FISH

FISHERIES RESEARCH & DEVELOPMENT CORPORATION NEWS

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SEPTEMBER 2018

A TASTE FOR AQUACULTURE

FISHERS LINK IN TO FESTIVALS

STATUS CHECK FOR FISHERIES RESOURCES

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APPLICATIONS CLOSE SEPTEMBER 16, 2018

Calling Australian seafood entrepreneurs!

Fish 2.0 and the FRDC invite you to Fish 2.0 Australia Innovation Workshop and Networking Event Melbourne.

Oct. 23–24

You'll get a head start on the new Australia track in the Fish2.0 2018-2019 business competition cycle (for more info visit www.fish20.org).

The workshop is open to businesses throughout Australia. It will include:

- Expert advice on how to present your venture or innovation to investors and potential partners.
- Detailed information about Fish 2.0 and what you can gain from participating.
- The workshop will conclude with a reception offering you an opportunity to pitch your innovation investors.

To join this free, fun and informative event, go to www.fish20.org/australia.

Entrepreneurs and investors can also apply to hear pitches on the 24th of October.

NATIONAL SYMPOSIUM ON SEAFOOD MARKETING

QUEENSLAND SEAFOOD MARKETERS ASSOCIATION

RYDGES SOUTH BANK / BRISBANE / 28 SEPTEMBER 2018

Hear the seafood stories that sell.

Fishermen are great at tales, seafood professionals sell their story. In a global economy where any product can be sourced from anywhere, it's your story that creates value, difference and margin.

At the 2018 National Symposium on Seafood Marketing you'll hear how to tell and sell your story, increase the value of what you produce and how to turn today's bycatch into tomorrow's hot ticket item.

If you're better at catching than marketing, then this is for you. If you're an experienced marketer and want to be better, this is for you. If you're in the seafood industry and you want your story to be heard, this is for you.

Register today.

For registrations, speaker lineup and topics go to www.queenslandseefoodmarketers.com.au

REGISTRATIONS CLOSE 25 SEPTEMBER 2018.

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SEPTEMBER 2018

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REGULAR

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Cover: Blue Swimmer Crabs, part of the Fair Fish SA catch. Photo: Josh Geleen, Wildcatch Fisheries SA Inc.

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FRDC RESEARCH CODE: 2016-407

Triple challenge for Barramundi expansion

An international investigation identifies the steps needed to realise the growth potential of Australia's favourite white-fleshed fish

By **Rebecca Thyer** Photos **Humpty Doo Barramundi**

A 12-month international study tour has Dan Richards, from the Northern Territory's Humpty Doo Barramundi, more confident than ever that Australian Barramundi could become the 'white fish' equivalent of Tasmanian farmed Atlantic Salmon.

Dan Richards is his family company's general manager and has been investigating Australian Barramundi's potential via a Woolworths-sponsored Nuffield Scholarship.

He says the farmed Barramundi market definitely has the potential to grow in Australia, but the industry needs to address three key issues: genetics, management and disease.

Genetics creates the potential. Management realises the potential. And disease destroys the potential; an issue that greatly concerns him.

"Disease brought into Australia from uncooked, imported Barramundi products is the biggest threat to the industry," Dan Richards says.

"Lobbying to push for change to government policy on Barramundi importation regulations must be a priority. Alongside this, a high standard of domestic biosecurity must be a feature."

Biosecurity concerns

Discussing biosecurity concerns, he references the devastation that the imported white spot disease has had on southern Queensland's prawn farmers (see *FISH* June 2018, 'Prawn farmers regroup', pp4-6).

Any biosecurity lapse which introduces a disease that affects Barramundi "could wipe out not only the Australian Barramundi farming industry but could also impact on commercial and recreational fishing, tourism and Indigenous uses of the fish", he says.

"It will not be a case of losing profit, it will be a case of whether the Australian industry will survive."

Above Dan Richards holds a juvenile Barramundi.

Throughout his Nuffield Scholarship he investigated disease prevention, including a visit to Barramundi Asia, a company that farms its fish in Singapore's southern waters.

"It really opened my eyes to the disease risk that we face from imported fish," Dan Richards says. "They have been so impacted from disease that they have also developed their own vaccine company. At last count, they vaccinated against seven diseases. The scary thing is they import fish into Australia."

Barramundi, also known internationally as Asian seabass or Australian seabass, is native to the Indo–West Pacific region of South-East Asia. It is farmed in several countries including Singapore, Malaysia, Indonesia, Vietnam, Israel, Thailand, the US, Poland and the UK.

Global farmed production of Barramundi was estimated to be 72,500 tonnes in 2014, according to the United Nations Food and Agriculture Organization, while Atlantic Salmon production was 2.3 million tonnes.

Barramundi production in Australia has been increasing, from about 3000 tonnes in 2014 to about 6500 tonnes in 2017. However, the Australian Barramundi Farmers Association estimates imports of fresh and frozen Barramundi fillets have also increased, from about 7000 tonnes in 2014 to as much as 15,000 tonnes last year.

Domestic Atlantic Salmon production in Australia has also increased, from an estimated 40,000 tonnes in 2014 to about 60,000 in 2017. However, imports of Atlantic Salmon are minimal, being restricted to processed products, which helps to reduce biosecurity risks for the sector and also underpins its position in fresh and frozen markets.

Study findings

As part of his Nuffield Scholarship Dan Richards investigated genetic and management strategies that could increase production.

He says Barramundi has the genetic potential to develop further as an aquaculture species, with investments being made globally to increase production capacity.

Although there are a few limitations to the species, such as melanisation of the flesh and relatively low fillet yields, these can be improved incrementally over time with genetic selection and breeding programs.

"For the ongoing competitiveness of Australian Barramundi farming, investments into genetic breeding programs are essential," he says.

Management improvements are also needed to realise the sector's potential, including aquaculture regulation, farming systems work, research and development, and marketing.

Dan Richards found that:

- ongoing development of aquaculture regulation regimes will be required nationally to enable growth;

- Australian Barramundi farmers will need to commit to maintaining and improving quality standards to ensure consumers have consistently positive experiences;
- investment in Barramundi marketing is essential to compete with other white fish; and
- investment in new product development could enhance Barramundi's ability to penetrate domestic markets and absorb production increases.

The Richards family has been farming Barramundi for 25 years, since Dan's father, Bob Richards, took over a fledgling local business.

Today Humpty Doo Barramundi produces 3000 tonnes of product a year for domestic and international markets and employs 60 people.

Dan Richards has spent the past 11 years working on the farm (after a decade in environmental management), and says the sector's potential has not yet been realised.

"When I applied to Nuffield three years ago, I wanted to more thoroughly investigate this question: could Australian Barramundi be the white-fish equivalent of Atlantic Salmon and what conditions were required to make this a reality?"

His final report (to read, visit www.nuffieldinternational.org/live/Reports) was published in June 2018, and he believes the answer is definitely "yes".

"If we work on genetics, management and disease, I do believe Australian Barramundi has the potential to challenge salmon."

Humpty Doo Barramundi general manager Dan Richards surveys his fish farm at sunset. He and his father are working on a three-stage project to expand production.

"If we work on genetics, management and disease, I do believe Australian Barramundi has the potential to challenge salmon."

Dan Richards

Norwegian example

A key stop on Dan Richards' Nuffield study tour was Norway, the world's largest Atlantic Salmon producer. He visited various hatcheries and research, technology, farming and processing facilities, and met with the Norway Directorate of Fisheries. He says the development and management of the Norwegian Atlantic Salmon industry provided a useful case study.

"There are some similarities with Australia, such as high cost of labour and dispersed coastal communities. But there were also some marked differences, most notably that Norway has an extraordinary level of access and infrastructure along the coastline compared to the relative isolation of Australia."

In 2017 Australian Barramundi production reached 6500 tonnes. This is the same level of production achieved by Norway's Atlantic Salmon industry in 1979.

It has since grown to produce an estimated 1.4 million tonnes in 2016, making up 96 per cent of Norway's total aquaculture production.

Dan Richards says Norway has a number of natural advantages that underpin its success, such as clean freshwater (required for juvenile salmon production); clean seawater; a long, protected coastline with accessible areas; good coastal infrastructure; a good quality fish-feed supply; robust technology application and availability; and a high level of scientific research.

Although Australia shares some of these attributes with Norway, including ample natural resources, and the ability to access technology and high-quality research, he says the Norwegian west coast has extensive areas of sheltered, deep, glacial fjords.

"They provide the perfect conditions for sea-cage aquaculture. In contrast, the north Australian coastline lacks significant areas of coastline sheltered from storm and cyclone activity.

"This is particularly relevant in the tropical zones, where Barramundi can be most efficiently grown outdoors. Three separate Barramundi sea-cage operations in northern Australia have been destroyed by tropical cyclones and flooding."

Consolidated approach

In terms of regulation, the Norwegian Atlantic Salmon industry has a well-developed framework of aquaculture zones, impact monitoring and management.

Dan Richards says this regime has evolved and developed as a national approach over time to keep pace with salmon industry development and is commensurate with its significant production value.

"By contrast, Australian aquaculture regulation is managed at the state level and is fragmented, with a diversity of approaches and levels of commitment from the various state governments."

However, he says that in recent times a number of state governments have taken the proactive step of identifying and pre-approving aquaculture

Above Dan Richards holding an Atlantic Salmon while visiting a farm in the Faroe Islands, an archipelago halfway between Norway and Iceland, 320 kilometres north-west of Scotland.

zones to clear the way for aquaculture development.

"As the scale of the Australian aquaculture industry grows, its value contribution to the Australian economy is likely to increase and government regulatory regimes will further develop and mature."

With Atlantic Salmon accounting for 96 per cent of Norwegian aquaculture, production there is a clear focus for investment in the country, he says.

"In Australia there are a wide range of aquaculture research priorities, so financial, human and technical resources are naturally spread. The point to be made is that while Australia has a high standard of research and science, there is likely to be fragmentation of R&D funding between a wide range of species until clear industry priority species emerge."

Dan Richards says his Nuffield Scholarship, sponsored by Woolworths, was a valuable opportunity. "I got to examine aquaculture all over the world. It is a big world and there is a lot to look at. We've taken on some of the technology I investigated as a result of this Nuffield Scholarship."

He says the scholarships are a "fantastic investment in people and the industry. I encourage anyone who is interested in being a leader and ensuring a strong industry for Australia to apply". F

Members of the Australian seafood and aquaculture sector are eligible for FRDC-funded Nuffield Scholarships. Applications for the 2020 Nuffield Scholarships open in April 2019.

Loan win helps expand facilities

By **Rebecca Thyer**

A $28.7 million loan from the Australian Government to Humpty Doo Barramundi signals renewed confidence in aquaculture as part of northern Australia's future economic development.

The loan comes from the Australian Government's Northern Australia Infrastructure Facility (NAIF) and was only the second project to be approved for financing from the NAIF's $5 billion fund.

The Richards family, which owns Humpty Doo Barramundi, will match the NAIF loan with bank finance of $28.9 million to fund a three-stage expansion, delivered over five years from mid-2018 to 2022.

The $14.4 million first stage of the Humpty Doo project will be co-funded between NAIF and the ANZ bank.

It will include:

- building a solar generation facility to generate two megawatts of electricity and reduce reliance on natural gas-generated electricity;
- developing a specialised Barramundi nursery to reduce bird predation and grow smaller farm-ready fish for other aquaculture farms (a first for the Northern Territory);
- introduce the NT's first automatic feed storage and distribution facility to protect feed from feral animals, based on internationally recognised aquaculture technology; and
- an ice-making facility to ensure product quality.

Managing director Bob Richards says he is pleased the farm can now invest in solar power and infrastructure, moving the business towards carbon neutrality while enhancing its position as a leader in sustainable aquaculture.

General manager Dan Richards says environmental milestones – such as carbon neutrality – are very important to the family and the loan is vital to meeting those challenges.

"In the Northern Territory everything is expensive. So while the loan will help us to reduce energy costs, it means more than that to us. Environmental stewardship is very important to us and environmentally we are an award-winning company and we aim to continue improving on that."

Last year the company won a Territory Natural Resource Management Award for its closed biological recirculated water treatment system.

Dan says the loan and family investment will also benefit the wider community, allowing the company to offer aquaculture opportunities to others in the region. "Overall, the opportunity will ensure all Australians and the world have access to Australian-grown seafood every day." F

Left An aerial image of Humpty Doo Barramundi, based in the Northern Territory.
Photos: Humpty Doo Barramundi

Green light for seafood marketing

On 16 August 2018, the *Primary Industries Research and Development Amendment Bill 2017* was passed by both houses of parliament.

This allows the FRDC to undertake marketing activities funded by voluntary contributions on behalf of Australia's seafood sector.

This is a major step forward for the FRDC and for Australia's seafood sector. The change opens the doors for FRDC to partner with and deliver any marketing activities on behalf of Australia's seafood industry. The FRDC is keen to start discussions with any industry partners looking to undertake or be part of marketing activities. and will work with them to develop plans and processes to undertake requested activities.

The FRDC can only undertake marketing where industry request and provide funding for the activity. In the coming months the FRDC will work to establish:

- seafood industry interest in marketing activities – what you would like to see happen;
- a collection process for marketing funds that is simple and efficient – whether voluntary or levy-based; and
- policies and procedures to ensure good governance of marketing funds and metrics on which to evaluate activities. F

More information: Peter.Horvat@frdc.com.au

Colbeck returns to fisheries

Tasmanian Senator Richard Colbeck has returned to the fisheries fold as part of new Prime Minister Scott Morrison's Ministry.

Working with Minister for Agriculture and Water Resources David Littleproud, as Assistant Minister, Richard Colbeck will be responsible for the fisheries aspects of the portfolio.

He held a similar role, as Parliamentary Secretary to the Minister for Agriculture, Fisheries and Forestry for almost two years from October 2004 to January 2006, and again as Parliamentary Secretary to the Minister for Agriculture from September 2013 to July 2015.

Senator Anne Ruston then stepped into the position, but she has now been appointed Assistant Minister for International Development and the Pacific, and Richard Colbeck returns. F

Informing UN sustainability goal

As of July 2018, the evidence-based science of *Status of Australian Fish Stocks* (SAFS) reports (fish.gov.au) are being used to inform the United Nations Sustainable Development Goal number 14 'Life below water'.

Goal 14 is made up of several different indicators. The SAFS information will inform indicator 14.4.1: 'Proportion of fish stocks within biologically sustainable levels' (https://www.sdgdata.gov.au/goals/life-below-water). Australia has already met its target for this indicator.

The SAFS reports provide a road map for the recovery of stocks for fisheries management, industry and research. The next edition of SAFS will be released in December 2018. It will see an increase in the number of species assessed (from 87 to 120) and a reduction in the number of species classified as undefined (a category used to indicate a lack of available data about which to make an assessment). F

CALL TO HONOUR WOMEN IN SEAFOOD

The Women's Industry Network Seafood Community (WINSC) is calling for nominations for the inaugural WINSC Women's Honour Roll. This will provide recognition to those women whose contributions have made a significant difference to the knowledge, growth and prosperity of the seafood industry.

Nominations will be judged on whether the nominee:

- demonstrates a long-term involvement or background in the seafood industry;
- has a clear dedication and commitment to and support of the industry through her contribution;
- demonstrates a proven commitment to raising both community and industry awareness of seafood; and
- has built a reputation for a high level of integrity, positive influence and professionalism in the seafood industry as a whole.

The WINSC Women's Honour Roll will be released every two years, starting in 2018.

New inductees into the Honour Roll will be announced at the WINSC 20th Anniversary Gala Dinner on Friday 19 October in the Grand Ballroom, Hilton Adelaide.

WINSC is the only national organisation that represents women in the seafood industry. It is a unique and diverse network of members with backgrounds in wild catch, aquaculture, post-harvest, wholesale, retail, management, research, consultancy, hospitality and more. F

For more information about the WINSC 20th Anniversary Gala Dinner and to nominate an individual for the Honour Roll please visit the WINSC website (www.winsc.org.au).

ECOLOGY

Releasing a *Mola mola* sunfish.

NEW SUNFISH IDENTIFIED

Sunfish have bizarre, oversized head-like bodies and can grow up to three metres. Their elusive, deep-diving lifestyle makes encounters rare.

However, a recent research collaboration has identified the most common species in Australian waters, using tissue sampling from incidental catches of sunfish in Australian longline fisheries over a 12-month period, and from museum collections.

The research found that the species most recognised globally, *Mola mola*, is, in fact, rare in Australian waters. The three most common species found were *Masturus lanceolatus*, *Mola alexandrini* and a newly identified species, *Mola tecta*.

Mola tecta is the first new sunfish species to be described in nearly 180 years.

The research collaboration involved Murdoch University researchers, the Commonwealth longline fishing industry and the Australian Fisheries Management Authority (AFMA).

Sunfish are a fisheries bycatch species with little commercial value and are released back into the water if landed. F

WORD

SORTING THE CATCH: BYCATCH, BYPRODUCT AND DISCARDS

The thing about landing a catch is that once you have it, you need to know what to do with it.

'Discards' and 'bycatch' are hotly contested terms from an ideological standpoint, and they are also rife with misuse.

We think, if you are going to have a well-informed argument, you may as well make sure you are using them correctly.

Each term actually has a very particular meaning.

Bycatch is anything that is returned to the sea because it has no commercial value, or because regulations preclude it from being retained, or is affected by interaction with the fishing gear but does not reach the vessel's deck.

Byproduct is a species taken incidentally in a fishery while fishing for another species. The species is retained for sale because it has commercial value, but does not usually contribute significantly to economic yield.

Discards are any part of the catch returned to sea, whether dead or alive. F

More information: www.fish.gov.au/overview/glossary

WEIGHTS & MEASURES

HOW MUCH DOES FROZEN SEAFOOD ACTUALLY WEIGH?

The 'frozen fish method', also known as the partial thaw method, or test procedure 7.9, is now the only method approved to establish the net weight of packaged frozen seafood in the Australian retail and food service sectors.

This covers all species of fish, crustaceans and molluscs, but excludes value-added variations such as marinades and coated seafood products.

The net weight will exclude the weight of water and ice-glaze, which may previously have been allowed and can constitute up to 10 per cent of a product.

The National Measurement Institute regulates Australia's weights and measures and is responsible for clarifying the acceptable frozen net weight. A compliance campaign will be undertaken in the 2018-19 financial year, with notices of non-compliance likely to result in the withdrawal of products from sale.

The inspections will be conducted throughout the entire distribution chain and will include packers, importers, wholesalers and retailers. Fines of up to $210,000 per infraction for a company and $42,000 per infraction for individuals may apply. F

More information: www.measurement.gov.au

INNOVATION

CALLING ENTREPRENEURS AND INNOVATORS

Making more of under-utilised species is the focus of the first Australian-specific track in the international program FISH 2.0, which brings together entrepreneurs and investors.

Apply for the FISH 2.0 Australia workshop and networking event before 25 September to join the free, two-day event in Melbourne on 23-24 October.

The workshop will give entrepreneurs an opportunity to meet investors interested in the sustainable seafood sector.

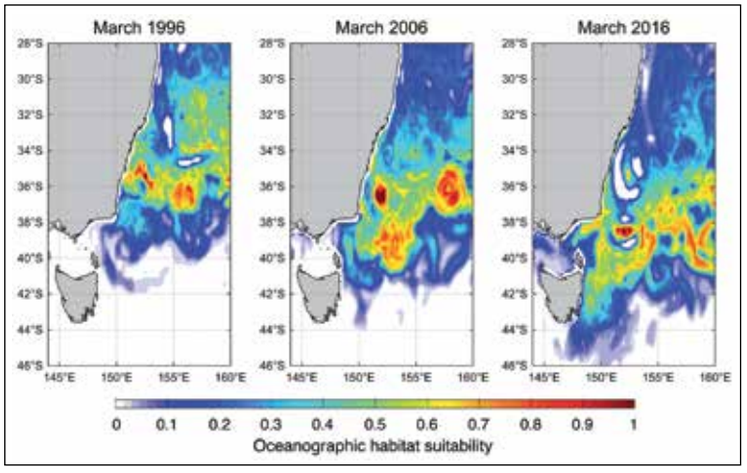
Entrepreneurs will get advice on improving their business strategies and presentations to investors during a program that culminates with a pitch session and investor reception.

The new Australian track provides an opportunity to address a country-specific issue and will be part of the FISH 2.0 2018-19 international business competition cycle.

The track is open to all Australian seafood-related ventures. F

More information: https://www.fish20.org/ventures/2018tracks/

Below Suitable ocean conditions for Yellowtail Kingfish (*Seriola lalandi*) are shifting south and are staying off eastern Tasmania for longer. Graphic: Curtis Champion



Curtis Champion

Hayden Schilling

Research tailored for recreational fishing

By **Catherine Norwood**

Recreational anglers will benefit from new student research presented to the marine science community in Adelaide

Yellowtail Kingfish and Tailor, both species popular with recreational fishers, were the subject of the best student presentation awards sponsored by the FRDC at this year's Australian Marine Sciences Association's annual conference in Adelaide in July.

Curtis Champion, Institute for Marine and Antarctic Studies (University of Tasmania) and CSIRO PhD candidate, won the oral presentation. He spoke about his research into the influence of warming oceans on Yellowtail Kingfish, which has become a favourite target for anglers in Tasmania, south of its traditional range.

University of New South Wales PhD candidate Hayden Schilling won the poster presentation for his research with the NSW Department of Primary Industries, Queensland Fisheries and recreational fishers investigating the ecology and biology of the popular sportfish Tailor.

Angling for Kingfish

Curtis Champion's research has identified how changing ocean conditions have extended the window of opportunity for anglers targeting Yellowtail Kingfish (*Seriola lalandi*) in Australia's southern waters.

He says this trend is predicted to continue into the future, suggesting more frequent opportunities to target kingfish, specifically in the Twofold Shelf region, off southern Victoria, and the eastern Tasmania region.

He assessed changes in the number of months per year that ocean conditions, such as temperature and current speeds, preferred by Yellowtail Kingfish persist in regions of south-eastern Australia's coastal ocean.

He used a combination of citizen science records of Yellowtail Kingfish occurrences and satellite-recorded ocean data to determine the oceanographic habitat that Yellowtail Kingfish prefer across six regions, stretching from Moreton Bay in southern Queensland to the east coast of Tasmania.

These preferred conditions were then projected for south-eastern Australia at monthly intervals from 1996 to 2040, with future projections created using ocean data predicted under a climate change scenario that incorporates increasing future greenhouse gas emissions.

He says his project demonstrates how analyses of changing species distributions can be applied for the needs of specific stakeholders.

This study was recently published in the journal *Marine and Freshwater Research*.

Tailor-made project

Hayden Schilling's research has provided new information about Tailor, a species found around the world although known by different names ('bluefish' in the US and the Mediterranean, 'elf' or 'shad' in South Africa, and 'enchova' in South America).

Anecdotally, he says, the size and number of Australian recreational fishing catches has declined along the east coast, from Fraser Island in Queensland to southern Victoria. His project was designed to fill knowledge gaps to support more informed management of the species.

He used a combination of traditional fisheries science techniques (surveys of fish lengths, gonads and gut contents, as well as ageing of fish using annuli counts in otoliths, or fish ear bones), environmental chemistry and statistics.

He found that Tailor grow quickly, reaching almost 30 centimetres in length in the first year, but have a high annual mortality (80 per cent – about 40 per cent natural mortality and 40 per cent from fishing), resulting in a fishery with very few old, large fish.

Sea-surface temperature is important for the annual northern migration of Tailor to Queensland's Fraser Island area for spawning. Tailor abundance peaks in waters of approximately 21.5°C. Hayden Schilling also identified a previously unknown spawning period in northern NSW.

He found that juvenile Tailor use both coastal and estuarine habitats and are not restricted to estuarine habitats as previously thought.

The diet of the fish also changes as they grow. Small Tailor favour crustaceans such as mysid shrimp and prawns, before shifting to a fish-dominated diet as they reach 30 centimetres in size.

The findings from his research will directly feed into stock assessments and future management plans to ensure Tailor populations continue to be sustainable. F

Fish from your phone

Fisher Bart Butson is taking part in Wildcatch SA's Fair Fish initiative.

Investing in a share of South Australia's wild harvest fisheries allows customers to access a weekly delivery of freshly harvested seafood

By **Ilaria Catizone**
Photos **Josh Geleen, Wildcatch Fisheries SA Inc**

Your smartphone pings with a new message: it's the Fair Fish app, letting you know that your local fisher has just delivered his catch, what it is and your designated collection point. There are details about the species, cooking suggestions and more.

This will soon be the reality for consumers in South Australia with the much-anticipated launch of the Fair Fish app in October, which will make it easier to buy a share of the local seafood harvest directly from the fishers who catch it.

The app is part of an initiative of Wildcatch Fisheries SA Inc, also called Fair Fish, which is giving SA consumers access to the local seafood harvest. For the fishers, it provides direct access to their consumers.

The initiative is already active via the Fair Fish SA website (www.fairfishsa.com.au). Customers buy Fair Fish shares, each of which entitles them to $22 worth of the SA seafood harvest, freshly caught by one of the 12 commercial fishing businesses taking part in the initiative.

Initially, fish are being delivered fresh every Saturday morning to the Fair Fish headquarters at Fishing Industry House on the docks in Port Adelaide. The Fair Fish start-up subscription package offers four shares for $88, supplied over an eight-week period. The timing of supply within this period is flexible. Subscribers might opt for four shares to be collected weekly for four weeks, or fortnightly over eight weeks. Shares can also be combined for less frequent collection of larger quantities of fish.

There's also an extended subscription for $264, which provides 12 shares available over three months.

What's on offer

What's available depends on what the fishers catch that day. This could be anything from King George Whiting and snapper, to Yellow-eye Mullet, Southern Calamari and garfish, depending on the fishing and seasonal conditions.

"Fishers guarantee volume but not species," says Tom Cosentino, who is managing the development of Fair Fish for Wildcatch Fisheries SA Inc.

He recognises that customers may receive fish they have never tried or even seen before. "But if you are open to trying new species, learning more about how they are caught and supporting and getting to know your local fishers, then this is perfect for you."

Each share includes a popular species and a less well known secondary species as well, and is expected to provide enough fish for four serves. Customers can take their fish whole or have them filleted, and the recovery of meat from each species will largely determine the final size of portions ready to cook.

Tom Cosentino says the Fair Fish shares have been developed with Australian Dietary Guidelines in mind (www.eatforhealth.gov.au), and he expects it will provide, at a minimum, the two serves of seafood recommended each week.

"However, Fair Fish is designed to provide customers with a promised value each week, rather than a promised quantity. This way, consumers are rewarded for trying under-utilised species when the fishers bring them in.

"Each weekly package will contain at least two 200-gram serves of seafood, but in times when under-utilised species are the catch, consumers might receive up to one kilogram. This helps the fishers to establish a market for their bycatch and consumers to try delicious seafood that would otherwise be kept secret."

MORE INFORMATION
Fair Fish, www.fairfishsa.com.au
FRDC RESEARCH CODE: 2017-183

Right A selection of the best, freshest South Australian seafood will be delivered regularly to participants in the Fair Fish program.

Connecting with fishers

Fair Fish is applying a community-supported fisheries (CSF) business model, which is gaining momentum around the world. In addition to being a funding partner for the Fair Fish initiative, the FRDC has been an active proponent of the model in Australia, sponsoring a range of knowledge-exchange activities between Australia and the US.

Customers pay for a share of the catch upfront. This helps fishers lock in a fair price early in the season to cover their gear repairs, upgrades or boat maintenance. In return, consumers get a guaranteed amount of fresh fish delivered.

This differs from the traditional model where fishers take their catch to an auction to be sold to other wholesalers or retailers, and then on to the public. Auctions are an easy option, but there is no guaranteed price for fishers and there is no direct interaction with consumers.

Fair Fish shares have been unofficially available since July 2018 through the Fair Fish website (www.fairfishsa.com.au) with a dozen early subscribers. However, the launch of the smartphone app in October will launch Fair Fish into promotion mode, with a target of 450 subscribers.

The app provides notifications to consumers, including details about who has caught their fish and how, weather updates influencing the catch and seasonality details of why a species may be abundant at certain times but not others.

Tom Cosentino says Fair Fish headquarters is the original collection point for fish, but he is working to add other collection points as the subscriber base builds, including collection from the local communities where fishers are based.

"One of the benefits of the app is that fishers or fishing groups in other locations can also use it outside of the CSF program, to tell their local consumers when their fish are ready for pick up. Ideally, we'd love to see this happening all around Australia."

Restaurant trials

Before the public offering this year, Fair Fish conducted a 10-month trial with restaurants in Adelaide, connecting them directly with fishers to take their fresh catch. The response was so good the pilot was capped at 20 restaurants and two festivals.

Toby Gush from Chianti Restaurant, in Adelaide, says he really values the fresh product he receives.

"You can taste the difference in the simplest things. It'd be like carrots from the farmers' markets as opposed to the ones that have been in storage. With the calamari we just grill them and serve with lemon, parsley and garlic, and everyone goes crazy for them."

The app provides notifications to consumers, including details about who has caught their fish and how, weather updates influencing the catch and seasonality details of why a species may be abundant at certain times but not others.

Andrew Douglas from Iberia Restaurant agrees. "The biggest thing is the quality and freshness of seafood we get," he says. "It is shortening the supply chain and the time taken to get the fish. And I like to give money straight to the guys who are doing the hard work."

He says the sometimes random assortment of seafood supplied is part of the appeal, and something he's happy to work with; it helps bring some less well known species to the attention of consumers.

Tom Cosentino says chefs were very creative during the trial, trying to use all species and all parts of the fish caught. "They created a bottarga out of Snook roe, used skate in their recipes and are even working on a dish featuring snapper scales."

Recipes developed by these restaurants feature on the Fair Fish app, along with catch and delivery information, so people feel confident cooking the different species supplied each week.

Promotion and expansion

Tom Cosentino has also developed the Instagram account @fairfish to promote the CSF concept, amassing 1000 followers during the past year. The account features the fish, the fishers and restaurants involved.

"We have been really lucky with our fishers," he says. "Many of them have been keen to be pioneers of this new model of selling fish and have been regularly attending meetings to provide feedback.

"Our fishers have said they've begun to feel appreciated by their communities. Three of the program's fishers have even been nominated for *Delicious Magazine* Food Awards by the chefs using their catch."

Future plans include liaising with local vegetable and wine producers, with a view to creating a combined offering that provides a complete meal option, and an even better local buying experience.

Along with support from the FRDC, Wildcatch Fisheries SA Inc has been supported by the Farm Co-operatives and Collaboration Pilot Program (Farming Together program), which is made possible by a grant under the auspices of Southern Cross University to administer the program by the Australian Department of Agriculture and Water Resources. F

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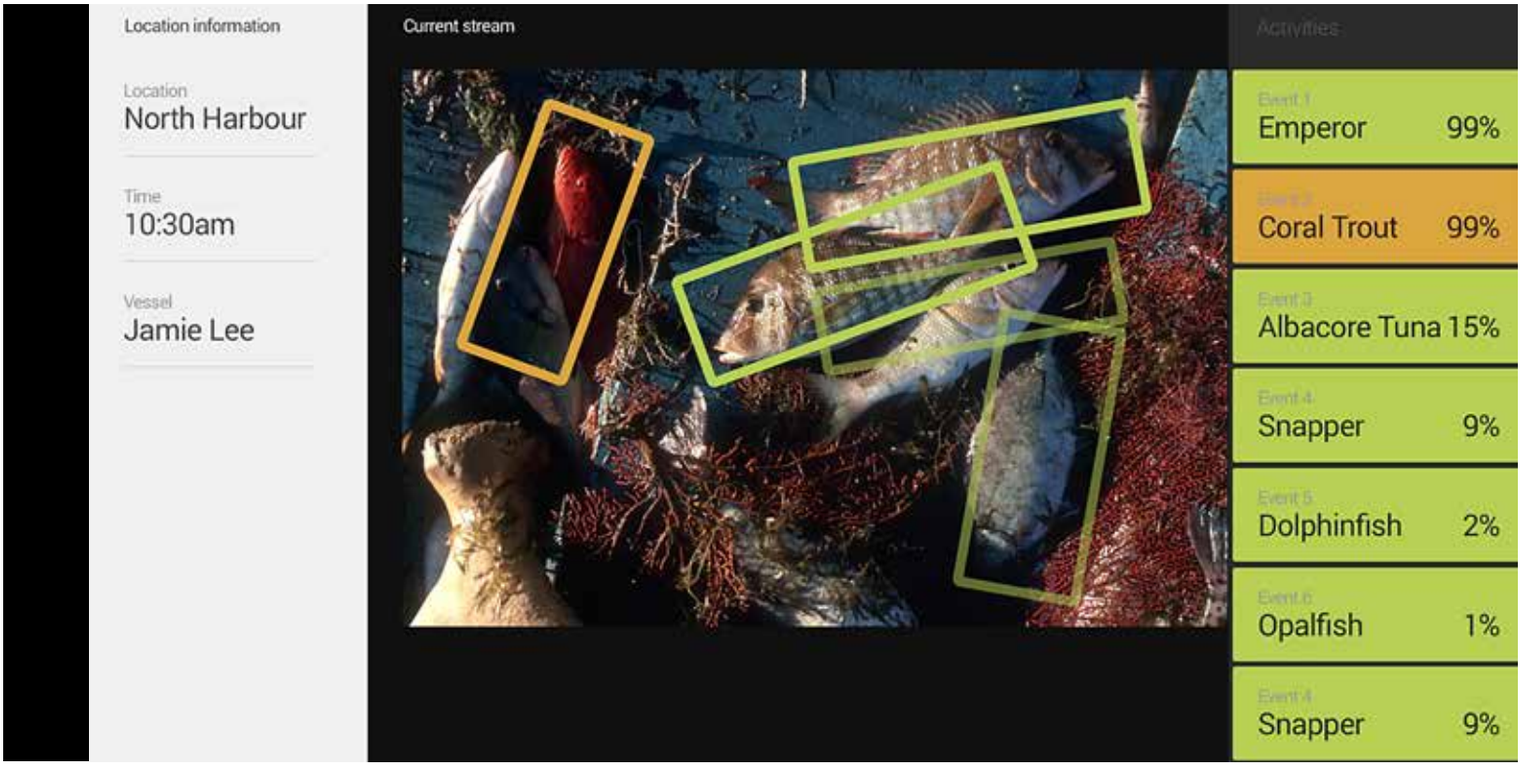
Below Screenshot of new fish-identification software, 'Wanda'.



Wanda in training for fish recognition challenge

By **Catherine Norwood**

The automated identification of harvested fish could improve confidence in the fishing sector and reduce the cost of surveillance

The use of artificial intelligence (AI) is coming to the Australian fisheries sector in the form of new software that can identify which fish are being landed on board a vessel based on video from electronic monitoring.

Called 'Wanda', the program uses advanced mathematical and computing techniques such as deep learning – a subset of AI – to automatically detect and identify fish species.

Wanda is the product of a CSIRO research collaboration between its Oceans and Atmosphere and Data61 divisions, with the Australian Fisheries Management Authority (AFMA) providing imagery to train the new software.

CSIRO fisheries scientist Rich Little says the software has so far been trained to recognise several species, including Yellowfin Tuna, with about 85 per cent accuracy. But with access to more images to help train Wanda, he anticipates this will increase to more than 90 per cent accuracy.

The development of Wanda began in 2016 when CSIRO Oceans and Atmosphere fisheries scientists Rich Little, Geoff Tuck and Rob Campbell teamed with CSIRO Data61's Dadong Wang to explore the potential of a machine-learning product for species identification in fisheries.

In demand

Currently, electronic monitoring imagery is reviewed by people who identify different fish species. "But we realised this was a constraint on the current technology, and discovered there was a very large need nationally and internationally for our new program to automatically identify fish species and to remove this human element," Rich Little says.

"As a commercial product the market is quite small; the most likely customers are typically regulatory agencies and resource managers."

However, the potential application of the technology continues to expand as more countries introduce on-board electronic monitoring in their fisheries. Wanda sits amongst a cohort of similar initiatives being developed around the world, including those led by the UN's Food and Agriculture Organization and another led by Queensland's Department of Agriculture and Fisheries.

In Australia, AFMA has mandatory electronic monitoring on 75 vessels operating in the Eastern Tuna and Billfish Fishery, the Western Tuna and Billfish Fishery and the Gillnet, Hook and Trap Fishery. Electronic monitoring technology potentially offers a cost-effective alternative to aspects of the human on-board observer programs that still operate in many fisheries.

Human observers are required to monitor a certain percentage of activity in various fisheries to meet assessment targets and enable

effective data analysis. This can vary greatly – anywhere from five to almost 100 per cent of activity, depending on the fishery and what observers are looking for, with an average of about 10 per cent.

Likewise, only a small proportion (usually 10 per cent) of the thousands of hours of video collected by electronic monitoring is actually reviewed. The reasons for this vary; for example, only a small percentage of footage actually captures fishing activity. However, AI has a real potential to streamline and reduce the reviewing costs, while increasing the amount of video actually reviewed.

There is potential for electronic monitoring to be used in other Australian Commonwealth and state fisheries. It has also recently become mandatory in some New Zealand and Chilean fisheries.

"It's a growing trend, worldwide," Rich Little says. "And with the right training, Wanda will be able to assess all of the available video, rather than a small fraction. We think we will be able to help further reduce the costs of monitoring through the automatic identification of species."

Transparency

While species identification features will begin with target catch species, it is likely to expand to byproduct and bycatch species as well as threatened, endangered and protected species.

Rich Little says increasing the amount of fishing time actually scrutinised has the potential to significantly increase public confidence in the fisheries sector. From both a management and an industry perspective, it will provide greater evidence of compliance – that fishers are doing the right thing, and are known to be doing so.

From the initial concept, when it came to developing the software Rich Little and Geoff Tuck joined with Dadong Wang at Data61 for expertise in the computer vision and machine learning processes.

Initial video training has used test data from AFMA, but really requires thousands of images all up. But it's not just a matter of identifying a fish. The program needs to be able to identify where in each frame the fish is – often as it is sliding across the deck of a working fishing boat.

In the early stages of training, this means someone needs to find the fish and graphically put a binding box around it so that Wanda can 'learn' where the fish is and what it looks like. The more images used in training, the more accurate the results. While imaging technology continues to make huge gains, the sophistication required to distinguish certain species is likely to make it impossible for wholesale use.

Recognising the long-term savings available to industry of this technology, AFMA is keen to work with CSIRO to provide access to imagery from its Eastern Tuna and Billfish Fishery (ETBF), which has the longest and most extensive video dataset in Commonwealth fisheries.

"As the ETBF is a longline fishery, it generally brings fish on board one at a time – unlike a trawl fishery – and this will make training and identification easier," Rich Little says.

Swordish, and Yellowfin, Albacore and Big Eye Tuna are likely to be the focus of the initial AFMA case study designed to demonstrate Wanda's effectiveness.

A postdoctoral researcher will be employed as part of a three-year project to refine Wanda. But with the new dataset, Rich Little says results with high accuracy could be achievable in six to eight months. F

Eyeing a smarter catch in the trawl sector

Significant issues of bycatch, biosecurity and environmental benefits are being addressed through new technology that gives trawl-net fishers 'eyes in the net'.

While camera technology is becoming an essential part of on-board monitoring for fisheries compliance, it is also being applied to improve the efficiency of trawl fishing.

DigiCatch is the name of a new 'precision fishing technology' developed by US company SmartCatch. CEO Mark Dahm presented at last year's Seafood Directions conference, saying the system has provided a two per cent reduction in bycatch for some users, which could be worth up to $100,000 to a trawl business. It provides 'eyes in the net' via real-time, high-definition video that allows fishers to see what they are capturing – at depths of more than 900 metres – before the catch is landed on deck.

Combined with another SmartCatch innovation, SmartNet, fishers can release non-target species from the net underwater through a pre-catch release system. Mark Dahm said it allowed fishers to maximise catches of target species within quota, while avoiding non-target species that could lead to fines or potential fishery closures.

Additional digital sensors also convey information about salinity, depth, location and acidity – information that is vital for biosecurity and traceability, which is becoming increasingly important in seafood markets as consumers demand detail on seafood origin.

Mark Dahm, whose background in technology includes more than 25 years working in Silicon Valley, in the US, said it was his passion for the sea that led him to apply his technology skills to the fishing industry.

The DigiCatch technology was voted the Gold Winner for Innovation in Sustainable Solutions in the 2016 Edison Awards and is being used by some major players in the North American seafood industry fishing in the Bering Sea.

While the technology has initially been expensive, costing about US$40,000 (A$53,7500) a system, Mark Dahm said the price was fast coming down and could be retrofitted to existing gear. Eventually, he said, the system could become cost-neutral as the data recorded by the technology builds and becomes more valuable.

"Data is the oil of our time and we believe the major commercial seafood companies, the government agencies and fishery councils will pay for that data and subsidise these devices on the boats so it becomes standard practice," he said.

The technology could help sustain the fishing sector as well as fish stocks, helping fishers comply with regulations while providing consumers with the sustainable seafood they sought.

"We start right here with what begins with DigiCatch in the net capturing data at the point of capture ... and ultimately it's about a great piece of protein on the plate," he said.

Mark Dahm said Smartcatch delivered on a triple-bottom-line objective to bring economic, ecological and social benefits.

"There is huge economic impact in being able to bring this type of technology to the seafood industry; there is the ecological component of building sustainable ocean technology to save our fish species and make our supply chain more efficient; and then there's the social and the food security aspect ... and as we know, seafood is really good for us."

– MELISSA MARINO

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FRDC RESEARCH CODE: 2017-194

Five minutes to a safer workplace

Fast, simple and accessible training will anchor the new SeSAFE program to prevent injuries and deaths at sea

By **Catherine Norwood**

Watch a short video, answer some multiple-choice questions. The five minutes it takes hardly seems like much, but it could be enough to prevent injury or save a life – a mate's, or maybe your own.

The video and quiz session represents a single module in the SeSAFE program, a voluntary learning system being developed as part of the FRDC's Seafood Industry Safety and Welfare Initiative launched in March this year.

The SeSAFE program is being funded by the commercial seafood sector, the FRDC and the Australian Maritime Safety Authority, with a budget of $650,000 for the first two years. This will go towards the development of basic training modules for fisheries and aquaculture workers new to the sector, before they begin working on the water. It will also offer a refresher for experienced hands. Further funding is being sought from different industry bodies to develop sector-specific modules.

SeSAFE's project leader Steve Eayrs says the program targets foundational safety training for crew.

"Modules are designed to be online and user-friendly, rather than the traditional book-learning approach. The crew can complete the modules at any convenient time before going to sea; all at once or spread out over multiple days.

"For skippers and production managers, these modules offer a simple, low-cost way to meet their 'duty of care' requirements to ensure crew have appropriate training for their workplace, and they complement any at-sea training they provide to their crew."

National safety targets

At a national level, the FRDC is seeking to halve the number of fatalities and accidents in the sector by 2023.

Workplace fatalities have averaged five a year for the past five years, making the fishing and aquaculture workplaces the most dangerous in Australia – 25 times more dangerous than mining or construction (based on fatalities per thousand workers). The most 'at risk' group are male workers aged 20 to 24 years, followed by those aged 45 to 54 years.

The figures are less certain for workplace injuries. Steve Eayrs says many minor injuries and 'near miss' events are not reported at all, and in some instances it is likely that more major injuries are also not reported.

He says safety has traditionally been shaped by a slew of national, state and territory maritime safety laws, including vessel surveys. However, a vessel may be deemed safe to operate without being operated safely.

Bridging that gap between equipment and behaviour is an important part of the SeSAFE program's aims.

Several modules are being developed based on a training package created by Austral Fisheries for its staff, who work in the Northern Prawn Fishery and in the Southern Ocean longline fleet. "Module topics are wide-ranging, from hand safety to fatigue, and from man overboard to abandon ship and use of personal protective equipment," Steve Eayrs says.

Austral also has an enforceable undertaking with the Northern Territory Government following the electrocution of a crew member in the Gulf of Carpentaria in 2013. This includes $250,000 funding towards a national safety program, and benefits accruing to the workplace, broader industry and NT community of almost $1 million.

Expanded program

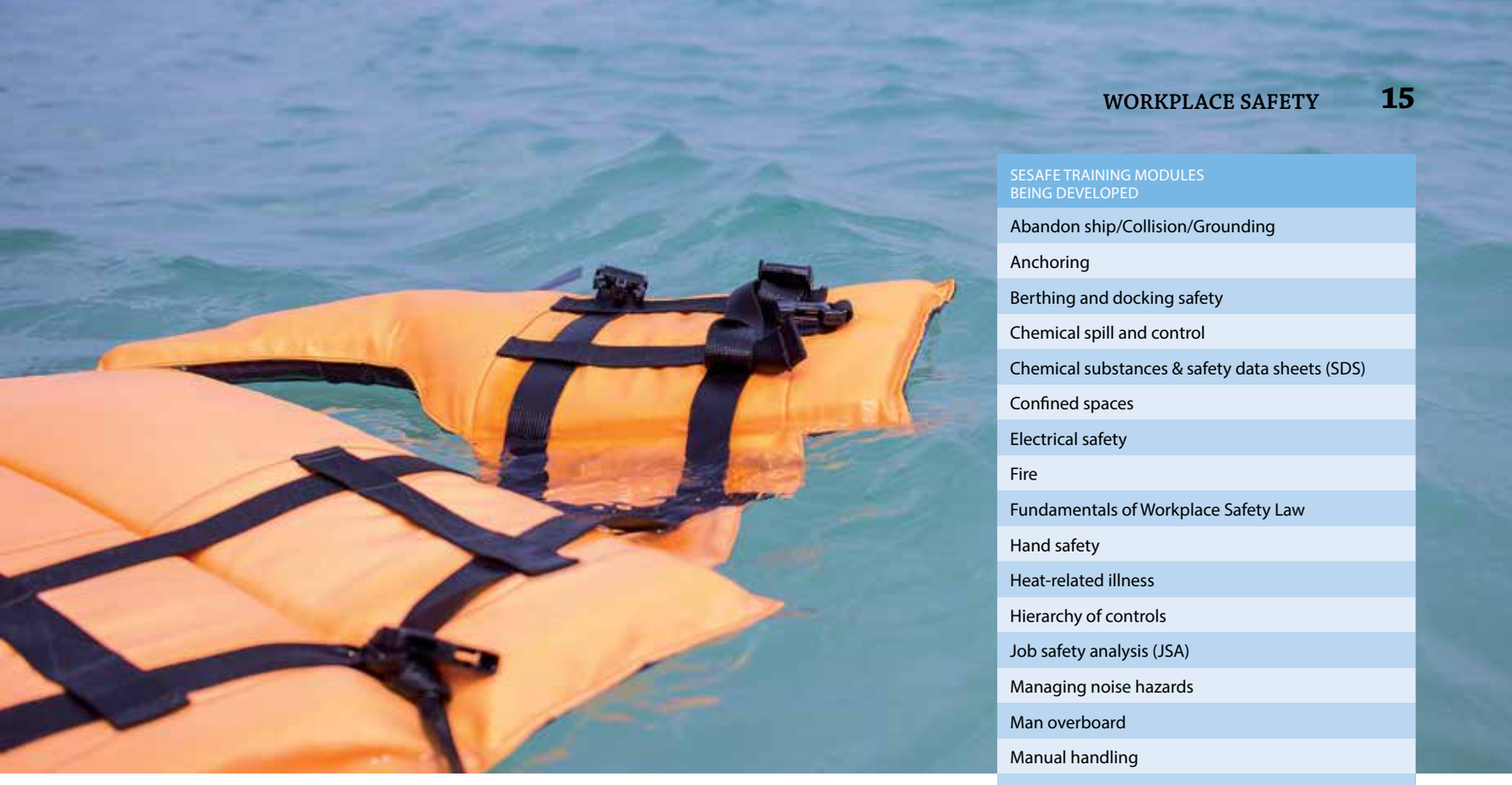
Oliver Krcoski joined Austral in 2016 as health, safety and environment adviser, and says developing safety training was his priority. "I spent over a month actually on the prawn trawlers working as a deckhand and collecting video and images and taking notes on what they do, to help develop the training."

5
The average number of fatalities of commercial fishers per year on Australian waters.

25
The number of times more likely a fatality will occur on a commercial fishing boat than in mining.

60
The cost in billions of dollars that workplace injuries, illness and disease cost the Australian economy each year.

?
The number of injuries and accidents per year on Australian waters is unknown because the data is unreported.



SESAFE TRAINING MODULES BEING DEVELOPED
Abandon ship/Collision/Grounding
Anchoring
Berthing and docking safety
Chemical spill and control
Chemical substances & safety data sheets (SDS)
Confined spaces
Electrical safety
Fire
Fundamentals of Workplace Safety Law
Hand safety
Heat-related illness
Hierarchy of controls
Job safety analysis (JSA)
Managing noise hazards
Man overboard
Manual handling
Medical emergency, including allergies
Personal flotation devices
Personal hygiene
Personal protective equipment (PPE)
Refuelling
Risk matrix
Rope handling
Severe weather/cyclones
Slips, trips, general housekeeping
Standard policies for drugs, sexual harassment and racism
Sun protection
Using knives
Working at heights

SeSAFE has now taken Austral's initial training program and begun to refine each module to ensure broader applicability and to expand the number of modules to include additional fishing practices. Operators in different fisheries should be able to identify relevant modules for their own crew.

Oliver Krcoski says Austral is happy to have its training create a basis for the broader SeSAFE program. "If we find we still need something specific aligned to our own policies, we can add to it then. But this will provide a way to offer efficient and effective training, with a standardised approach across the fisheries sector."

The SeSAFE program will make use of the Adobe Captivate Prime learning management system, which could cost as little as $6 per user per month, plus the cost of administering modules to participants.

Once the program has been finalised, modules can be made available to individuals via email, then completed online or offline on a computer or tablet and uploaded to the module administrator.

"We're still putting the modules together and working out the nuts and bolts of module delivery and administration," Steve Eayrs says. "In the next few months, we will make modules available for a trial run focusing on the Western Rock Lobster Fishery and the Northern Prawn Fishery."

SeSAFE is expected to complement onboard workplace safety management systems and help provide a holistic approach to safety management, training and compliance, particularly when combined with at-sea training and other requirements.

The Western Australian Fishing Industry Council (WAFIC) is coordinating funding and administration for the program. WAFIC CEO John Harrison says three WA trawler crew perished in one recent incident and he has also been personally involved in a marine workplace fatality during his time in eastern Australia.

As chair of the SeSAFE steering committee, he says a major commitment to safety is well overdue. "We need to do whatever we can to make sure the crew on our fishing vessels come home," John Harrison says.

"This new approach with electronic delivery will allow people to learn at their own pace."

He says it will also make it easy for crew to do a refresher as needed; for example, in response to specific incidents, such as the recent news of a man-overboard drowning in the US, which highlights the importance of personal protection devices and knowing procedures to bring someone overboard back on deck.

John Harrison says the committee wants to see the program continue beyond the initial two-year timeframe, as it becomes integrated into standard industry practice.

In conjunction with the SeSAFE training, the video series 'What if they don't come home?' is also being developed, which features one or more individuals and their families affected by an accident or tragedy at sea and the impact on loved ones left behind. F

Below Austral crew practise an emergency response drill using high-buoyancy life vests designed for severe weather conditions.
Photo: Austral Fisheries

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FRDC RESEARCH CODES: 2003-061, 2008-023, 2010-023, 2010-043, 2013-028

Photo: Catherine Norwood

Ecosystem view of fisheries health

By **Gio Braidotti**

International research finds good fisheries management does improve ecosystem health, with Australia's southern fisheries awarded a top ranking

Beth Fulton
Centre for Marine Socioecology

"Australia's commercial fishing sector recognised there was a problem, they were willing to address it and that effort is paying off."

There was a time, up until the turn of the century, when the technological ability to harvest fish was expanding rapidly and outstripping our understanding of oceans. Over-fishing turned into a global crisis that demanded a regulatory response which could not wait for science to close the knowledge gap.

Using the tools and data available at the time, a series of single-species management protocols was developed. The aim was to achieve the sustainability of both fishing enterprises and fish stocks, striking a balance between conservation and profitability.

In the intervening years scientists have continued to work towards more sophisticated understandings of the systems in which fish populations live – to quantify fish stocks, develop monitoring techniques and better understand impact and consequences in marine habitats.

This emerging understanding of oceans has been labelled an 'ecosystem' view and has been used by fisheries managers to implement ecosystem-based fisheries management (EBFM) strategies.

A leading proponent of this approach is Beth Fulton from CSIRO and the Centre for Marine Socioecology, a joint centre supported by CSIRO and the University of Tasmania in Hobart.

She describes EBFM as the inevitable evolution in thinking about fisheries and our oceans.

"We are at the point where we can start to give context to what managers have been doing, using an ecosystem lens," Beth Fulton says. "That means we have the ability to explore the impact of fisheries governance in terms of the health of entire ecosystems."

She views it as inevitable that management structures will need to keep evolving, given the unprecedented rate of change occurring globally and the challenges the world is facing.

"This is a faster rate of change than anyone has ever had to deal with before," she says. "That means a lot of the old management structures are not enough by themselves anymore. So there is this desire to find new ways of doing things."

Even though EBFM is a work in progress, taking a systems approach has found real-world applications and made impressive contributions, with more in store as the approach gains capability.

International assessment

EBFM is being looked to globally for improvements in the management of fisheries.

An exploration of governance and impact is at the heart of an international research project led by Alida Bundy of the Bedford Institute of Oceanography in Dartmouth, Canada.

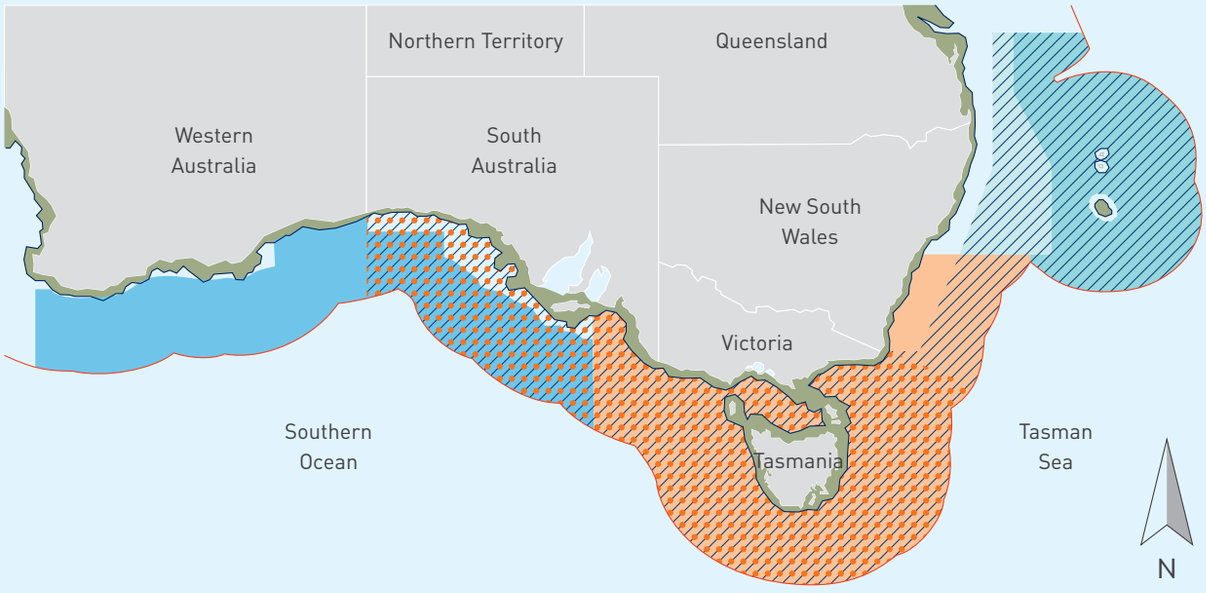
Researchers worked collaboratively to assess the ecosystem status of fisheries around the world relative to two key governance metrics: management effectiveness and governance quality.

In all, 27 ecosystems from around the world – including Australia – were included in the analysis, ranging in size from 1000 to 3,700,000 square kilometres.

The selected ecosystems were analysed by 61 experts, including Beth Fulton and others experienced in Australian fisheries. The researchers each had an average of 18 years of experience in fisheries and 13 years in sociological research or fisheries management.

Among the largest regions included was the ecosystem(s) of Australia's Southern and Eastern Scalefish and Shark Fishery (see Figure 1). It

FIGURE 1 THE SOUTHERN AND EASTERN SCALEFISH AND SHARK FISHERY IS MADE UP OF SEVERAL DIFFERENT COMPONENTS.



Source: Australian Fisheries Management Authority, www.afma.gov.au/fisheries/southern-eastern-scalefish-shark-fishery/

has been managed by the Australian Fisheries Management Authority (AFMA) via an integrated set of management rules that act together to achieve sustainable catches and protect the ecosystem supporting the fishery. These rules restrict total catches, how many boats can fish, and regulate where and when fishing can occur and what gear can be used.

The study found a clear relationship between governance structures and ecosystem health, with more effective management and higher quality governance linked to healthier ecosystems.

When all ecosystems analysed were ranked, the three ecosystems with the best-performing scores were the south-east Australian shelf, followed by the USA's west coast and the Barents Sea, off the northern coast of Norway and Russia.

"It was a pleasant surprise to see how well Australia did," Beth Fulton says. "We can become a bit cynical about the status of our own backyard, focusing on the issues and not recognising all the wins, so the ranking was a good reward for the effort put in by industry, managers and scientists.

"Australia's commercial fishing sector recognised there was a problem, they were willing to address it and that effort is paying off."

Australia's high rank becomes understandable when the key governance determinants associated with positive ecosystem outcomes are listed. All would be familiar to Australian commercial fishers. They are:

- using reference points (such as limits and targets) for management;
- assessment and addressing of ecosystem impact of fishing;
- accounting for and addressing illegal, unreported and unregulated catches;
- including stakeholders; and
- implementing a long-term management plan, including economic and social dimensions of fisheries in exploited ecosystems.

The analysis bodes well for the Australian fishing sector, although the scientists warn that no nation achieved results worthy of complacency.

The rise of Atlantis

Unlike single-species management approaches, EBFM does not view fisheries as exclusively biological entities. In reality, fisheries are more complex than that since the biological elements intersect with environmental, geological, climatic, anthropological, cultural, social and economic dimensions.

Ecosystem-based thinking endeavours to capture this complexity by finding ways to integrate within one conceptual framework the knowledge systems of many disciplines, with economic and social science prime among them.

The need for this interdisciplinary integration forced Beth Fulton to look beyond her own training in marine biology and ecology, and even question the way science is structured.

She says that science's empirical rationality tends to categorise the objects it investigates, taking things apart and separating them. The resulting descriptions can be astonishing, but they rarely represent the complexity of real systems, with their capability for dynamic changes and influential interactions.

"That old way of thinking within disciplinary silos had to be gotten over," she says. "It took time – and the process is ongoing – but

this more whole-of-system approach is now embedded into ecosystem thinking and in the management advice it provides. For a modeller like me, that meant integrating knowledge from different disciplines to match or mimic the degree of integration in the real world."

As such it is the 'inter-connections' between parts of a system that she and her collaborators strove to better understand.

To that end, the data-crunching power of ever-more sophisticated computer models has become central to the ecosystem-based analysis. These help researchers to perform the complex integration of biological, social and economic considerations.

Prime among these modelling systems is Atlantis, developed by Beth Fulton and her team.

"Initially Atlantis was used to understand how to represent an ecosystem and then how ecosystems work," Beth Fulton says. "As it evolved, it found practical applications. You would never use it to set a total allowable catch (TAC), but you can use it to contrast different management options, to support decision-making and to identify otherwise unpredictable outcomes of management policies."

Atlantis has been used to address specific fisheries questions as part of several FRDC-funded projects. One project in particular 'Alternative management strategies for south-east Australian Commonwealth fisheries', was key to the system's evolution.

The project sought to find alternative management strategies when the quota-management system in place was failing. The Southern and Eastern Scalefish and Shark Fishery is one of the few fisheries in Australia where EBFM is applied.

In addition, Atlantis has also been used in the management of more than 40 ecosystems globally. In 2007 the United Nations Food and Agriculture Organization rated Atlantis as the world's best program for the strategic evaluation of marine fisheries management.

Besides the model of the south-east Australian shelf used in the study led by Alida Bundy, models have been developed for other locations, including the whole Coral Sea and the Great Australian Bight. An Atlantis model is under development for the Great Barrier Reef and another is close to completion for south-west Australian fisheries.

FRDC projects have applied Atlantis to a range of fisheries and scenarios, such as evaluating the potential effects of climate change on south-eastern Australia's coastal waters. Over the years, Atlantis has grown in capability as it has been applied to more fisheries and as scientific knowledge has grown. The availability of more data with which to validate models has also greatly removed the need for assumptions.

More research will ensure that ecosystem-based analysis will keep growing in sophistication and the researchers' willingness to work with industry and management helps to drive adoption.

The Alida Bundy study was co-funded by IOC–UNESCO (www.ioc-unesco.org), EuroMarine (www.euromarinenetwork.eu), the European FP7 MEECE research project, the European Network of Excellence EUR-OCEANS and the FRB EMIBIOS project. Researchers outside of Europe volunteered their time, with Australian researchers grateful to funding bodies, such as the FRDC, for supporting their work. F

The report, Strong fisheries management and governance positively impact ecosystem status, *can be downloaded at https://onlinelibrary.wiley.com/doi/full/10.1111/faf.12184*

New approaches to add status

By **Catherine Norwood**

Even when data is limited, the right techniques can help determine the sustainability of fish stocks

As researchers prepare for the update of the 2018 *Status of Australian Fish Stocks* (SAFS) reports in December, CSIRO fisheries scientist Malcolm Haddon has been training researchers to use new assessment techniques that may help reduce the number of 'undefined' species and stocks in the reports.

In 2016, almost 90 per cent (annually by both value and volume) of Australia's commercially harvested fish were accounted for in the 83 species in the SAFS reports, which is coordinated and published by the FRDC. These 83 species make up 294 stocks or discrete fish populations, 75 per cent of which were characterised as 'sustainable'. This represented 85 per cent of the total commercial harvest reported on in SAFS. However, 12 biological stocks, or 14.5 per cent, were 'undefined'.

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FRDC RESEARCH CODE: 2017-102

Above Bluespotted Flathead is classified as undefined in the *Status of Australian Fish Stocks* (SAFS) reports. Photo: William Meppen

The aim is to reduce the number of species categorised as 'undefined' in the next edition of the reports. Set to be released in December 2018, there will be 37 new species added, bringing the total to 120 species.

Malcolm Haddon says most of the main commercial species, which have quotas and formal assessment and management processes, have already been included in the SAFS reports. Species that are being added are most likely to be non-target species that may be a byproduct of the targeted catch or may be part of more sporadically harvested fisheries or species.

This will make informative fisheries data more difficult to come by and increase the likelihood of an 'undefined' status. However, analysis techniques specifically designed for fisheries with data limitations offer ways to use what can be scant information to produce a defined resource status.

"In Australia we haven't really tried to do assessments for fisheries with data limitations before, or if we have, we've come up with a 'trigger' catch that was assumed to be sustainable, and extra work would be needed to increase it. So this is a different process," he says.

As part of efforts to reduce the 'undefined' entries, he led seven FRDC-funded training workshops, held in the Northern Territory, New South Wales, Tasmania, Victoria, South Australia, Western Australia and Queensland earlier this year.

Software he developed was provided with worked examples of real fisheries data as part of the training and participants brought their own state-based data for analysis using different techniques demonstrated during the workshops (see breakout).

DATA-POOR ANALYSIS TECHNIQUES

Some of the techniques explored in the workshop, along with the kind of data they use, included:

- Catch–maximum sustainable yield (MSY)
  This requires data on a series of catches over time but assumes that low catches are a result of reduced population size. When other factors such as management change, changes in fishing behaviour or fishing for other species may occur.
- Surplus production modelling
  This requires data from a series of catches over time and an index of relative abundance (estimated volume of fish), which is often estimated using catch per unit effort (CPUE) in Australia.
- Age-structured production models
  This requires a series of catches over time, CPUE (or another index of relative abundance), and additional biological information such as estimates of natural mortality, age at maturity and length and weight at age.
- simpleSA (simple stock assessment) and CEDE (catch effort and data exploration)
  These use open-source software packages developed for data-poor fisheries. The packages, which integrate the previously described techniques, were demonstrated during the workshops.

Malcolm Haddon says simpleSA provided the basis for most of the analysis participants undertook, with the ongoing development of the software as the workshops progressed. It allows researchers to move from one analysis technique to another as more detail becomes available – from catch volumes, to catch rates, to the biological details of the species and the catch itself.

Assessing status

Preliminary results during the workshops yielded several successes in terms of determining status. However, these findings will need to be verified through a process of 'sensitivity' testing, to see how the results change when the assumptions underpinning the analyses are changed. There will also be a peer review of the process and status, which is a crucial part of the SAFS science quality control procedures.

Malcolm Haddon says the workshops also showed that some stocks were not able to be assessed; there simply was not enough useable information. "But now the analysts can defend their decision – why they have elected to call something undefined."

The workshops raised issues such as what constitutes a 'negligible' fishery – when catches by all fisheries are so low as to be considered negligible, and that inadequate information exists upon which to base a status classification – and what the minimum assessable stock is, or the minimum amount of data needed to assess a stock.

"For example, a 50-tonne fishery might sound quite significant, but spread across 2000 kilometres of coast it's actually a tiny amount. And it could be made up of very few records," Malcolm Haddon says.

"Despite this, if we have some data, we may still be able to come up with management advice and status for a species. And maintaining the productivity of our fish stocks is an important focus of the SAFS reports." F

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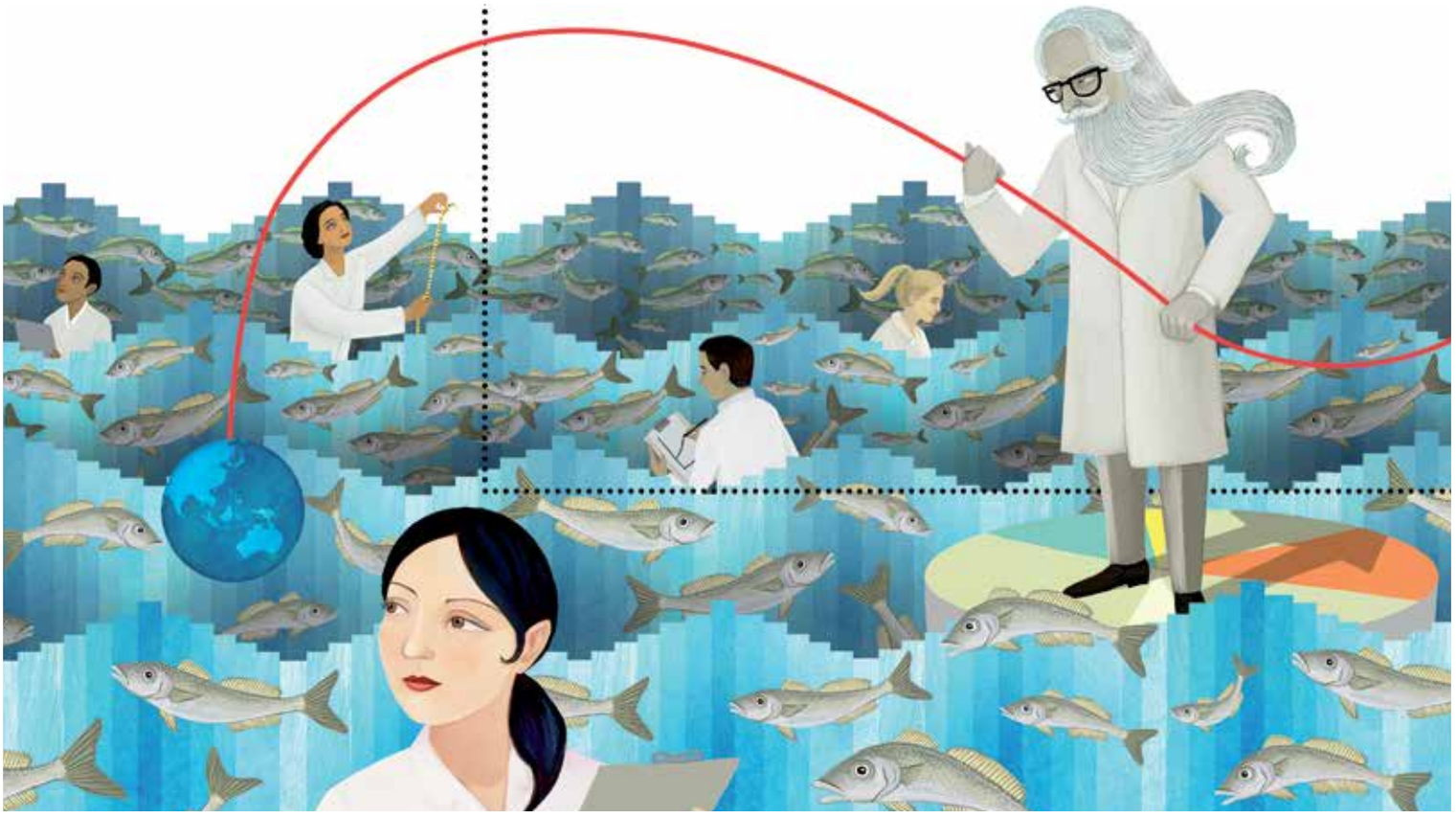
FRDC RESEARCH CODE: 2014-039



Skills shortage forecast for stock assessments

If Australia is to maintain its leading edge in fisheries stock assessment and management, it will have to attract more young scientists and encourage a greater level of collaboration

By **Bianca Nogrady**

Illustration
Sonia Kretschmar

You can't manage what you can't measure is a truism that has particular relevance in fisheries.

Stock assessments aim to provide fisheries managers with the best possible scientific information in order to calculate the volume of fish that can be harvested without depleting the stock for the following year's catch and into the future.

Collecting and analysing biological and statistical information to determine the effects of fishing on fish populations and to predict their future condition is an essential component of sustainable management.

Australia has been home to some of the world's top fisheries assessment scientists who, for decades, have made the country's stock assessments the envy of much of the rest of the world.

But times are changing. The new report *Stock Assessment Integration: a review*, funded by the FRDC, has taken a long, hard look at the state of Australia's fisheries stock assessments and sounded a note of caution about the future.

The report's authors found that, at times, Australian stock assessment work was hampered by an isolationist approach that has stymied international collaboration and the sharing of expertise. This has also limited stock assessment scientists from taking advantage of new technologies that could make stock assessments faster, cheaper and more accessible.

One of the big issues is a lack of time and resources to support collaboration. And there's a ticking clock: a significant proportion of Australia's stock assessment experts are approaching retirement and it's proving hard to attract new recruits.

"The modelling world has changed," says Cathy Dichmont, lead author of the report and an internationally recognised expert in stock assessment modelling. A former senior CSIRO scientist, she now has her own consultancy.

"The kinds of models that are out there – not just assessment models but statistical and mathematical model-building tools – have grown enormously," she says. "In other parts of the world they're adopting these technologies very quickly, but adoption is patchy in Australia."

In contrast, stock assessment experts in the US and the European Union are collaborating more often and taking advantage of generic packages as demands for stock assessments increase.

The report was initiated because of concerns that a lack of national

and international collaboration in fisheries stock assessments was leading to unnecessary duplication, with each jurisdiction often acting independently and effectively 'reinventing the wheel'.

"We wanted to know why Australian stock assessments were happening in smaller teams, doing bespoke models and having very little time to talk to each other, and why the US and EU had gone in the opposite direction," Cathy Dichmont says.

"Although the use of home-grown tools is not in itself an issue, it does not always allow for synergies and more cost-effective practices."

Are Australia's fisheries so unique that we need bespoke fisheries assessments? It turns out that the answer to that question is "not really".

The report's authors considered 76 model-based stock assessments for Australian commercial species ranging from rock lobsters to prawns to finned fish. These stocks represent about a third of Australia's commercial harvest.

They concluded that 58 of these stock assessments could have just as easily been done using one of the many freely available stock assessment packages used in the US or New Zealand as with the customised Australian modelling packages that had been used.

International benefits

International collaboration on fisheries stock assessments could have mutual benefits. For one thing, countries such as the US have a substantially larger (and growing) budget for fisheries.

The US National Oceanic and Atmospheric Administration (NOAA) – under whose auspices the US fisheries sector falls – has benefited from two consecutive budgetary windfalls specifically aimed at stock assessments. As a result, the US has a host of generic stock assessment packages that are very well supported and peer reviewed. The scientists who develop these packages are also supported to deliver courses on their use around the country and dedicated time to keep developing the package.

In Australia, funding for fisheries has been stagnant at best, which means innovation and sharing has become harder as the workload has increased. There have been few opportunities to share skills and know-how.

"Australia has some of the world's top scientists who are well positioned to invest in the development and maintenance of packages as a core component of stock assessment science," Cathy Dichmont says. "What they need is support to enable this."

The new report proposes some ways to improve collaboration. For example, making training, manuals and example datasets for generic stock assessment packages more accessible may make it easier for time- and resource-stretched scientists to get to grips with a new system.

It also suggests Australia could do more to share its own packages internationally, developing models into something more generic that other people could use. Cathy Dichmont says Australia has much to offer the rest of the world in stock assessment expertise, particularly when it comes to length-based models for hard-to-age species such as lobster and abalone.

"We have advanced, well-written, length-based models and if we turn these into a generic model, there is a world of crab and lobster modellers out there who would just love to have our package, because we have some of the best people on the job."

Open access

One challenge is how to make these stock assessment models accessible to everyone. The executive director of the FRDC, Patrick Hone, envisages a global, open-source, open-access fisheries stock assessment toolkit.

"Australia has some of the world's top scientists who are well positioned to invest in the development and maintenance of packages as a core component of stock assessment science. What they need is support to enable this." Cathy Dichmont

"For fisheries of the world, we need a collection of stock assessment models, we need to put them all into the cloud, they need to be open source so other people can contribute to their ongoing development," Patrick Hone says. "Then people will be able to go onto that cloud, take that stock assessment model and even get access to our data and re-run the model any way they like."

It would mean greater transparency and accountability for fisheries because the stock assessment data would be there for all to see.

But Patrick Hone admits that not everyone in the stock assessment community is entirely happy with the notion. There are concerns that making these complex models available to everyone could lead to their accidental – or deliberate – misuse, which could have devastating consequences for the management of those fisheries.

He says there is also likely to be resistance from parts of the industry where stock assessments form an important part of the business model. Providing these stock assessment models in an open-source, cloud-based manner could threaten revenue streams.

The need for such an accessible resource became starkly apparent to Cathy Dichmont when the NOAA took its own stock assessment toolbox offline.

"Many packages were available from the toolbox but they hadn't been aware that people were using it internationally until I spoke to them," she says.

Shared knowledge

The sector is also crying out for forums – either online or offline – to enable scientists to collaborate and share methods more easily and more regularly. In the US, the annual American Fisheries Society conference is enormous and brings together most of the industry. Australia has the Australian Society for Fish Biology Conference.

But the success of a separate one-off international event a few years ago focused entirely on stock assessments showed there was a need for more dedicated meetings, Cathy Dichmont says.

Another factor that prompted the stock assessment review project is what Patrick Hone describes as "succession planning".

"There's been an amazing group of scientists who led the quantitative revolution through the 1980s, 1990s and 2000s, who have built a whole lot of models that are now the foundation of almost all of our high-value and advanced country stock assessments," he says.

Many of these people are now close to retirement, and there are not nearly enough young scientists to take their place. Bright young scientists coming up through the ranks are needed to work directly with these experts.

While countries such as the US and South Africa have dedicated fisheries stock assessment courses, Australia has comparatively few. And a career as a stockassessment scientist is not necessarily an attractive option for young scientists. F

Below Aerial surveillance spots a Vietnamese fishing boat targeting sea cucumber, one of 14 vessels apprehended by Australian forces in 2016-17.
Photo: AFMA

Protecting precious waters

Australia's marine territories are double the size of its land mass, and protecting these resources from illegal fishers – both foreign and domestic – requires constant vigilance and collaboration between government forces and fishers themselves

By **Catherine Norwood**

The deliberate sinking of foreign fishing vessels as dive wrecks – or scrapping or torching them ashore – makes for a dramatic climax to the prosecution of illegal foreign fishing in Australian waters.

Along with jail terms, fines and the confiscation of catch and equipment, the destruction of boats is the culmination of often exhaustive operations targeting illegal operators across national, state and territory jurisdictions.

But just as important, if not more so, is the deterrent effect of these highly visible policing and compliance efforts.

A suite of operational measures, including policing and education programs, helps to prevent the level of activity that would jeopardise fish stocks, particularly in the case of high-risk species and locations.

Over the past few decades efforts across all jurisdictions have helped to ensure that the overall volumes of catch taken illegally have remained low enough that they can be accounted for as part of natural mortality numbers within stock-assessment modelling.

Protecting our borders

In the 2000s the number of foreign vessels fishing illegally in Australian waters was steadily increasing, reaching a peak in 2005-06 when 367 vessels were apprehended, most of them across northern Australia.

"That's more than one a day," says Peter Venslovas, general operations manager at the Australian Fisheries Management Authority (AFMA). "And there were many more that we just didn't have the resources to pursue," he says.

Most vessels were small (less than 10 metres) but the large numbers had potentially serious impacts on the sustainability of fragile northern fisheries.

Since 2005, however, there has been a dramatic decline in incursions – just 14 vessels in 2017-18 (Figure 1) – attributed to the Australian Government's more active enforcement campaign.

To reduce illegal fishing in Commonwealth waters AFMA works closely with Australian Maritime Border Command – a multi-agency taskforce within the Australian Border Force – which coordinates surveillance and monitoring for a host of maritime threats, including poaching.

Incursions in the north are most commonly from neighbouring countries such as Indonesia, Papua New Guinea and, recently, Vietnam. However, it's international demand that drives up both the prices and consequently the risks that fishers are prepared to take.

The detrimental effect could be crippling, Peter Venslovas says. In 2016-17 there was a spike in illegal activity, with 14 fishing vessels from Vietnam apprehended. All were targeting sea cucumber, and their combined catch of 64 tonnes was greater than the annual total allowable catch (TAC) of 55 tonnes for licensed Australian fishers in the Commonwealth fishery.

Peter Venslovas says ongoing poaching on this scale could quickly cause the sea cucumber fishery to collapse, but enforcement efforts, including the seizure of boats and catch, and jail terms for crew have since stopped the Vietnamese incursions.

Enforcement is just one of the strategies AFMA uses. In-country education becomes an important follow-up step. "We visit the key ports where illegal fishing vessels are coming from, such as Indonesia and Vietnam, and explain to fishers what happens if they are caught in Australian waters," he says.

Australia also works directly with neighbouring governments to improve their ability to monitor and control fishing activities in their own waters, and works collaboratively with international partners to strengthen regional fishing frameworks and the exchange of information to address illegal fishing on a larger stage.

Peter Venslovas says while enforcement efforts are paying off for Australia in northern waters there remains considerable activity outside Australia's maritime border. Maritime Border Command mapping of activity shows hundreds of vessels sitting just across the imaginary line that represents Australia's Exclusive Economic Zone. "It's crucial we maintain our capacity to conduct patrols. We still do boardings at sea to educate operators about coming across the border, and have fisheries officers on Navy and Border Force patrol boats."

Southern strategies

The strategy AFMA deploys in the north is very different to that used in the Southern Ocean.

Since the 1990s vessels have targeted Patagonian Toothfish (also sold as 'Chilean seabass'), seriously jeopardising international toothfish populations. In 1997 there were more than 30 'rogue' boats identified in the Southern Ocean, including in Australian waters. These were large, industrial-scale vessels with a massive capacity to take fish, and to make the operators millions of dollars.

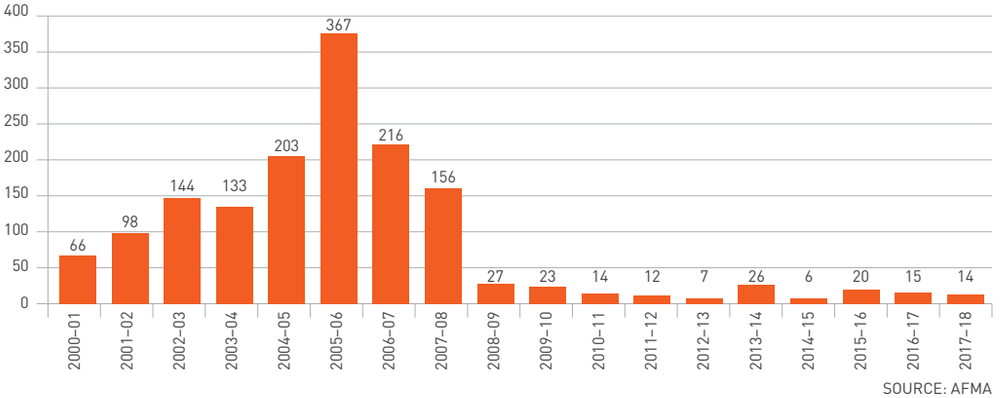
Since then, licensed fishers have created the Coalition of Legal Toothfish Operators to work with Australian and other government forces and NGOs to report and help apprehend poachers. It's the kind of alliance essential in international fisheries to provide the level of enforcement needed to support management that will protect the long-term sustainability of fisheries resources.

Australian Government authorities have successfully prosecuted the operators of at least nine vessels; sinking two boats as dive reefs off the Western Australian coast and sending others to ship-breaking yards. Many of the vessels were found to have Spanish connections, and the largest syndicate, known as the Bandit 6, was pursued for more than a decade before finally being put out of action. Bandit 6 included the *FV Thunder*, famously scuttled by its own captain after a 110-day pursuit by Sea Shepherd vessels in 2015.

Peter Venslovas says the original tactic of pursuit and prosecution in the Southern Ocean evolved into a strategy that focused on dismantling the business model for these illegal fishers.

This involves agreement to close ports where illicit catch could be landed and working with international authorities to prosecute the beneficial owners, which has been successful in

FIGURE 1 FOREIGN FISHING VESSEL APPREHENSIONS, FINANCIAL YEARS 2000-01 to 2017-18.



SOURCE: AFMA

virtually eliminating illegal activity in the south.

Much of the media focus is on the limited number of foreign incursions in Commonwealth waters. But with 197 kilometres to cross from the boundary of Australia's Exclusive Economic Zone to reach state and territory water, foreign incursions aren't an issue inshore.

Domestic fisheries

On a domestic level illegal fishing crosses both commercial and recreational sectors. It also includes organised criminal activity by elements outside the fishing community.

The key areas of domestic illegal activity include:

- commercial fishers misrepresenting their actual catch (deliberately or not);
- recreational fishers failing to comply with regulations such as bag and size limits;
- recreational fishers selling their catch; and
- deliberate criminal activity (although this is not an extensive problem).

A large variety of species are targeted, however, high-value abalone and rock lobster, which are both easily harvested using minimal gear, are easy targets.

Surveillance and compliance are crucial across state and territory jurisdictions to address these activities, and have led to several successful prosecutions encompassing commercial and recreational fishers, as well as other players in the seafood supply chain.

In NSW the courts handed down a two-year jail term for a NSW commercial fisher who illegally re-used rock lobster tags as part of an organised black market operation. Two other people involved in this operation, including a cook at a function centre that received the illegal catch, received 12-month suspended sentences. Fines imposed in the case totalled $2 million.

NSW Department of Primary Industries director of fisheries compliance, Patrick

Below left Eastern Rock Lobsters were the target of organised criminal activity in NSW that resulted in jail terms for those prosecuted.
Photo: NSW Department of Primary Industries

Tully, says the courts are taking fisheries cases more seriously, with harsher penalties being applied in recent cases. He says while illegal fishing threatens fisheries resources, it also undermines legitimate fisheries users, including the investment of commercial fishers and the value of their licences and quota.

In Victoria, Operation Torpedo led to the arrest of a fish shop owner and two associates in January 2018 for allegedly laundering recreationally caught fish through the shop and "dealing in the proceeds of crime". The shop owner's 7.5-metre boat, valued at $150,000, and a truck were seized, along with fishing gear worth more than $10,000.

In another Victorian case two men were fined more than $17,000 in June and forfeited their boat, a car and other equipment after being convicted on charges of deception and illegal fishing. The pair posed as commercial fishers, taking illegal catch from the Gippsland Lakes and selling it in Melbourne.

Director of the Victorian Fisheries Authority, Dallas D'Silva, says while the sale of recreationally caught fish undermines the legitimate commercial fishing sector it also creates potential public health issues. "These fish aren't subject to the same food safety standards and scrutiny as commercial fish," he says. "They put the health of customers and the reputation of the retailer at risk."

He says tips from the public via the state's '13FISH' hotline were important in assisting compliance efforts, with thousands of calls received each year and "some fantastic apprehensions".

Manager of compliance statistics and systems for WA's Department of Primary Industries and Regional Development, Tim Green, says there is clearly some hard-core criminal activity in fisheries. While it was not an extensive problem, it was enough of an issue to warrant a special enforcement team to deal with it in WA, and in other states.

Tim Green works with the compliance subcommittee of the Australian Fisheries Management Forum, an informal network of government managers from across the country, and has led FRDC-funded research to identify indicators for better compliance outcomes.

He says quantifying illegal fishing, and the impacts on resources, remains an ongoing challenge for governments.

"It is difficult to use indicators such as the number of fines issued, or the dollars spent on enforcement, because these may not reflect activities that directly impact on the sustainability of fisheries themselves," he says.

"For example, illegally pulling someone else's lobster pots has been a high priority issue in WA, but it's an issue of public amenity and equity between fishers rather than ecology – at least in the short term.

"But we have strong legislation, good compliance risk-management processes and capable, professional compliance officers. We also have good partnerships with fishers and their representative bodies, which helps to ensure, based on all the indictors we have, that levels of illegal fishing are contained or minimised." F

REPORT ILLEGAL FISHING

COMMONWEALTH FISHERIES
CRIMFISH hotline,
1800 274 634
email:
intelligence@afma.gov.au
submit a report at
www.afma.gov.au

AUSTRALIAN CAPITAL TERRITORY
Crime Stoppers hotline,
1800 333 000

NEW SOUTH WALES
Fishers Watch,
1800 043 536
submit a report at
www.service.nsw.gov.au

NORTHERN TERRITORY
Fishwatch hotline,
1800 891 136
or report via the NT
Fishing Mate app

QUEENSLAND
Fishwatch hotline,
1800 017 116

SOUTH AUSTRALIA
Fishwatch hotline,
1800 065 522

TASMANIA
Fishwatch hotline,
0427 655 557

VICTORIA
13FISH, 13 3474

WESTERN AUSTRALIA
FishWatch,
1800 815 507

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FRDC RESEARCH CODE: 2016-200.40

Left Caroline Candebat's presentation on feed research won an award at a symposium in Spain.

Kingfish feed findings win symposium award

By **Alayna Hansen**

A winning presentation reveals how Australian research is revising feed formulations for local Yellowtail Kingfish farming

PhD candidate Caroline Candebat

Australia's Yellowtail Kingfish industry has made waves at the recent International Symposium on Fish Nutrition and Feeding in Spain, where James Cook University (JCU) PhD candidate Caroline Candebat was one of four students awarded for their oral presentations.

Her presentation was on the interactive effects of the nutrients taurine and methionine in the diet of juvenile Yellowtail Kingfish (*Seriola lalandi*) at the Port Stephens Fisheries Institute in New South Wales. The research shows that the dietary requirements differ from that of similar species farmed elsewhere.

Caroline Candebat is part of the NSW Department of Primary Industries (DPI) team involved in the national Kingfish for Profit (K4P) program researching improved feed formulations and feeding strategies for Yellowtail Kingfish. Her PhD supervisors are Mark Booth (NSW DPI) and Igor Pirozzi (JCU).

The K4P initiative is part of the Australian Government's Rural Research and Development for Profit program. It is coordinated through the FRDC, which oversees research by the NSW DPI and the South Australian Research and Development Institute. Industry partners in the program include Clean Seas Seafood, Huon Aquaculture, Ridley Aqua Feed and Skretting Australia.

Yellowtail Kingfish is an aquaculture species prized for its fast growth rates, quality 'white' meat and global marketability. It is being farmed in South Australia, NSW and Western Australia. However, at this stage very little is known about its specific amino acid requirements.

Caroline Candebat has investigated the effects of amino acid supplementation on juvenile Yellowtail Kingfish health and performance. Her preliminary studies show that taurine requirements are dependent on the level of methionine in the diet.

Past studies on a closely related species (*Seriola quinqueradiata*), farmed in Japan, indicated that the fish may not have the metabolic machinery to produce amino sulfonic acids such as taurine, so taurine has been added to their diet.

Researchers thought this would also apply to Australian Yellowtail Kingfish, but Caroline Candebat's studies have found evidence to the contrary.

"If methionine levels in the diet are sufficient, then it appears taurine supplementation is not as important in terms of achieving normal growth and development in juvenile fish.

"However, we still have much to learn about taurine and how it relates to other amino acids such as methionine and cysteine, or how taurine requirements are affected by environmental factors such as temperature or biological factors such as age."

Follow-up experiments are investigating the impact of dietary methionine and cysteine levels to complement the taurine research, and to map the metabolic pathways of taurine synthesis in Yellowtail Kingfish.

After completing her practical trials at the Port Stephens Fisheries Institute, Caroline Candebat plans to finalise her research at the JCU Centre for Sustainable Tropical Fisheries and Aquaculture in Townsville.

"I've always had an interest in biology, which developed into studies of marine biology and eventually the aquaculture industry. I love collaborating with others in the K4P program to fill the gaps in knowledge about Yellowtail Kingfish – there is so much that we still don't know about them."

She says the K4P program, which winds up next year, has provided industry partners with important knowledge about nutrient requirements and how raw materials and feeds affect fish health, ultimately improving the profitability and sustainability of the industry. F

MORE INFORMATION
Seafood Industry Victoria, www.siv.com.au
FRDC RESEARCH CODES: 2014-207, 2017-092

Fishers step up to the festival experience

Above Harbourside stands and events brought festival-goers into direct contact with fishers at the Apollo Bay Seafood Festival.
Photo: UBranding Pty Ltd

Victoria's commercial fishers are making community engagement a priority to build support for the sector and local seafood

By **Catherine Norwood**

Victorian fisher Tim Harrington is more accustomed to time at sea than among big crowds, but earlier this year he obligingly moored his vessel for the day to share his story with visitors to the Apollo Bay Seafood Festival on the state's south-west coast.

Thousands of people attended the festival's main Harbour Day, some heading to the food booths around the Apollo Bay Fishermen's Co-op, which sits on the hill overlooking the harbour. Fresh oysters, paella and seafood croquettes were just a few of the offerings, matched by craft beers and regional wines.

There were fish-filleting and cooking demonstrations at the co-op, and information booths dotted along the wharf opposite the string of fishing boats brought home for the event.

Many visitors stopped to chat with Tim Harrington, who was happy to share the details of his fishing life: week-long trips setting lines for shark and pots for lobster; the anticipation of the catch; the clean, fresh air and the open sea. He spoke of the challenges of a life on the water – uncertain weather, changing quotas and public misconceptions about what he does – for example, that all sharks are endangered. The Gummy Shark he targets is sustainable (for more information on the sustainability of Gummy Shark go to fish.gov.au).

Tim Harrington also shared his best tips for interested seafood punters: buy Australian (you'll know it's well managed), buy freshly caught fish (of course) and give something new a go – a species you might not have tasted before – especially if it's fresh.

It's this kind of personal interaction with the public that Seafood Industry Victoria (SIV), as the peak body for the state's professional fishers and the broader seafood sector, is keen to encourage.

Taking part in festivals and other major community events, and asking commercial fishers such as Tim Harrington to take part too, is a key plank in SIV's five-year strategic focus, launched last year. SIV chairman Markus

Below Tim Harrington
Photo: UBranding Pty Ltd

Below Recreational fishing stands at festivals encourage more people to go fishing, more often. Photo: Catherine Norwood

Above Always popular at the Apollo Bay festival: seafood paella from staff at the local La Bimba restaurant.
Photo: UBranding Pty Ltd

Nolle says the organisation has recognised it needs to be more proactive in taking fisheries (including the fishers) to the people.

Change of approach

"In the past, we've been reactive, caught up in the day-to-day tactical issues of fishers and responding to government policy. Our role needs to extend beyond that, to promote fisheries and the value we deliver, particularly in rural areas," he says.

The previous status quo was given a major jolt by the Victorian Government's decision to close Port Phillip Bay to commercial net fishing, a process that began in 2015 and will be finalised by 2022. This was a key commitment of the Victorian Government's Target One Million plan for recreational fishing, which aims to grow participation to one million by 2020 and get "more people fishing, more often".

The policy decision removes the 43 commercial net fishers who operated in Port Phillip Bay, making the bay an exclusively hook and line commercial fishery. The commercial net fishing catch was not large, at up to 700 tonnes, and some of this was used for bait. However, SIV estimates this closure represents more than one million serves of fish, mostly for Victorian consumers, which are no longer available.

The director of the Victorian Fisheries Authority (VFA), Dallas D'Silva, says Port Phillip Bay supports Victoria's largest recreational fishing community.

The government's decision to reallocate a large part of the bay's fisheries resources to recreational users was based on socioeconomic drivers, rather than on concerns about the biological sustainability of commercial fishing.

Above Seafood Industry Victoria executive director Johnathon Davey.
Photo: UBranding Pty Ltd
Right Robert Frost demonstrates the art of crayfish pot construction.
Photo: Catherine Norwood

He says other states have seen similar policy decisions made in recent years. An example is Queensland, where recreational fishing has been promoted in conjunction with the closure of net fishing in Cairns, Mackay and Rockhampton.

Markus Nolle attributes the decision in part to the lack of visibility that fishers have in the eyes of the public; you cannot see a boat at sea the way you can see a farm and fence lines. Fishers have also been steadily disappearing from local communities over recent decades as the sector has contracted in the face of environmental, economic and political forces, including pressure from recreational fishing groups.

Fishing heritage

The Apollo Bay Fishermen's Co-operative, which turned 70 this year, is one of only three fishing co-ops in Victoria with enough members to remain operational. There was once more than a dozen co-ops operating along the Victorian coast, with facilities established as part of a Victorian Government regional development initiative following World War II. The other active co-ops are at Lakes Entrance and San Remo.

Markus Nolle is a member of the Apollo Bay community, where he is a rock lobster fisher, and last year also joined the festival committee.

The festival committee has relocated the festival's main event from the main street foreshore to the fishermen's co-op and along the harbour itself.

The expanded three-day program included a sold-out "seafood feast" by chef Frank Camorra, from Melbourne's MoVida restaurant. There was also a full house for the Sunday speaker program talking about fishing, farming, science and sustainability.

The importance and value of provenance and sustainability was an ongoing theme of

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MORE INFORMATION
Slow Food Melbourne, www.slowfoodmelbourne.com.au

the festival, with as much seafood as possible sourced from Victorian waters and all of it from Australian fisheries. Markus Nolle says promoting the importance of provenance is critical.

Demonstrating value

To do this, SIV has also participated in community seafood and fishing events across the state this year. These have included the SeaDays Festival in Port Welshpool, Hooked on Portland, and the Kilcunda Lobster Festival in January, as well as the Hooked on Lakes Entrance event in March. Others are on the calendar, including the San Remo Fishing Festival on Sunday 9 September, and engaging the community in activities on World Fisheries Day, 21 November.

The 'Hooked on' events are an initiative of the VFA, beginning in Lakes Entrance in 2017 and this year in Portland, and are designed as "celebrations of what seafood and fishing bring to the community".

They are expected to become annual events, promoting commercial fishing, aquaculture and recreational fishing.

The VFA has also become a major sponsor of the Apollo Bay Seafood Festival and San Remo Fishing Festival this year.

Meanwhile, the FRDC is funding research into the socioeconomic benefits of the Victorian seafood sector, to be finalised next year, in line with similar research in New South Wales and Queensland. These earlier projects demonstrated positive economic flow-on effects, including the finding that fresh, local seafood was an anticipated part of the experience for people visiting coastal communities.

SIV is confident similar positive benefits will emerge in Victoria, helping to build a tangible value proposition around the people, the produce and the places that make up the state's seafood sector as something worth protecting and promoting.

In the case of Apollo Bay, a 2010 evaluation of port infrastructure prepared for the state government put the value of direct and indirect benefits from the local harbour at $43 million. The Colac Otway Shire also conducted a financial evaluation following the 2018 Apollo Bay Seafood Festival. This showed the festival had generated $1.8 million worth of economic activity for the town and $1.2 million worth of media coverage.

More importantly for the fishing sector, more than 10,000 people, including many of the 1600 locals, attended at least one of the festival-related activities, building stronger social connections for the community and for the local seafood sector. F

Below At the Slow Fish Festival. Top from left: lunch options from Te Kimu of the Kimu Korean Japanese Eatery; Daylesford's Dele mobile food van. Centre right: sardines prepared by chef Matt Wilkinson from Pope Joan. Bottom, from left: more sardine options from Frank Camorra of MoVida; chef Marisa Raniolo demonstrating sardines Sicilian style. Photos: Catherine Norwood

GLOBAL MOVEMENT TO PRESERVE LOCAL SEAFOOD PRODUCTION

Tapping into the growing global slow food movement celebrating fresh produce and local provenance, Melbourne launched Australia's first ever Slow Fish Festival in April.

Modelled on the biennial Slow Fish Festival in Genoa, Italy, this Melbourne event was also the first ever held in the southern hemisphere.

It was coordinated by Slow Food Melbourne, whose president Alison Peake says the slow food movement is about the politics of food and preserving local production.

"The loss of fishing licences in Port Phillip Bay has really brought the issue into focus; access to local seafood is under threat," she says.

A particular showcase for the festival, and for Melbourne Slow Food, is the humble sardine. The fish are sustainably harvested from Port Phillip Bay, but the days of local supplies are numbered.

Fisher Phillip McAdam was among the presenters at the festival. He and his family are among the few fishers still fighting for the right to continue harvesting sardines from the bay, which requires the use of purse seine nets. The Victorian Government is committed to removing all net fishing from the bay by 2022, which will close the sardine fishery.

Sardines featured in the food stalls at the Slow Fish Festival at the Spotswood–Kingsville RSL Club in April and were also used in demonstrations provided by chefs from local restaurants that all have an emphasis on fresh, local produce.

"We were pleased with the engagement on the day, despite bad weather," Alison Peake says. "Our aim was to get consumers to support our fishers, and to raise the issue of the loss of access to local seafood. When we lose our seafood, we lose the fishers and the community that surrounds them." F

The 2019 Slow Fish Festival will be held on 3 March at Seaworks in Williamstown, Melbourne.

MORE INFORMATION
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rowan@littletuna.com.au, www.littletuna.com.au

By **Gio Braidotti**

Far left Albacore tuna used in Little Tuna products is sourced from a sustainably managed fishery, with the fishing vessels based in Cairns, Queensland.

Left top A true love of quality, Australian-caught seafood was the inspiration for the creation of Little Tuna by Kate and Rowan Lamason.

Left below Little Tuna has three products on the market, available online, with more in the product development pipeline.
Photos: Little Tuna

Little Tuna: a quality take on a big market

An all-Australian Albacore offering adds new value to the fishery (and throws some shade on canned imports)

Canned tuna is a ubiquitous and popular product among Australian consumers, but all of it is imported despite the availability of Australian-caught fish.

Husband-and-wife team of Rowan and Kate Lamason in Queensland has taken up the challenge to change that. Based in Cairns, they have launched Little Tuna, offering Australian consumers an Australian-caught tuna from sustainable fisheries, processed and bottled as a premium product.

The company sells its three products online and through stockists across Australia. All use Albacore (*Thunnus alalunga*), which Rowan Lamason describes as an under-valued and under-used species with a delicate, firm flesh that retains a pleasant white colour once cooked.

He says quality, sustainability and Australian sourcing are a huge part of the product's identity and marketing. "Those are values that consumers have responded to, with ethical and health issues seemingly a growing concern among Australians."

The bottled rather than canned offering also supports the quality message, and allows customers to see exactly what they are buying.

The Albacore is primarily sourced from Great Barrier Reef Tuna, a family-owned and vertically integrated fishing enterprise run by Rowan Lamason's father.

"The fish is caught using hook and line gear from a fleet of three vessels fishing in the Eastern Tuna and Billfish Fishery, which is governed by the Australian Fisheries Management Authority," Rowan Lamason says.

He has firsthand knowledge of the fishery, having worked as a skipper on the family's vessels. He understands the care taken to conserve Albacore stocks and the onboard procedures to ensure quality of the fish caught.

"Fishing trips are kept deliberately short – to about seven days – to ensure the tuna's quality. This ethos continues inside Little Tuna, where we cook with carefully selected quality ingredients, right down to selection of the best suited oil for bottling."

The quality of the fish from the Great Barrier Reef Tuna fleet was the inspiration for establishing Little Tuna. But Kate Lamason says there is another important reason: "We saw a niche in the market given the lack of Australian canned tuna in the market and gave it a go filling it," she says. "It provides the fishery with an opportunity to value add."

The couple spent about six months assessing hundreds of recipes, testing the results on family and friends. And occasionally – given a grand failure – on the dog.

They settled on rice bran oil, which they found was the healthiest option and, being flavourless, it did not overpower the tuna. There was also a steep learning curve related to entering the food industry, including food safety regulations and marketing.

In June 2018, Kate Lamason jumped at the chance to finetune her business-development skills by taking part in the Fish-X hackathon (fish-x.com.au), a program run by the FRDC to mentor start-ups in the seafood sector.

Held in Sydney, she says it was an extremely beneficial experience, providing training, advice, feedback, networking contacts and even opportunities to refine her pitching skills.

The Lamasons now have their eyes on other under-valued or under-used but high-quality fish for the development of new products. But they are not providing any details just yet.

"You will just have to watch this space," Kate Lamason says. F

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FRDC RESEARCH CODE: 2011-724

Below Crispy-skin Cobia by Colin Barker of The Boathouse, Sydney.
Photo: Rob Locke

Tasty results for Cobia in consumer trials

Story **Rebecca Thyer**

The results of fish processing, preparation and consumer testing are part of the latest pond-to-plate research into Cobia aquaculture

Right Philippa Tyler taste testing food in her role as a consumer and sensory scientist.
Photo: Queensland Department of Agriculture and Fisheries

With a senior seafood scientist acting as 'head chef', three types of fish are grilled and served to a group of 12. Presented in foil trays, there is no seasoning or lemon slices. Instead, glasses of water are offered as palate cleansers.

The group is seated in individual booths in a laboratory-style setting, but it's not some new avant-garde restaurant experience.

Rather, it is consumer research, part of a broader FRDC-funded project to support the development of an Australian Cobia aquaculture industry.

The taste testing is one element in the 'pond to plate' project, which aims to move Australian Cobia aquaculture from pilot stage to commercialisation. Industry partner and co-funder of the project is the prawn farming Pacific Reef Fisheries (PRF), based in north Queensland, which already farms Cobia on a small scale.

Although Cobia is known to have excellent traits in terms of its flavour profile and shelf life, researchers were keen to quantify this.

Senior food scientist Andrew Forrest and his team at the Queensland Department of Agriculture and Fisheries (DAF), Coopers Plains, Brisbane, were responsible for the 'plate' end of the project – front-end processing, including fillet recovery, consumer assessment and shelf-life work.

Andrew Forrest says the team learned a lot about Cobia during the project. "The experience provided valuable data with regard to expected fillet recovery and meat yields, which is vital information for any stakeholders wanting to become commercially involved in the species."

This project's large-scale consumer testing work was designed to test how Cobia compared with two commercially available fish – Tasmanian Atlantic Salmon and Yellowtail Kingfish.

He says as clear market leader for fresh fish in Australia, Atlantic Salmon provides a well-recognised benchmark for the trial. Yellowtail Kingfish was also chosen because of its physiological similarities to Cobia.

"As a cooked product, Kingfish, like Cobia, is also a firm, white meat fish that has tight muscle bundles. As a cooked portion Kingfish will look almost identical to Cobia, which is highly desirable in a consumer assessment."

High-end markets

Although not as widely known to consumers, Cobia has already achieved significant market penetration in the high-end food-service sector, extracting a premium as a result. It is the same market that Yellowtail Kingfish producers target, which also provides an excellent comparison fish for consumer assessment.

Working with Andrew Forrest, DAF consumer and sensory scientist Philippa Tyler recruited consumer panels and designed and ran the consumer tests.

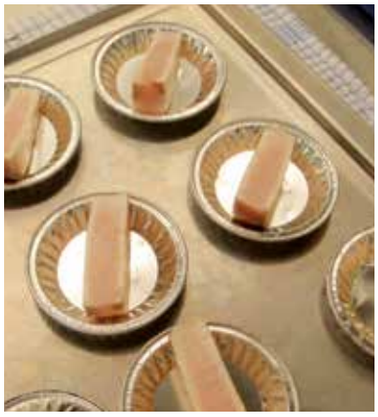
"We wanted people who are regular fish consumers (they eat fish at least once a week) and a cross-section of people," she says.

The 144 consumers recruited assessed the fish using a grid that included 30 attributes to choose from, such as glossy, golden, dry or juicy. The grid of attributes helps to evaluate the fish for texture, aroma and willingness to purchase.

Philippa Taylor says the grid helps consumers identify what they are tasting. "It sparks their imagination and gives us a way to quantify the data."

Consumers were also asked whether they would buy the fish and what they would pay for it, with good results for the Cobia industry.

Below, clockwise from left Cobia samples prepared for consumer testing; Cobia being smoked; whole Cobia supplied by Pacific Reef Fisheries for taste testing.
Photos: Queensland Department of Agriculture and Fisheries



Retail potential

"We gave consumers a scale which included prices of mullet (at $16 per kilogram); tuna (at $56/kilogram) and Atlantic Salmon (at $30/kilogram). Consumers put it in the region of salmon, which speaks volumes for the value of the fish."

The work showed that Cobia has great potential – rating as highly as cooked Atlantic Salmon in three of the six parameters studied: flavour, texture and overall liking.

Andrew Forrest says this is a "really powerful statement".

"It shows that the Cobia industry has the potential to compete very strongly with Tasmanian Atlantic Salmon, which is the clear market leader in seafood in Australia. So the economic potential of the Cobia industry is quite substantial."

The team also experimented with hot smoking, a process of cooking as well as smoking the fish, which became a firm favourite with the staff.

"Hot smoked Cobia has a refrigerated shelf life up to at least seven weeks from our testing. So this provides Cobia producers with another line of value," Andrew Forrest says. F

Breeding focus for year-round supply

A desire by Queensland prawn farmers to diversify into fish farming originally prompted research into the potential of Cobia in aquaculture almost a decade ago.

Fisheries scientist Peter Lee, who is based at the Queensland Department of Agriculture and Fisheries (DAF) facility at Bribie Island, says prawn famers were interested in growing Cobia out of season in south-east Queensland.

However, research with DAF soon found that the species grew almost twice as fast in northern Queensland ponds as it did in the south, and could reach more than five kilograms in 12 months.

The current FRDC-funded project 'The Development of an Australian Cobia Aquaculture Industry' is expanding on earlier research, working with Pacific Reef Fisheries (PRF) as a commercial partner and co-funder. The aim is to establishhow best to integrate Cobia aquaculture into an existing prawn-farming business.

Maria Mitris-Honos, PRF chief executive officer, says the first year's trial at its north-Queensland-based prawn farm went very well.

"Farm-wise, we got some really great results and the Cobia was also rated highly by chefs, in particular chef Tetsuya Wakuda.

"He was really impressed with its versatility. Suddenly, we were inundated with calls, people wanted to get their hands on it," she recalls. "We'd just finished the season, but it showed there was demand for it."

PRF soon made the decision to put aside two of its prawn ponds to grow Cobia. Two big wins at the 2015 Sydney Royal Fine Food Show – a gold medal and a President's Award – reinforced the decision.

For the DAF research team, the priority objective was to ensure Cobia fitted into an existing prawn-farming business.

Peter Lee says this meant that much research was needed on Cobia reproduction. "Cobia usually spawn in mid-January. We needed them to spawn earlier and more reliably, and we wanted that to work on a commercial farm."

Using photothermal manipulation (water temperature and day length), wild and genetically improved broodstock were successfully brought into spawning condition in October, three months earlier than previously observed for Cobia held under ambient conditions.

"Early spawning, and reliable fingerling production, were key to the inclusion of Cobia within PRF's overall farm production strategy," he says.

Maria Mitris-Honos says PRF now has six ponds of Cobia in various stages of growth to help ensure a year-round supply. More ponds will be added when the farm moves to a new site at Guthalungra, north of Bowen. Construction is yet to begin but planning approvals and permits are underway. "All through this process with DAF at Bribie Island our end goal was always to have our own hatchery. And that plan is in place," she says.

Increasing volume at the new farm will also allow PRF to explore retail options.

"DAF consumer testing will help when we move into retail, which increasing production volumes will allow. It will help us establish what consumers want. For example, fillets or smoked fillets or a marinated product."

PRF currently produces about 100 tonnes of fresh Cobia per year– or about 20,000 fish at market size. F

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Coopers Plains food research capabilities

In Queensland, the Department of Agriculture and Fisheries operates a food pilot plant as part of the Health and Food Sciences Precinct at Coopers Plains in Brisbane.

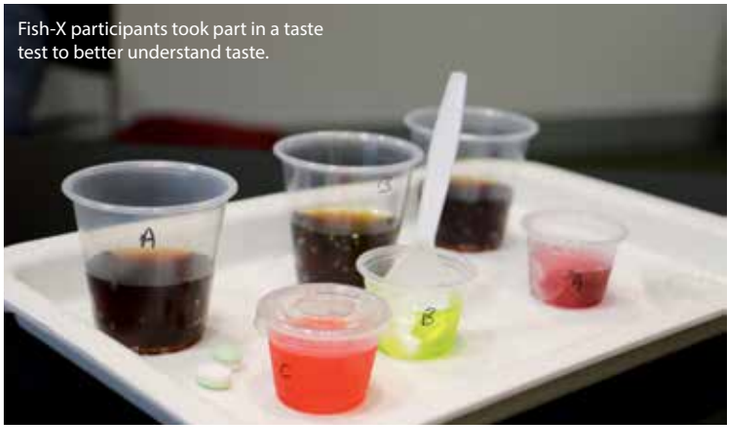
The plant and associated food technology, sensory and consumer science facilities allow researchers and industry to experiment and produce trial batches of up to 1000 litres of product under industrial conditions.

Based at the Coopers Plains facility, food scientist Andrew Forrest says that making use of the pilot plant could help producers reduce their risk by trialling products before investing in full production. The plant's capabilities include five flexible-layout processing areas with plug-and-use service droppers providing:

- general processing;
- high-hygiene cool room for fresh product handling;
- thermal processing and drying;
- warm room for thermal operation or fermentation;
- high-hygiene cold room for meat and seafood processing;
- six cold rooms; and
- dry goods storage and equipment stores.

It has more than 120 individual food processing units including a freeze dryer, membrane filtration, thermal processing (including ultra-high temperature (UHT) and pasteurisers) and a high-pressure processing unit. The plant has Safe Food Production Queensland registration and can be used for process development and trials, market evaluation and related food research.

Specialised consumer testing also helps develop marketing terms and identify product concepts. For example, processing trials as part of an FRDC-funded project identified that farmed Cobia could be successfully smoked, producing a value-added product to supplement fresh fish offerings. F



Fish-X participants took part in a taste test to better understand taste.

Left Coloured booths lit to remove physical differences between products.
Photos: Rebecca Thyer

What contributes to our sense of taste?

Preconceptions about what a food tastes like are often based on what it looks like. But looks can be deceiving says sensory scientist Philippa Tyler, who is based at the Queensland Department of Agriculture and Fisheries' Health and Food Sciences Precinct at Coopers Plains in Brisbane.

As part of a recent FRDC-funded Fish-X 'icrohack' in Brisbane, participants toured the Coopers Plains food pilot plant and their food sensory perceptions were put to the test. What seemed a simple exercise quickly revealed how easy it is for other senses to influence taste.

Test 1

Describe the flavours in three coloured jellies: pink (strawberry perhaps?), green (maybe lime?) and a deep plum (most guessed blackcurrent).

It turned out that 'lime' jelly was really lemon jelly dyed green, while the 'blackcurrant' was a strawberry jelly dyed purple. The pink jelly was strawberry flavoured.

Philippa Tyler says the visual impact on taste is an important factor for those in the food industry to remember when bringing new ideas to market.

Test 2

A cola 'triangle test', picking the odd one out – in this case a diet version of the drink. This can be used to test how a new product can be matched against a market leader or how changing ingredients affect the product profile.

Test 3

Taste a mint with a blocked nose. This helps participants to better understand that flavour is a mixture of taste, using the tongue's tastebuds, and volatiles, picked up by the olfactory epithelium in the upper part of the nose.

These kinds of tests are used with tasting panels to test food for clients, using either consumers or trained food tasters.

Consumer panels tend to test later-stage products for acceptability, while Philippa Tyler's trained sensory panels help to describe food for marketing purposes and to test new products.

The trained panel acts as a human 'machine', she says, for profiling and giving quantifiable information about new food products, using booths in a laboratory-style setting. The booths can be lit in red, green, yellow or blue to remove any physical differences between products or stay at the normal 'northern daylight' setting.

Philippa Tyler says a range of food industry clients use the facility – for the development of new products to triangle testing or simple market research. F

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FRDC RESEARCH CODES: 2006-229, 2011-209, 2016-057, 2017-097

Information transfer to improve prawn harvests

Portside workshops have generated interest from prawn fishers in gear changes to reduce fishing impact and increase prawn catches

By **Catherine Norwood**

Left and below Checking gear at a NSW workshop, (from left) Matt Broadhurst and NSW fisher Ian Perry.
Photos: NSW Professional Fishermen's Association

Australia's prawn fishers are keen to trial modifications to trawl gear to reduce bycatch and increase fuel efficiency, working with regulators to improve fishing performance.

The wildcatch prawn sector knows that it is not just business performance that will benefit from the changes. It will also increase community support for the sector, says the executive officer of the Australian Council of Prawn Fisheries (ACPF), Rachel King.

Nine workshops to discuss gear modifications and new bycatch-reduction technology have been held in fishing ports across the country so far this year with another three to come, coordinated by the ACPF and IC Independent Consulting and supported by the FRDC.

Fisheries researchers and gear experts Steve Kennelly and Matt Broadhurst have led the events, sharing research findings and gear adaptations between the country's different prawn fisheries.

While recognising that each fishery has its own specific characteristics and issues, Rachel King says there are still potential benefits to be gained from sharing the collective experience and knowledge of industry and research among the different fisheries.

"The workshops are an important way for us to take trawl gear research results from the shelf to the boat. It gives fishers the opportunity to ask questions about how the results could be adapted for their boats and their fisheries.

"It's also been important for the ACPF to demonstrate to the community that we are serious about helping our members to further reduce the impacts of trawl fishing. We want our fishers to be known for looking for better ways to fish," she says.

Permits required

One consistent concern raised by fishers at workshops has been the difficulty of getting research permits approved for those who want to trial gear modifications in their fishery.

"Without the appropriate approvals, while trying to do the right thing, fishers could effectively be fishing illegally, so establishing streamlined approval processes in each jurisdiction has been identified as a priority," says Steve Kennelly, from IC Independent Consulting.

As the workshops have rolled out, some fisheries departments appear to have 'come to the party' with a gear trial permit approved in Queensland, and advice that a 12-month blanket permit for fishers may be approved for trawl fishers' research in NSW.

In Queensland, the Kon's Covered Fisheye bycatch reduction device will be trialled in the Townsville region where sea snakes are a priority bycatch issue. Kon's Fisheye was approved for use in the Northern Prawn Fishery by the Australian Fisheries Management Authority in 2017 and has been shown to reduce small fish bycatch by more than 30 per cent.

In NSW, fishers have requested further research to develop a 'ready-to-go' quad rig package (a configuration of four nets) for their fisheries, as well as more work on other net configurations developed by Matt Broadhurst in previous FRDC projects, to further reduce bycatch. South Australian fishers are also interested in trialling quad rigs to improve catch efficiency.

Steve Kennelly says there may be more work involved for crew members in operating quad rigs because there are simply more moving parts than in single, double or triple rigs. However, research has identified reductions in fuel use and improved catching efficiency using quad rigs – benefits that fishers in the Northern Prawn and Queensland East Coast trawl fisheries have been realising for many years.

Fishers at Lakes Entrance (Victoria) and at the South Australian workshops were also interested in testing changes to the knot alignment in their nets and the use of square mesh panels. Relatively simple changes could reduce bycatch or improve fuel use – benefits demonstrated in both research and industry applications.

Workshops are still to be held in Queensland and Western Australia. F

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Skills in demand

Thinking ahead is helping Tasmanian educators and students meet the needs of the evolving aquaculture sector

By **Anne Crawford**

Above (From left) Brad Thompson, Zach Young, Henry McGuire, Ruben Blake-Murphy, Ethan Hutchison and Steve Harrison. Photos: courtesy © Tassal Group Ltd

When educator Steve Harrison was offered the chance in 2012 to establish and run an aquaculture training centre for secondary school students in Huonville, Tasmania, he had the right credentials for the role. He had previously run an aquaculture program at a secondary school further south.

His family background too is firmly entwined with the development of aquaculture in Tasmania. Steve Harrison's father, Tony Harrison, had been the deputy director of fisheries for Tasmania in the 1980s and was instrumental in establishing the Atlantic Salmon farming industry in the state.

But Steve Harrison was still, as he put it, "thrown in the deep end". The timeframe was short, he says, and the initial plans were totally inadequate. The facility would be the largest of its kind, but needed to balance production potential with opportunities to learn about different aquaculture and water-treatment systems.

The new centre was being established as part of the Huon Valley Trade Training Centre to provide vocational training for key industry areas under the Federal Government's Trade Training Centres in Schools Program.

The Huon Valley centre is operated by Huonville High School, which is across the road. It offers a full range of subjects to secondary students from Years 9 to 12, in addition to the vocational training courses. It also offers stand-alone vocational courses for adults run by a range of registered training organisations (RTOs).

Five years after the first intake of students, 34 graduates have gained full-time work, Steve Harrison has won two awards for his innovative approach to teaching, and the Huon Valley Trade Training Centre is planning even stronger links with industry partners.

Each year the centre trains 15 Year 9 and 10 students, and 15 Year 11 and 12 students in Certificates I and II in Aquaculture and Certificate II in Maritime Operations. But it is far from a school environment.

Steve Harrison's concept from the start was to run a workplace model, blurring the line between the job and the classroom.

"We knew from day one that we couldn't run it like a school because we have some adults in the courses and we couldn't expect them to be treated like school kids," he says.

The training centre has a freshwater Atlantic Salmon hatchery, holding systems for draining tanks or to hold fish prior to harvest, aquaponics systems, a 12,000-litre tank for Atlantic Salmon production and a full commercial fish-farm licence.

There are no school uniforms or detention-style punishment. 'Toolbox meetings' replace assembly, and students clock in and out with their own time cards. Work placement with Tassal or Huon Aquaculture is the real deal. It might mean working long shifts or going out in the morning on the water when it's 2°C.

The approach is proving successful. "The students really lift to expectations," Steve Harrison says. "We've had real success with students who've been disengaged from school."

But the course is by no means an outlet for kids who are "good with their hands", he says. The level of technological change in the Atlantic Salmon industry in Tasmania means students also need to be good thinkers. Graduating students are equipped to become entry-level farm attendants, and then branch out.

One 18-year-old graduate became a bathing team leader at an Atlantic Salmon farm, overseeing the cleaning of fish with the gill parasite *Paramoeba*, which can cause a lethal allergic reaction in the fish. Another is now a feed controller with Huon Aquaculture, but she does not go anywhere near the water. She

uses computerised monitoring and networks to operate the feed system from her desk in Hobart, 300 kilometres away from the fish pens.

Proud of his students' successes, Steve Harrison is also proud of centre volunteer Mark Jones. The retired hatchery attendant tends the centre's fish on weekends and was awarded Volunteer of the Year in both Huon Valley and Tasmanian Department of Education awards.

Steve Harrison's own work has also been recognised with the awarding of a Churchill Fellowship and a $45,000 Commonwealth Bank Teaching Award.

He says the teaching award is really the result of a team effort by the centre's 14 staff. The prize money has been combined with funds from other sources to buy a $12,000 remotely operated underwater vehicle as part of a new unit of study. These vehicles are increasingly doing the jobs of divers such as net inspections.

Program expands

The funds will also develop two new projects. The first involves Tassal employers coming into the centre, training students and taking them back to their workplace. As part of this project, the centre is also negotiating with Tassal to use a sea cage for Atlantic Salmon to diversify training opportunities.

The centre currently keeps its fish in fresh water, harvesting them at 700 grams to sell through its commercial kitchen as hot-smoked salmon. A sea cage would allow the school to harvest the fish at five kilograms, bringing in significantly more revenue and completing the cycle of learning about the industry.

In the second project the centre will trial hatchery production of purple sea urchins (*Heliocidaris erythrogramma*) for the Japanese market. The urchins are native to Tasmania and also occur in Victoria.

Employment pathways

Steve Harrison is using his recent visits to Norway and Scotland investigating school-to-work employment pathways – made as part of his Churchill Fellowship – to establish a more structured and formal approach with industry.

"In Norway all apprenticeship training begins in the last two years of school. There is virtually a seamless pathway from school to work." He hopes establishing closer, formal partnerships between school and employers will facilitate a similar pathway in Tasmania and add value to the training the centre provides.

He says the centre's relationship with industry has evolved considerably from the early days when the companies engaged with the students as "good corporate citizens".

"Employers can see, each year, 15 young people committed to getting employment in the industry, so if industry commits to supporting that training they have input into developing future employees before they actually employ them."

This is especially the case as technological changes require new employees to be more 'brain workers' than 'brawn workers'.

Steve Harrison outlined the development of the aquaculture training program and his Churchill Fellowship findings at the Primary Industries Education Foundation Australia Conference 'Food and Fibre - the original STEM', held in May this year.

He says the outlook for future graduates is bright. With industry experience and transferable aquaculture skills, they are in a prime position to take advantage of the $700 million Atlantic Salmon industry in Tasmania.

The Atlantic Salmon industry is the single biggest primary industry sector in Tasmania and the single largest private employer in the Huon Valley, where the centre is located. Of the 12,000 people living in the area, 1000 are employed in the Atlantic Salmon industry.

The industry has doubled in the past five years and is expected to double again in the next three or four years. With this growth comes a need to attract employees with higher levels of technical and fish husbandry skills, as farm practices continue to evolve.

"The Huon Valley Trade Training Centre course will continue to play a vital role in developing this future workforce," Steve Harrison says. "Most importantly it gives the young people of the Huon Valley increasing opportunities to remain in the local community, adding to social capital and economic growth." F

Above left Ruben Blake-Murphy tests the pH of a holding tank.

Left Ethan Hutchison returning fish to the tank after weighing.

Above Steve Harrison teaching aquaculture to secondary school students in Huonville, Tasmania.

Steve Harrison's concept from the start was to run a workplace model, blurring the line between the job and the classroom.

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Sentiment softens on fisheries sustainability

By **Anne Crawford**

The latest fisheries perceptions survey points to opportunities for the industry around greater visibility and engagement

The latest fisheries perceptions survey suggests many consumers are uncertain but hopeful about the future of the sector.

The 2018 edition of the *Community Perceptions of the Sustainability of the Australian Fishing Industry* report, which has been running since 2011, uses a sample of randomly selected adult Australians whose demographics broadly represent those of the Australian population. This year, 1508 online surveys were completed. The main finding – the breakdown of views on sustainability – are similar to those of previous surveys, although changes in some responses are a concern for the sector.

The number of people who believe the industry is or could be sustainable in the future is 59 per cent (compared to 60 per cent in 2011 and 59 per cent in 2017) (Figure 1). But a breakdown of this figure reveals a softening in the conviction about whether the industry is sustainable now.

Of the overall figure, 36 per cent think the industry is currently sustainable – a drop on last year's figure of 41 per cent (and compared with 37 per cent in 2011). Conversely, the percentage of people who were hopeful and confident the industry would be sustainable rose five per cent to 23 per cent (the same as in 2011).

Not visible

The visibility of the commercial wild-catch sector and actions being undertaken by government could play a key role in changing perceptions. In both cases the more familiar people are with this sector and government actions, the more convinced they are that the industry overall is sustainable, the study found.

Respondents who rated their familiarity with the commercial industry the highest (6.6 out of 10) had a rating of 8.8 on sustainability, whereas those with the lowest familiarity (1.6 out of 10) had the lowest rating (2 out of 10).

However, the community has very limited awareness of both industry and government activities – with awareness of the industry at 13 per cent and government at 11 per cent (Figure 2). Given the significant correlation between awareness and rating, it is clear that government and industry need to do more to raise awareness.

Opportunity for engagement

The survey also found a high level of uncertainty about the sustainability of the industry today, with 44 per cent of respondents unsure about this. Such findings suggest the industry needs to focus on building its credentials on sustainability to improve community perceptions, perhaps taking new approaches to this.

Differing views about specific sectors within the seafood industry (Figure 3) were also apparent. Of the rural sectors rated, farmed fishing was seen as sustainable by the most respondents (61 per cent) followed by recreational fishing (55 per cent) and traditional fishing (49 per cent). However, only 29 per cent of people regarded the commercial wild-catch fishing sector as sustainable.

Overfishing was seen as the key issue impacting perceptions of the wild-catch sector. As in previous studies, this one showed that people who were more engaged with the fishing industry generally were likely to view it as sustainable or believe it could be sustainable.

Three degrees of engagement were identified:

- 21 per cent of people were engaged (those who are interested, familiar with and aware of things that are occurring within and across the industry);
- 58 per cent were connected but not engaged (regular recreational fishers and/or regular fresh seafood consumers); and
- 21 per cent were not engaged or connected.

In the engaged group, 80 per cent believed the industry is sustainable or are confident it can be, compared to 57 per cent of the connected group and 44 per cent of the group that was neither engaged nor connected.

One in five people surveyed holds the view that the industry is not sustainable – a small group that has remained largely unchanged since the start of the survey. Shifting this group's views and perceptions will be a "hugely difficult challenge" the report notes.

Action plan

The study suggests ways of engaging with each of the three segments:

- continuing to reinforce the success around sustainability using existing channels of communication for the group that was already engaged;
- targeting the 'connected' segment more directly using fishing industry publications, websites, social media and blogs to engage recreational fishers

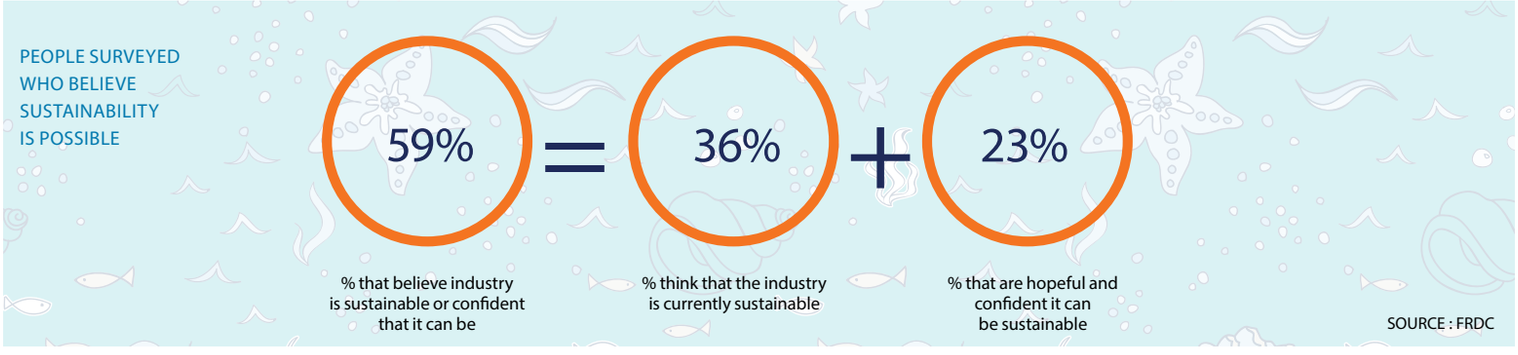
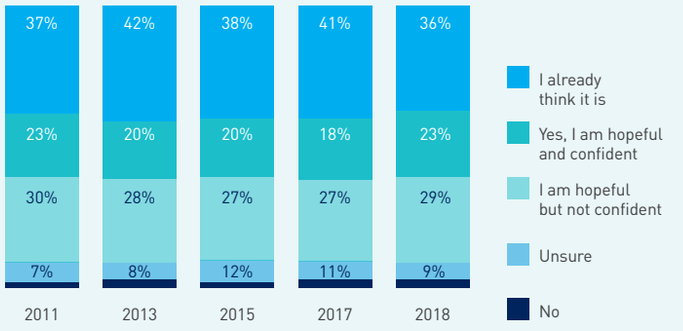
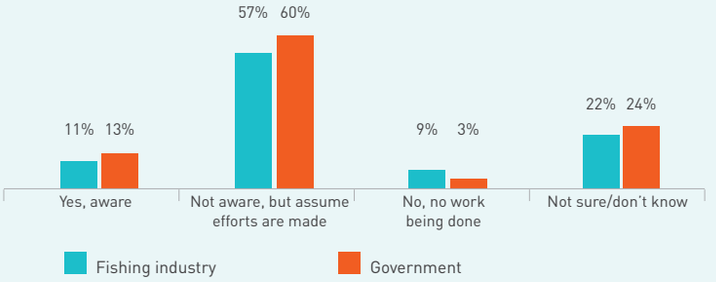


FIGURE 1 DO YOU THINK AUSTRALIA'S FISHING INDUSTRY CAN BE SUSTAINABLE?



SOURCE: FRDC

FIGURE 2 DO YOU KNOW IF THE FISHING INDUSTRY OR GOVERNMENT IS DOING WORK TO IMPROVE ITS LEVEL OF SUSTAINABILITY?



SOURCE: FRDC

and having a point-of-sale focus for fresh seafood consumers; and a more passive and selective approach for the 'not engaged' segment.

The survey also found that most people learn about the fishing sector from newspapers (43 per cent) and fishing-specific shows (37 per cent). However, increasing numbers were finding out about the sector from general news websites – 27 per cent in 2018 compared to 19 per cent in 2013, the first year the question was asked.

Peter Horvat, the FRDC's manager of communications, trade and marketing, says the survey is an important barometer of public views for the FRDC. "When you have a performance indicator that says 'we want to be sustainable', and we want people to know', you have to be able to measure it," he said.

Ensuring the sector is sustainable and 'acknowledged to be so' is the FRDC's first national priority. "When you're assessing a public resource, it's really important to maintain that connectivity and understand where the pressure points are in your local community."

International comparison

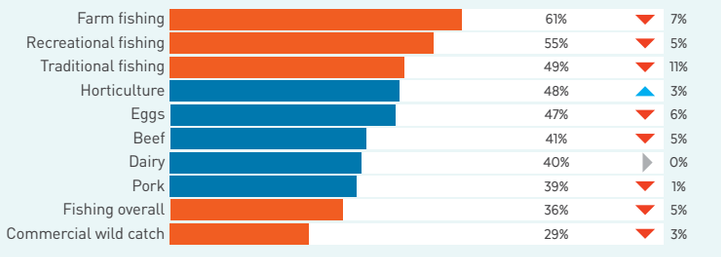
A new component was added to the 2018 survey to supplement the standard questions. This measured the 'level of concern' across a range of issues, allowing responses to be compared with similar questions posed in surveys by the Canadian Centre for Food Integrity and the US Center for Food Integrity.

The results showed that Australians were less concerned about the safety of food produced here (48 per cent) than Americans (59 per cent) or Canadians (51 per cent) were about food produced in their countries.

Australians were significantly more concerned (70 per cent) about the safety of food imported from outside Australia than respondents in the US (59 per cent) and Canada (52 per cent). Concerns about the rising cost/affordability of food and about keeping healthy food affordable were similar in all three countries, hovering around 63 per cent for these two factors.

Peter Horvat says the perceptions report overall had some fairly consistent messages: "We need to continue to work at raising awareness about fisheries management. It's not just one campaign that will do it, it's a long, inclusive process," he says. "Everyone has a role: the FRDC and the researchers need to tell the research story."

FIGURE 3 SUSTAINABILITY ACROSS OTHER RURAL SECTORS.



SOURCE: FRDC

The value of signposts for consumers

While there is no conclusive evidence at this point, the research has provided indications that signposts like certification (for example, MSC, ASC and Friend of the Sea certification) are likely to provide consumers with confidence in making more informed choices about the sustainability of seafood.

Michael Sparks, director of the market research company Intuitive Solutions, which conducted the survey, says an increasing number of people believe certification can provide consumers with more confidence about their purchase decisions. The latest study reported that eight in 10 people agreed that certification (that is, MSC, ASC and Friend of the Sea) provided confidence that the seafood was sustainable. Certification could become, over time, a signpost for consumers, not unlike the Heart Foundation 'tick', Michael Sparks says. There is enough evidence to suggest consumers don't understand all the nuances around sustainability and will look to guidance and confirmation.

"It's almost like the consumer is thinking 'someone I trust is looking after my interests here'." Despite this opportunity, the link from these signposts to a direct influence on customers' purchasing behaviour is yet to be established. The indications are positive and warrant further exploration.

The survey also showed an increasing number of people believe that country-of-origin labelling is empowering them (at the supermarket). About 80 per cent rated the idea that country-of-origin labelling allowed them to make a more informed choice about the seafood at 8.8 out of a possible 10, indicating that the labelling is an important 'signpost' in their purchasing decision. F

MORE INFORMATION
Carolyn Stewardson, carolyn.stewardson@frdc.com.au

From adventurer to adviser

Her early experiences in some of the world's wildest fisheries have drawn Carolyn Stewardson to help understand and manage Australia's marine resources for future generations

By **Bianca Nogrady**

Carolyn Stewardson's work has taken her from the chilly waters of the sub-Antarctic to the wild seas off the coast of Africa. She's worked on-board vessels ranging from Australia's flagship icebreaker *Aurora Australis* to African fishing boats – trawlers, purse seiners and squid jigs – studying whales, dolphins, seals and seabirds.

And now, with the FRDC, she is involved with what she considers to be one of the most important projects of her career. She is the research portfolio manager coordinating a massive series of reports, the *Status of Australian Fish Stocks* (SAFS). These reports will help ensure that information on the performance and value of Australia's fisheries is readily available for everyone to access.

Carolyn Stewardson has long had an understanding of primary producers and the work they do. "I grew up on a sheep and cattle property, so I've experienced firsthand farmers putting their heart and soul into the land to make a living to put food on our plates," she says. "Fishing families are faced with similar challenges."

After finishing high school, she spent a gap year working with the Victorian Department of Agriculture, helping local farmers manage disease in their livestock, then headed to university to do a bachelor of science degree.

While starting on the land, Carolyn Stewardson always had a longing and an affinity for the marine environment and the life it supports.

As a newly minted graduate, she landed herself a berth on the maiden voyage of the *Aurora Australis* to the sub-Antarctic Heard and Kerguelen islands, and a trip to Macquarie Island on the *Polar Queen*.

Her main project was to help a team from the Australian Antarctic Division put together regional entries for the seabirds-at-sea atlas, and to collate marine mammal observations from the logbooks of Australian National Antarctic Research Expedition (ANARE) ships.

"Ever since I was young, I wanted to explore the Southern Ocean and voyage to Antarctica to see for myself what it was like out there, because it was one of those very last areas that was pretty much untouched."

Carolyn Stewardson (pictured above)

"It was one of the most beautiful things I've ever done in my life; it was a dream come true for me," she says.

"Ever since I was young, I wanted to explore the Southern Ocean and voyage to Antarctica to see for myself what it was like out there, because it was one of those very last areas that was pretty much untouched."

A self-described "fanatical photographer", she also took vast numbers of photos and sketched many of the creatures she observed. With the help of a professional illustrator, those sketches then became a book of their own – *Mammals of the Ice* – an introductory guide to the seals, whales and dolphins in the Australian sub-Antarctic and Antarctica, based on the logs from ANARE voyages from 1977–90.

The theme of boats and marine mammals continued throughout Carolyn Stewardson's doctoral studies at the Australian National University. She partnered with the World Wildlife Fund and a petroleum company to study the biology of fur seals and interactions with fisheries off the coast of Africa's Cape region.

At the time, there were tensions around the impact of seals on fisheries; fishers were

Below
Carolyn photographing King Penguins at Macquarie Island.

concerned their harvests were being plundered by the seals but the South African Government had imposed a ban on culling the seals.

Her task was to help work out whether the fur seals did actually pose a significant threat to the fisheries. Sometimes that included the gory task of doing autopsies of dead seals on the decks of fishing boats to study their stomach contents, but she still describes the whole experience as amazing.

After such an extraordinary run of fieldwork, Carolyn Stewardson decided she wanted to put what she had learned into practice, and moved into the public sector – always with an eye on fisheries management and policy.

Initially she took up a position working at the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES). Part of her role there involved exploring interactions between humans and marine mammals – particularly seals – and what could be done to document and manage bycatch in trawl fisheries.

She and her colleagues put together resources on how to log and report bycatch, as well as an identification guide that included footage shot in zoos, to help fishers accurately record their bycatch.

The project was well received and she was presented with a federal government award for science communication in recognition of her work. But what she most loved about her work was the chance to help the fishers and to influence policy.

"It's all very well and wonderful doing the science, but the next step is to make sure you join the dots to get the evidence-based advice to the final decision-makers to ensure government policies are underpinned by good science," she says.

The findings from that work then underpinned a national strategy to address interactions between humans and seals in fisheries, aquaculture and tourism, which was endorsed by the Natural Resource Management Ministerial Council in 2006.

After her time at ABARES, she moved to the Australian Fisheries Management Authority, where she was involved with the rollout of Australia's marine protected areas.

Finally she took up a position with the FRDC, where she has been for the past nine years. It's here that she feels she has made the greatest impact, managing the FRDC's environment program. This includes supporting natural resource sustainability in managing fishing activities and the delivery of the SAFS reports.

These reports are a mammoth undertaking: pulling together state, territory and Commonwealth information, with 120 species in the soon-to-be published 2018 reports.

This involves working with more than 100 fisheries scientists as well as a dedicated advisory group of influential scientists and policymakers who oversee the process. Each species chapter of the SAFS reports has a dedicated author team of experts on that species, and each chapter is peer reviewed by top fisheries scientists.

The processes have also required agreement on methodology and language, and a national framework for reporting on fish stock status – no mean feat when there are so many stakeholders involved.

Importantly, these reports provide a roadmap showcasing where Australia is doing well with respect to fisheries management and highlighting where more needs to be done.

"Even though Australian fisheries are small by world standards, internationally, we're way up there with our transparent, evidence-based reporting of stock status," Carolyn Stewardson says.

"It has been an amazing journey – all jurisdictions across Australia have been working collaboratively to make this a reality."

She also provides secretariat support for the subcommittee of the National Marine Science Committee looking at bycatch mitigation of marine mammals and marine protected species, and is the executive officer for both the Commonwealth Research Advisory Committee and the Industry Partnership Agreement for the Southern Oceans.

"Our natural resources here are amazing but we do need to look after them," she says. "At the end of the day, if you can actually manage something – whether a species or ecosystem – you can make a difference." F

Final reports

Climate change impacts 2016-139

Australia's commercial fisheries are unavoidably being affected by climate change, which is why fisheries managers have asked for a rapid and thorough update of information, so that the knowledge upon which they base their strategic planning is the latest and best. Based on the findings from assessment tools used in this study, the project has provided knowledge and advice on the impact, both historical and anticipated, that climate change is having on the ecosystems of our warming waters. This will ensure that Australian fisheries adapt effectively to climate change. This report also assists industry and management in planning operations that avoid or mitigate negative impact, and in making the most of new opportunities as they arise.

More information: Beth Fulton, beth.fulton@csiro.au

Recfishing Research 2.0 2013-401

Australia's recreational fishing sector, which is large and diverse, continues to be challenged by a variety of issues, including changing fisheries management, marine planning and resource deficiencies. In order to effectively respond to these and other emerging issues, the recreational sector requires a variety of skills, tools, strategies and information.

This project has assisted in building the knowledge base of the fishing community. It has facilitated the prioritisation of research needs for the recreational fishing sector nationally, and has given recreational fishers better access to information on relevant topics, while fisheries managers have greater information to assist them in meeting management objectives.

More information: John Diplock, john.diplock@bigpond.com

Rollout of lifesaving buoys 2011-404

Angel Rings are lifesaving buoys placed at popular fishing spots to aid rock fishers, tourists and members of the public who slip or get washed into the water. They are designed to keep them afloat until a rescue can be organised, or to assist them in finding a safe spot to exit the water.

The Australian National Sportfishing Association (ANSA), in partnership with the FRDC, conducted a trial of Angel Rings around Australia, setting out to deliver rock-fishing safety equipment to all ANSA state branches that had experienced rock-fishing incidents and fatalities, while also updating these branches on current practices.

This project focused on helping ANSA state branches raise awareness among rock fishers on how to safely participate in the sport. There was unanimous agreement that the NSW project had a proven track record in saving lives at various NSW coastal rock platform locations, and should be expanded nationally where there was risk of lives being lost. States such as WA and Victoria were the target for Angel Rings, as there have historically been rock-fishing fatalities. The project achieved great progress in these states for not only establishing Angel Rings, but also developing safety awareness and educational campaigns.

More information: Stan Konstantaras, pastelli@netspace.net.au

Salmon farming & macroalgae 2014-241

The salmon farming industry has significantly expanded in the past decade in south-east Tasmania, both in production and in number and location of farms. With this expansion has come an increasing concern from the general community about the effects of salmon farms on the environment. One of the main impacts of salmon farming is an increase in nutrients to the environment from waste products, with a possible effect being an increase in macroalgal beds near salmon farming operations. However, a survey of intertidal areas in the Huon and D'Entrecasteaux Channel region in 2002-03 found no clear patterns of macroalgal abundance near salmon farms.

In this project, researchers from the Institute for Marine and Antarctic Studies at the University of Tasmania repeated the 2002-03 survey to assess whether abundances have significantly changed at these sites. They also investigated monitoring macroalgal abundance at a larger scale by using drones, which is a much more cost-effective option.

This report covers the results of the surveys, which assessed the percentage of intertidal macroalgae at different spatial scales, and discusses issues and limitations of monitoring in the intertidal zone in southern Tasmania.

More information: Christine Crawford, christine.crawford@utas.edu.au

Evaluating marine spatial closures 2011-032

The Australian Fisheries Management Authority (AFMA) has established clear rules to set catch limits for commercially targeted species in Commonwealth fisheries, within the framework of the Commonwealth Harvest Strategy Policy. In several fisheries, AFMA has adopted a tiered harvest strategy framework that specifies both assessment methods and decision rules appropriate to the extent and quality of information available for each target species.

With an increase in the number and extent of marine spatial closures, whether for conservation or fishery management purposes, there is a need to evaluate the impact of closures on existing assessment methods and rules, and, if necessary, modify or provide new methods and rules that appropriately account for the existence of closures.

This project evaluates and develops assessment methods and meta-rules that can be integrated into the current assessment and management frameworks.

More information: Geoff Tuck, geoff.tuck@csiro.au

Tuna Australia governance training 2016-414

Tuna Australia is a newly formed industry association representing statutory fishing right

owners and holders, fish processors and sellers, and members associated with the Eastern Tuna and Billfish Fishery and the Western Tuna and Billfish Fishery of Australia. It has a board and a CEO to ensure ecological sustainable development of the industry, enhance market opportunities, and extend industry practices to stakeholders and to the general public.

Tuna Australia aims to advance, promote and represent the industry's views in dealings with state and Commonwealth governments, media, corporations and organisations, and all persons nationally and internationally.

This project enabled a one-day workshop on corporate governance training. It was designed and delivered by the Australian Institute of Company Directors to board members, in consultation with Tuna Australia. Workshop participants gained an understanding of the duties of a director, role of the board and governance relations. As a result, participants are now confident they have the skills to identify the role and key functions of the board and its directors.

More information: David Ellis, david@davidellis.biz

Marine discovery centres meet 2011-401

Marine Discovery Centres Australia (MDCA) is a network of marine education facilities across Australia that provides high quality education and engagement experiences for the wider community. These learning experiences promote sustainable behaviour in, and stewardship of, our fisheries and aquatic natural resources. MDCA has become Australia's leading national marine education organisation.

The FRDC has previously supported MDCA through funding that enabled network members to meet at annual workshops to share ideas, resources and materials. These workshops enabled MDCA members to gain greater knowledge and understanding of the issues affecting aquatic natural resources, which they were then able to share with the Australian community.

The aim of this project was to develop a program that utilised the collective knowledge, skills and abilities of the diverse MDCA members as a means of sharing information about natural resource management in, and education for, the marine environment.

More information: Michael Burke, 0437 886 015

Stock-assessment review 2014-039

Fisheries stock-assessment modelling is undertaken throughout Australia. It provides scientific advice that supports fisheries decision-making as it can predict population size, quantify the impact of fisheries on the population, and provide key outputs needed in harvest strategies.

Usually, stock assessments are conducted using software that was developed for a specific stock or group of stocks, and practitioners tend to produce their own preferred tools that are specific to their fisheries. Although home-grown tools are not necessarily an issue, they are not always the most cost-effective practice. There have been moves to address this financial issue through the use of generic tools, or the sharing of resources among agencies. In other parts of the world, a move towards cost saving has resulted in generic toolkits that are freely available, but are also peer reviewed and tested.

This project reviews the stock-assessment program within Australia in the context of international practices, seeking to find Australian-specific solutions while building on existing methods already preferred by fishers and managers. It reviews the range of packages used to conduct assessments of fish and invertebrate stocks in the US, which tend to have similar goals and outputs for decision-making. The project also worked with jurisdictions to undertake a strategic review of stock assessment in Australia, and provides recommendations for possible investments.

More information: Cathy Dichmont, cathy.dichmont@csiro.au

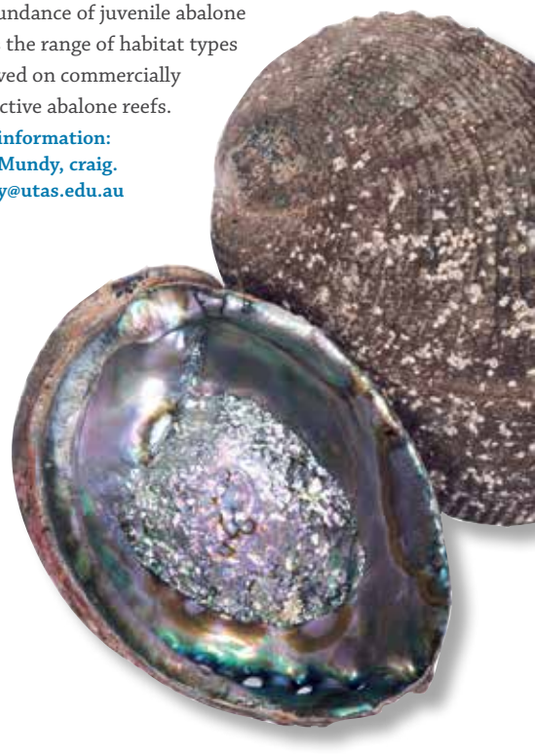
Juvenile abalone monitoring 2014-010

More than 80 per cent of the annual wild abalone harvest across southern Australia is Blacklip Abalone (*Haliotis rubra rubra*). They usually live in cryptic space (such as beneath boulders) until they reach full size at maturity, which is around five years of age. In Tasmania, abalone are not 'emergent', and therefore visible to researchers and fishers, until they are of sizes greater than the legal minimum length (LML). This makes it difficult to identify potential changes in stock levels, as recruitment failure or poor year classes cannot be detected until abalone are already at a size to enter the fishery. As a result, there is no way for management to consider adjusting catch limits before a period of low recruitment in the fishery.

Over the past three decades, the Eastern Zone Abalone Fishery in Tasmania has experienced several large variations in catch and catch rates, due in part to periods of intense fishing, as well as environmental disturbances such as marine heatwaves. This is not only affecting productivity, but also increasing unpredictability in recruitment to an already depleted stock. When recruitment to the fishery fails, the fishery must then rely on existing older year-classes already in the fishery, leading to a rapid decrease in fishable biomass.

This project tested artificial structures known as abalone recruitment modules (ARM), which monitor changes in the abundance of abalone across a range of habitats. The project has shown that ARMs can provide cost-efficient, high-quality data on abundance of juvenile abalone across the range of habitat types observed on commercially productive abalone reefs.

More information: Craig Mundy, craig.mundy@utas.edu.au



Social sciences program 2012-300

The FRDC is a leader in its cohort in supporting social sciences research, which is regarded by industry, government and researchers, both in Australia and internationally, as a beneficial aspect of the Australian fisheries, marine and aquatic research management arrangements. The Social Sciences Coordination Program arose from the need to counter the economic policy drive of the 1990s by including social science aspects and perspectives of fishing activities in industry considerations.

This report summarises the key activities of the Social Sciences Research and Coordination Program II, which began in 2012 and concluded in 2015. It focuses on the key objectives of the program, the achievements and recommendations for the future of the program, as well as areas where the FRDC may want to focus efforts to encompass social sciences in fisheries research.

More information: Kate Brooks, kate@kalanalysis.com.au

Abalone harvest strategies 2013-200

The management of abalone stocks is difficult for many reasons, including the high value and exceptional levels of spatial structuring found in their stocks. While changes to the legal minimum length and an introduction of a formal harvest strategy to replace the currently informal process have been proposed in Tasmania, these suggestions create high levels of often heated debate.

One of the aims of this project was to formally examine the implications of changing legal minimum lengths (LML) and the importance of LML to the management of abalone. This project aimed to contribute to the development of formal harvest strategies that would both successfully generate practical management advice and be defensible under increasing public scrutiny of wild fisheries.

More information: Malcolm Haddon, malcolm.haddon@csiro.au

Measuring norovirus particles 2011-726

Norovirus (NoV) is the leading cause of non-bacterial gastroenteritis in humans worldwide. It is highly contagious, as food can easily become contaminated. Oysters are particularly likely to be contaminated with NoV, thus the need for fast and accurate tests for the presence of this virus in oysters is constantly increasing. Ensuring product safety is crucial to maintaining consumer confidence, as well as maintaining and growing export markets.

Currently, testing for food-borne viruses, most commonly through quantitative reverse transcription PCR, is difficult, and must be undertaken in a lab by specialised personnel. There is also no way to differentiate between infective and non-infective viral particles, making the risk associated with illness from consuming contaminated food unclear. Internationally, there is considerable research being undertaken to develop rapid diagnostics based on biosensors. Biosensors provide a powerful means of detecting pathogens with the advantages of high sensitivity, high specificity, real-time sensing and on-site monitoring.

This project aimed to develop a functional biosensor for the detection of NoV in shellfish, and has proven successful in the concept of biosensor testing for food-borne noroviruses.

More information: Valeria Torok, valeria.torok@sa.gov.au

Social & economic evaluations 2016-263

There is a clear need to identify and measure the economic and social contributions that flow from Victoria's professional fisheries, both wild-catch and aquaculture, into regional and metropolitan communities. In the absence of this data, local professional fisheries have been unable to demonstrate the range and value of benefits that fisheries add to society's wellbeing. They are therefore missing out on potential visibility and support from the Victorian public, government, and other stakeholders and decision-makers. There has also been little data-led information about the likely impact of fisheries policy and management decisions on Victorian communities, or of potential opportunities for improving sustainable growth in fisheries.

As an urgent and high priority the FRDC Victorian Research Advisory Committee identified the need for a research project to measure the social and economic contributions of the professional fishing and aquaculture industries. The purpose of this project was to determine the appropriate approach for Victorian fisheries to take in collaboration with industry.

More information: Kirsten Abernethy, kirsten.abernethy@gmail.com

Tasmanian algal biotoxins 2014-032

During October 2012, a shipment of Blue Mussels from the poorly monitored east coast of Tasmania was tested by Japanese import authorities and found to be contaminated with unacceptable levels of paralytic shellfish toxins. As a result, local oysters, scallops, clams and the innards of abalone and rock lobsters were also found to be contaminated. This led to a global product recall of all Australian shellfish exported to Japan, and a loss to the local economy.

The 2012 Tasmanian biotoxin event represents a paradigm shift for seafood risk management in Tasmania, and in Australia as a whole.

This project sought to improve the understanding of Tasmanian harmful algal bloom biology, ecology and toxicology to support seafood biotoxin risk management.

More information: Gustaaf Hallegraeff, gustaaf.hallegraeff@utas.edu.au

Fish reproductive expert visits 2016-103

Kostas Ganias of Aristotle University, in Thessaloniki, Greece, is a world leader in the reproductive biology of small pelagic fishes related to

the application of the daily egg production method (DEPM). The aim of Kostas Ganias's visit to Australia was to evaluate and recommend options for improving the methods used to estimate the spawning fraction and fecundity of Australian Sardine, Jack Mackerel, Blue Mackerel and Redbait. His visit was informative, and his recommendations have the potential to improve application of the DEPM to the SASF and SPF.

DEPM is used to estimate the spawning biomass of several Australian fisheries for pelagic species, including the South Australian Sardine Fishery (SASF) and Commonwealth Small Pelagic Fishery (SPF). Egg production methods are one of the most accurate fishery-independent methods for assessing the stock spawning biomass of commercially important fish stocks.

More information: Tim Ward, tim.ward@sa.gov.au

Decision for abalone TACs 2012-236

The Western Zone Abalone Fishery in Victoria began in the late 1960s and has historically produced about 200 tonnes of abalone per year, worth, at current prices, about $8 million. Abalone viral ganglioneuritis (AVG), a viral disease affecting abalone, was first observed to be causing catastrophic mortality in abalone farms in western Victoria in 2006, and then continued to spread to wild populations close to the farms. As a result, there was a large reduction in the total allowable catch for the fishery, with consequent reductions in profitability.

Populations affected by AVG were closed for three to five years, and have been gradually reopened through a process involving abundance surveys, biomass estimates and structured fishing to deliver information about stocks. A substantial amount of data has been collected about the ongoing recovery of abalone stocks to inform management.

With the re-establishment of fishing in western Victoria, there is now a strong need to consolidate the available data to develop performance indicators for the fishery. As such, the main objectives of this project were to facilitate a workshop to do so.

More information: Harry Peeters, hpms@pipeline.com.au

Movers and ...

The Future Oysters Cooperative Research Centre Program (CRC-P) Management Committee has welcomed new members Sue Grau (Oysters Australia) and Steven Clarke (South Australian Research and Development Institute) who are stepping into the roles previously held by Graham Mair and Wayne Hutchinson.

The South Australian Research Advisory Committee welcomed new member Trudy McGowan to the committee after the departure of Graham Mair.

Affectus is delivering two National Seafood Industry Leadership Programs in 2018, with an expanded facilitator team including Stan Lui.

Deputy Director-General of Fisheries and Forestry at the Queensland Department of Agriculture and Fisheries Scott Spencer will retire from his position later this year.

Malcolm Haddon has left CSIRO, but is continuing to work as a consultant.

Gordon Neil, Assistant Secretary of the Fisheries Branch, Department of Agriculture and Water Resources, retired at the end of June.

Executive secretary of the International Coalition of Fisheries Associations Alistair Macfarlane has retired.

Mark Porter has left his position as CEO at Petuna to take up a position with Sealord Australia.

David White has moved to Tassal.

Alistair Hobday will replace David Smith as research director for the Marine Resources and Industries (MRI) Program within CSIRO's Oceans and Atmosphere.

Neil MacGuffie is the new chief executive officer of Abalone Victoria, taking over the position from Diana Attana.

Pip Baudert will begin as the FRDC's quality manager in September.

FEEDBACK
FRDC WELCOMES YOUR COMMENTS
frdc@frdc.com.au
MOVERS WE'VE MISSED?
INFO PLEASE TO
Annabel Boyer, 02 6285 0415,
annabel.boyer@frdc.com.au

Calendar of events

DATE	EVENT	MORE INFORMATION
2018		
9 September	San Remo Fishing Festival, San Remo Foreshore, Victoria	www.srfishfest.com.au
18-19 September	Annual General Meeting, Australian Barramundi Farmers Association, Melbourne	
25-28 September	Third Elsevier Aquaculture Conference 2018: International Advances in Aquaculture Research, Qinqdao, China	https://www.elsevier.com/events/conferences/aquaculture
28 September	National Symposium on Seafood Marketing, Brisbane	queenslandseafoodmarketers.com.au
2-5 October	AquaSur 2018, Puerto Montt, Chile	
7-13 October	Mental Health Week 2018	www.mhcsa.org.au/mhcsa-events/mental-health-week-2018
7-11 October	Australian Society for Fish Biology Conference, Melbourne	asfb2018.org.au
9-11 October	Australian Coastal and Oceans Modelling and Observations Workshop 2018, Shine Dome, Canberra	imos.org.au/calendar/events/acomo/acomo2018
18-21 October	7th Global Conference on Gender in Aquaculture and Fisheries, Bangkok, Thailand	www.gafconference.org
19 October	20th Anniversary Gala Dinner, Women's Industry Network Seafood Community, Hilton Hotel, Adelaide	www.winsc.org.au
22-24 October	Fish 2.0 Workshop, Brisbane	fish20.org/ventures/2018tracks/australia
22-26 October	3rd World Small-Scale Fisheries Congress, Chiang Mai, Thailand	toobigtoignore.wixsite.com/3wsfcongress
20-21 November	FRDC Board meeting	02 6285 0400
21 November	World Fisheries Day	www.gdrc.org/doyourbit/21_11-fisheries-day.html

Having people who understand international markets is good for everyone in the Australian seafood industry.

LOOKING TO EXPORT TO NEW MARKETS? LOOKING TO EXPAND YOUR HORIZONS?

DO YOU WORK IN AUSTRALIA'S FISHING AND AQUACULTURE SECTOR?

ARE YOU A PASSIONATE ADVOCATE FOR AUSTRALIAN SEAFOOD?

The **FRDC is inviting applications** for travel bursaries in 2018.
Each awardee will have the opportunity to visit one of the world's great seafood events (the next trip will visit the 23rd annual China Fisheries and Seafood Expo in Qingdao in November 2018 - see http://chinaseafoodexpo.com/ for more details), as part of study tour which will help participants to gain insight into the global seafood marketplace. Participants will also have the opportunity to visit seafood markets, and meet significant regional seafood players.

FRDC

email: Peter.Horvat@frdc.com.au