and cooking, rendering fish unsuitable for consumption and raising alarm within fishing communities

At present:

- The parasite's presence and distribution is poorly understood
- Environmental and ecological drivers are largely unknown
- There is no coordinated, long-term monitoring for detection
- The affect on fish health, physiology and reproduction remains unknown

Without targeted research and surveillance, the parasite may continue to spread silently, increasing ecological risk and eroding confidence in recreational and commercial fisheries.

What is Mushy Flesh Syndrome?

Mushy Flesh Syndrome is a condition caused by the smallest animals known as microscopic parasites that infect the muscle tissue of certain fish species, including Yellowtail Kingfish. Fish affected by the parasite appear and smell completely normal when caught—there are no visible signs of infection externally or internally while the fish is alive, dispatched or when prepared raw for sashimi

The problem only becomes apparent after the fish is cooked. At this point, it is assumed like other similar parasites, enzymes are released by the parasite which cause the muscle tissue to liquefy, turning what should be firm flesh into a soft, paste-like or wet-newspaper-like consistency. This renders the fish inedible and unsuitable for consumption.

What causes it?

Current evidence indicates that Mushy Fish Syndrome is linked to myxozoan parasites, a group of microscopic organisms related to corals and jellyfish. Species in the genera *Kudoa* and *Unicapsula* have been identified internationally and in Australian waters as causes of post-mortem muscle breakdown in fish, including Kingfish, Spanish Mackerel, Swordfish and Mahi Mahi.

These parasites:

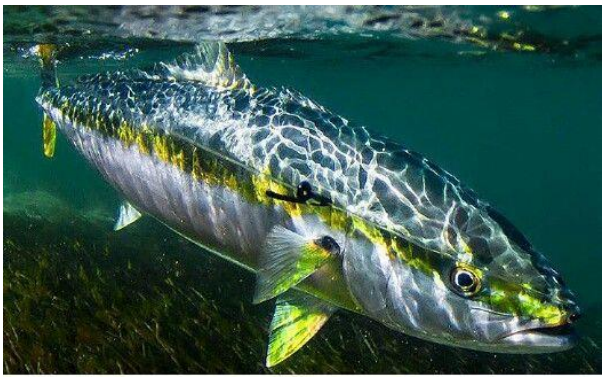
- Live within the muscle tissue of the fish
- Can be undetectable to the naked eye
- Remain dormant until the fish is killed or cooked
- Release enzymes that break down muscle fibres as they attempt to escape the host

Why is it difficult to manage?

Mushy Fish Syndrome is particularly challenging because:

- Infected fish cannot be identified at capture
- In Kingfish, an infected fish presents the same as an uninfected fish when prepared raw for sashimi
- Not all infected Kingfish become mushy on cooking, pointing to a complex interaction between fish host, parasite and the environment.
- Standard visual inspections do not detect the parasite
- There is limited understanding of where, when and why infections occur
- There is currently no widespread monitoring system in Australian marine waters to detect parasite presence and distribution

As a result, the syndrome often only becomes apparent after significant time, effort and cost have already been invested by recreational or commercial fishers and in unfortunate cases, everyone is ready to eat dinner!



The Biosurveillance Platform

Mushy Fish Syndrome and associated parasite infections are currently monitored through the Mushy Fish Project, a citizen science initiative led by Charles Sturt University. The project engages recreational and cultural fishers to report affected catches via an interactive mapping platform. Recreational anglers and charter operatrors have been central to its success, contributing close to 100 tissue samples to date. These samples have enabled researchers to detect parasite presence using PCR-based diagnostics, analogous to those used in COVID-19 testing.

The project has also attracted significant national attention, including continued coverage on ABC's Big Fish program reflecting strong community concern and engagement around mushy flesh in Kingfish. This visibility has expanded participation, strengthened trust with fishing communities, and demonstrated clear public appetite for practical solutions.

This community-driven surveillance network has been instrumental in mapping the distribution of mushy flesh conditions and identifying emerging hotspots along the New South Wales coastline and is expanding to Victoria, Tasmania and Western Australia. However, the current system is inherently retrospective as it confirms infection only after fish have been caught and, in many cases, discarded.

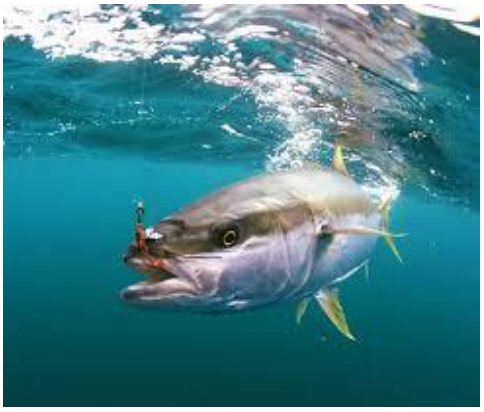
Building on this proven foundation, we propose to develop and deploy an affordable, point-of-collection biosurveillance tool designed specifically for the YTK sector including recreational anglers, commercial operators and citizen scientists. This platform will enable rapid, on-site detection of target parasites in both fish tissue and surrounding seawater. By shifting detection upstream, from post-catch confirmation to real-time environmental monitoring, this innovation empowers fishers with actionable information at the moment of decision-making. The results will then be used to inform the application of the Sashimi shield, a novel food-safe biochemical intervention to halt the development of mushy flesh in infected fish.

Implications Beyond the Science

The implications are significant as fishers will be able to assess infection risk before harvest, reducing waste and avoid unnecessary take and disptach. At a broader scale, aggregated real-time data will generate a dynamic, coast-wide biosurveillance network, capable of detecting shifts in parasite distribution as they occur.

For our project partners, this represents a high-leverage investment: a scalable model that combines community participation, low-cost diagnostics, and real-time data to protect fisheries, support sustainable practices, and strengthen coastal livelihoods. By transforming passive reporting into proactive environmental stewardship, this initiative delivers measurable ecological, economic, and social returns by turning a currently reactive system into a forward-looking, resilience-building solution.

For fish populations:
Early detection reduces the risk of unnecessary harvest of infected individuals, limiting waste and supporting a more sustainable fishing pressure. Overtime, this contributes to a resilient fish populations and improved fish-stock stewardship.



For the environment:
Tracking parasite dynamics in near real time provides a sensitive indicator of marine ecosystem health and resilience under changing conditions.

For recreational anglers:
Access to clear, evidence-based information at the point of capture restores confidence in catch quality and reduced uncertainty. This enables more informed decisions; whether to retain or release fish while maintaining trust and participation in recreational fishing.

For the wider angling industry:
Sustainable, high-quality fisheries underpin a substantial economic network, including tackle retail, charter operations, and regional tourism. Proactive biosurveillance reduces reputational risk, stabilises participation, and protects livelihoods that depend on healthy fisheries.

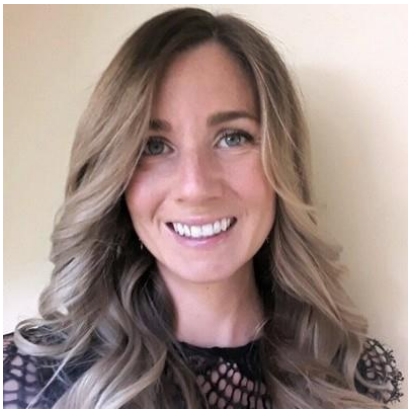
Sustainable, high-quality and healthy fisheries underpin a substantial economic network including tackle retail, charter operations, and regional tourism. Proactive monitoring reduces reputational risk, stabilises participation and protects livelihoods that depend on healthy fisheries.

For consumers and the seafood sector:

With adaptation for commercial use, this platform has the potential to strengthen quality assurance across the supply chain by identifying infected fish before they reach market. This would enhance consumer confidence, reduce product loss, and support industry-led quality control within key fisheries such as kingfish. Importantly, while the parasites associated with mushy flesh are not currently considered a food safety risk in Australia, these parasites in other regions (Japan) are known to cause food-borne illness in humans. Proactive detection therefore represents a precautionary, future-focused approach to safeguarding seafood quality, human health and consumer trust. In doing so, the platform strengthens food safety assurance and reinforces the long-term market viability of the fishery.

A public good investment:
Collectively, this initiative represents more than a research outcome, it is the development of shared biosurveillance infrastructure. By integrating citizen science, low-cost diagnostics, and real-time data, the platform delivers broad ecological, economic, and social benefits that extend well beyond individual users. This is a high-leverage, scalable public good platform: one that empowers communities, protects natural resources, and builds resilience across fisheries and coastal economies.

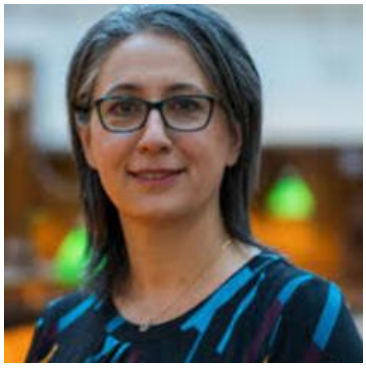
Research Team:



Dr Jessica Tout-Lyon, project lead.

Dr Jessica Tout-Lyon is an ecologist and lecturer at Charles Sturt University, with a strong track record in applying innovative science to real-world conservation challenges. Her work focuses on understanding what traditional monitoring cannot see—pathogens, parasites and ecosystem change occurring beneath the surface. Jess's experience leading biosurveillance research in freshwater and marine contexts positions her uniquely to address emerging risks in Kingfish and other valued species.

Prof Shokoofeh Shamsi, senior advisor,



Prof. Shokoofeh Shamsi leads parasitology teaching and research team. She has qualifications in veterinary and medical sciences, and skills in conventional morphological and molecular parasite identification and diagnostic methods. She is a taxonomist with interest in identifying species, who goes beyond taxonomy to understand parasitism, parasites transmission through food webs, behavioural changes due to parasitic infections, food safety, biosecurity, and how parasites population changes in response to anthropological and environmental factors, in various ecosystems.

Prof Chris Whipps (SUNY), senior advisor,

Dr. Chris Whipps, professor in ESF's Department of Environmental Biology (EB) and director of the SUNY Center for Applied Microbiology, was named the College's Exemplary Researcher for 2021-22.

Whipps focuses his work on fish and wildlife diseases. He is respected in his field of parasitology and fish health, reviewing more than 10 manuscripts a year and serving as associate editor of the "Journal of Parasitology" and section editor of "Parasitology Research." Whipps has also mentored multiple junior colleagues, helping them establish their programs and succeed in their endeavors.

In his biodiversity work, Whipps has named over 28 species of parasites and bacteria. Other researchers have named 3 species after him (Kudoa whippsi, Ceratomyxa whippsi, and Unicauda whippsi). His work on controlling diseases in fishes used in research is widely recognized, having been invited to speak on his work internationally.

Distinguished Professor Muhammed Shiddiky,

Prof Shiddiky is a global leader in the fields of analytical chemistry, sensor technology and nanobiotechnology, specialising in developing biosensing methods and portable diagnostics devices. The primary focus of his research is to advance the understanding of microfluidics, nanobiotechnology, electroanalytical chemistry, and surface chemistry-based phenomenon and processes for the development of new biosensing methods and point-of-care/on-site devices for biomedical, agriculture and environmental applications.

Dr Fatema Farhana,

Dr Fatema Zerin Farhana is currently a Research Fellow at the Shiddiky Laboratory within the Rural Health Research Institute at Charles Sturt University (CSU), Australia. She achieved her PhD and MPhil degrees in functional nanomaterials from Bangladesh University of Engineering and Technology (BUET). She was honored with the highly prestigious Bangabandhu Science and Technology Fellowship from the Ministry of Science and Technology, Bangladesh Government. Her research focuses on the development of functionalized nanoparticles based diagnostic platforms for various biomedical applications.

Dr Kiran Shrestha

Dr Kiran Shrestha is currently a Research Fellow at the Shiddiky Laboratory within the Rural Health Research Institute at Charles Sturt University, Orange, Australia. He achieved his PhD degree in Biophysics from Sungkyunkwan University, South Korea. His research focuses on the development of fabrication-friendly handheld molecular diagnostic devices.

Omar Bin Manjur

Omar Hamza Bin Manjur is a PhD student with a strong academic foundation in Biochemistry and Molecular Biology, having completed both his Bachelor's and Master's degrees from the University of Dhaka. With over 3.5 years of research experience, he has held scientific positions at renowned scientific institutions in Bangladesh, including BRiCM, BCSIR, and ideSHi. His research interests lie in liquid biopsy, single-cell biomarkers, and advanced molecular diagnostics. Currently, his work focuses on developing cost-effective and accessible point-of-care (POC) biomarker-based detection tests for pathogenic microorganisms that contribute significantly to the global burden of disease.

Project Investment Options

The project presents a tiered investment model, allowing partners to support delivery at different levels of scale and impact, from maintaining critical baseline surveillance through to deploying a transformative, field-ready biosurveillance platform.

Across all tiers, investment contributes to the development of a shared biosurveillance capability: a public-good system that integrates citizen science, low-cost diagnostics, and real-time data to protect fisheries, ecosystems, and coastal livelihoods.

Option 1: Full Impact Program (3 years)

Total investment: $560,910

- Postdoctoral researcher (3 years, full-time, Level B): $171,970 per annum (incl. 17% super and on-costs)
- Operational costs: $45,000

Investment focus: End-to-end development and deployment of detection platform.

This program will deliver:

- A validated rapid detection device for myxozoan parasites
- A portable, point-of-collection biosurveillance platform ready for use by anglers and citizen scientists
- Field validation across real-world fishing environments
- Translation of findings through community, industry, and scientific engagement

Outcome: A fully realised, field-ready solution that shifts parasite detection from retrospective analysis to real-time, user-driven monitoring.

Option 2: Full-SC Pilot Project (12–18 months)

Total investment: $186,970

- Postdoctoral researcher (1 year, full-time, Level B): $171,970 (incl. super and on-costs)
- Operational costs: $15,000

Investment focus: Proof-of-concept and prototype development

This project will deliver:

- Assay development for parasite detection in fish tissue and seawater
- Laboratory validation of detection performance
- Early-stage prototype integration
- Expansion of sample resources through archived specimen collection
- Engagement with community and sector stakeholders

Outcome: A validated proof-of-concept and prototype platform, positioning the project for scale-up and full deployment.

Option 3: Program Expansion and Acceleration (12 months)

Total investment: $20,000

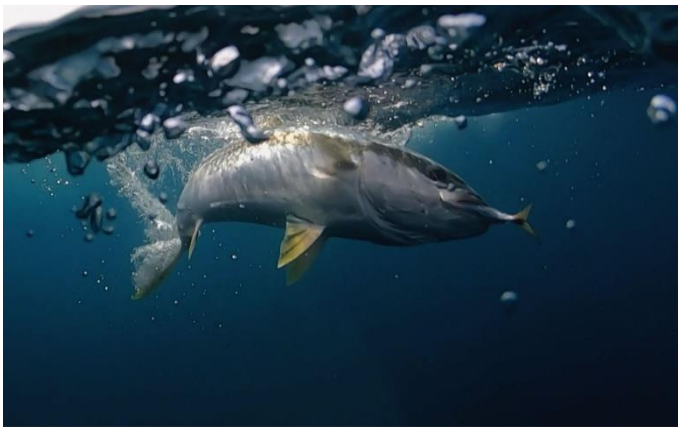
- Lead researcher salary support (part-time, Level C): $15,000
- Operational costs: $5,000

Investment focus: Scaling data, samples, and analytical capacity

This program will deliver:

- Expanded sample collection and testing, including archived specimens from museums and collections
- Development of new and improved detection assays
- Enhanced mapping and longitudinal tracking of parasite distribution
- Begin curating a predictive modelling map
- Increased project capacity through dedicated research time

Outcome: Accelerates the generation of high-quality data, directly advancing current knowledge of where the parasite occurs and how its distribution is changing over time which will be utilised for the generation of predictive modelling maps.



Option 4: Core Project Support (12 months)

Total investment: $5,000

Investment focus: Sustaining essential operations

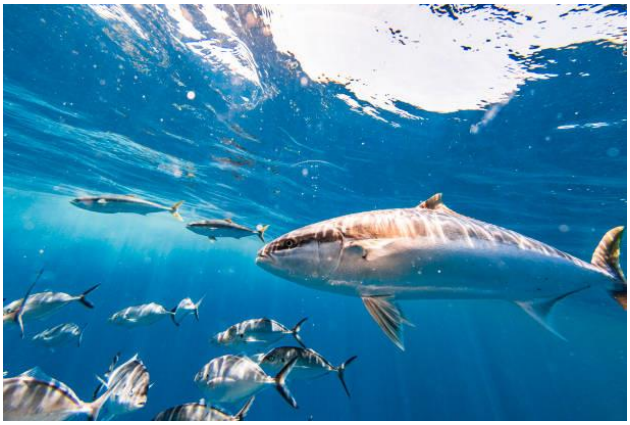
This support will deliver:

- Ongoing collection, preservation, and testing of donated fish samples
- Continued mapping of citizen science data and infection trends
- Regular project updates and community engagement
- Day-to-day operational support to ensure continuity and responsiveness

Outcome: Maintains and strengthens the baseline dataset, advancing current knowledge of parasite presence and distribution while ensuring the continuity of the surveillance network that underpins all future innovation.

Why Now?

Mushy Flesh Syndrome represents a growing concern at the intersection of ecology, fisheries and public trust.
The science to detect parasites early now exists, but without dedicated monitoring infrastructure, critical signals may be missed until impacts are widespread.



Support now allows:

- Baseline data to be established before conditions worsen
- Stakeholders to be informed with evidence, not speculation
- Long-term fisheries confidence to be protected

This is a pivotal opportunity to act early, rather than respond after damage is done.

To learn how you can be involved, contact Craig Trethowen, ctrethowen@csu.edu.au to discuss opportunities to support this work.

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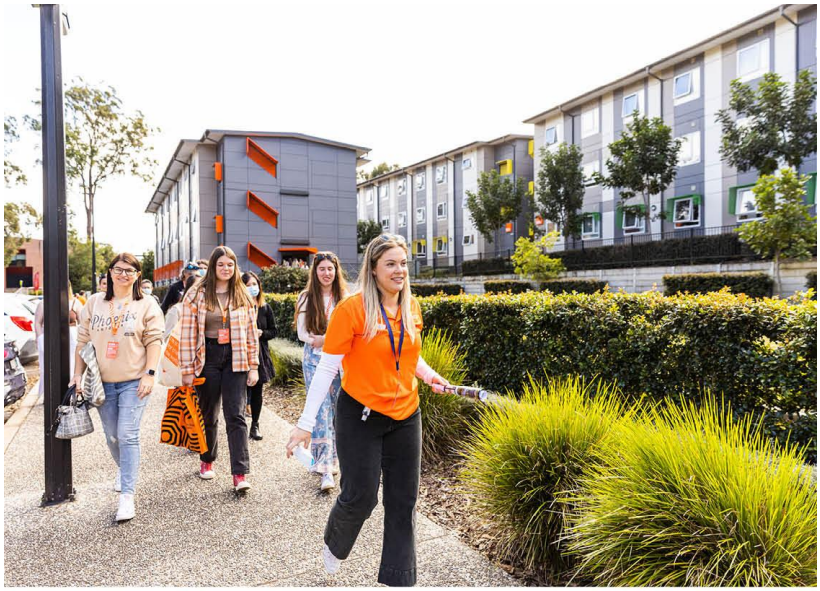
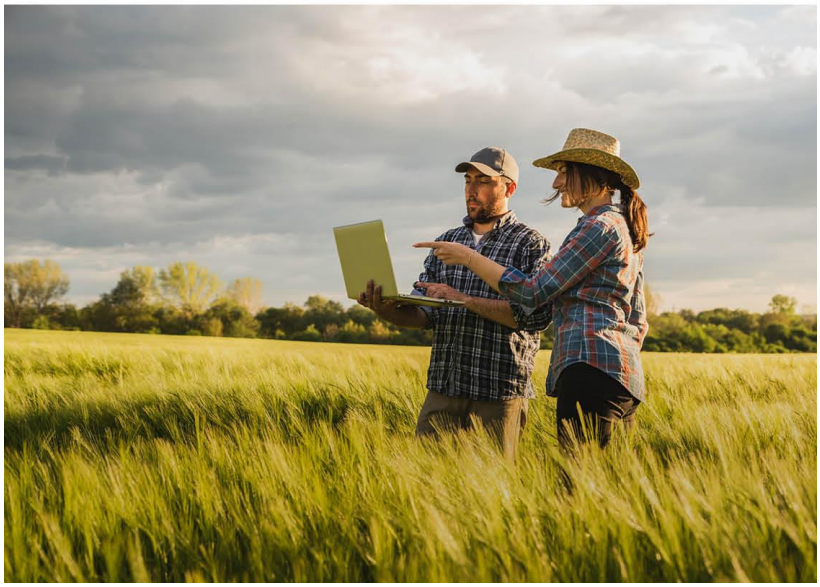
For the public good

Charles Sturt University has a proud heritage and an ethos of nurturing students to become holistic, far-sighted citizens who help their communities grow and flourish. The name of the University honours the noted explorer, soldier and public servant Charles Sturt. In the tradition of exploration, learning, inquiry and discovery as embodied in the life and work of Charles Sturt, the University has as our motto -for the public good.

Scholarships and financial support play an important role by supporting the aspirations of our students and our communities for participation in higher education and to give them the ability to achieve their educational and research goals.





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About Charles Sturt University

A combination of state-of-the-art facilities, innovative use of technology and teaching expertise has resulted in an outstanding graduate employment rate. Charles Sturt thrives by challenging traditional approaches to education through the use of flexible learning systems, which are constantly being developed to improve course delivery. This strategy has put Charles Sturt University at the forefront of communication technology, a position that allows students from isolated regions to access quality resources and education.

Charles Sturt takes pride in regional and rural Australia. The University has a network of campuses in Albury-Wodonga, Bathurst, Dubbo, Wagga Wagga, Orange and Port Macquarie along with smaller specialist campuses throughout Australia. Charles Sturt works together with industry to offer every student a great start to their career. The knowledge and industry experience that students gain at Charles Sturt through its close collaboration with business and the professions is keenly sought by employers -a fact reflected in our high graduate employment rate.

The Charles Sturt University Foundation Trust (CSUFT)

The Charles Sturt University Foundation Trust is a non-profit entity sitting within Charles Sturt University. The Trust has endorsement as an Income Tax Exempt Charity and carries Deductible Gift Recipient status. All donations above $2.00 to the Charles Sturt University Foundation Trust are tax deductible.

The Charles Sturt University Foundation Trust has been providing support for the University and its students since 1984.