

FISH

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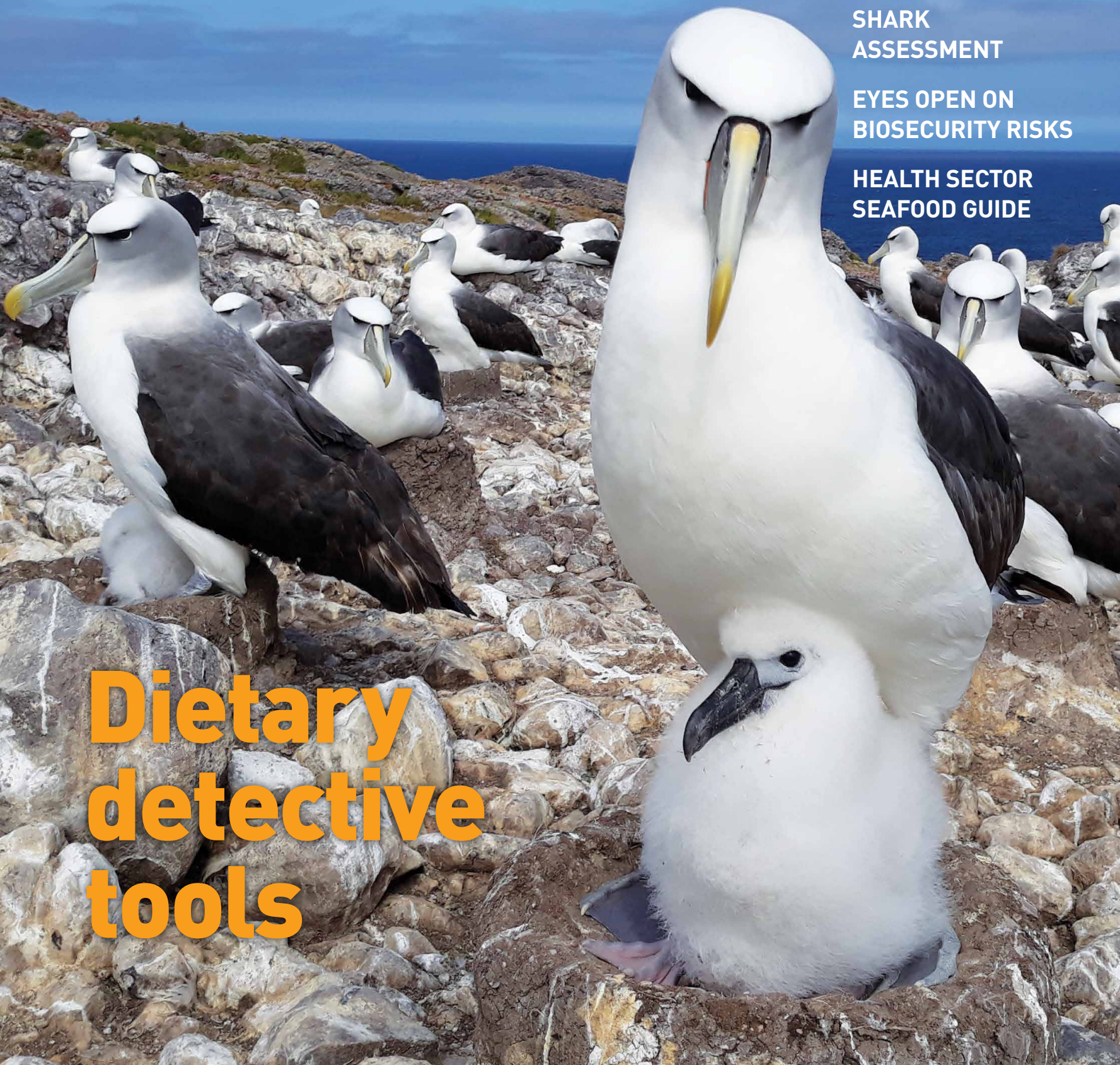
JUNE 2019

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Prawn venture heralds aquaculture step-up



By Brad Collis

As aquaculture progresses from niche to large-scale operations requiring teams of skilled workers, a major new venture, Project Sea Dragon, is creating economic development and job opportunities

One of the largest agriculture infrastructure projects in Australian history, a massive aquaculture development across two states, has reached 'shovel-ready stage'.

All planning, regulatory and Indigenous land-sharing approvals are in place for the first three farms (1120 hectares of ponds), allowing construction to begin as soon as finance is secured.

The venture, titled Project Sea Dragon, opened its headquarters in Darwin on 8 May and has been methodically assembled over the past seven years by the Perth-based Seafarms Group. It will be a vertically integrated marine

prawn breeding, farming and processing enterprise linking five specialist facilities in Western Australia and the Northern Territory.

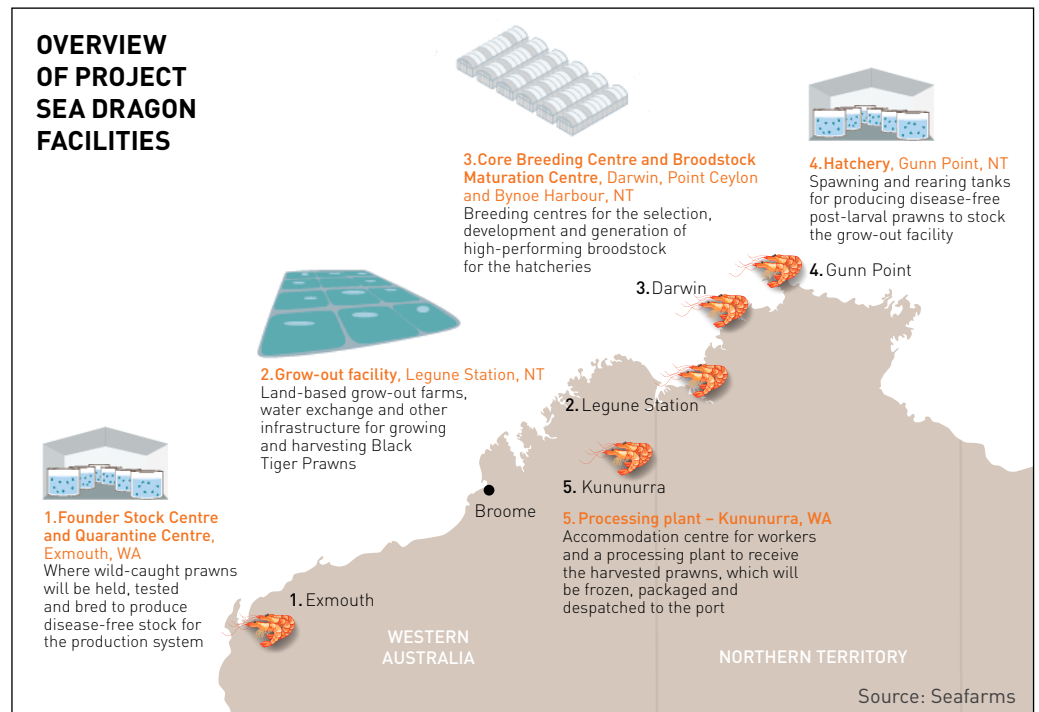
When fully completed in 2025, the project expects to achieve an annual production of 150,000 tonnes of Black Tiger Prawns (*Penaeus monodon*), valued at \$1.7 billion in annual export earnings. It would take Australia from the 67th largest prawn producer in the world to among the top ten. Media reports have put the cost of the project at about \$2 billion, and a number of large global seafood investors are reported to be in negotiations with Seafarms, with marine product giant Nissui recently signing on.

The project brings together 'big science' and 'big commerce' to ensure the operation starts on a large enough scale to be economic from day one. This includes 1120 hectares of grow-out ponds (each pond covering 10 hectares) on a cattle station, Legune Station, on the coast across the Northern Territory border from Kununurra, WA. The operation will have access to clean seawater, plus fresh water from a private dam. Its remoteness is also a crucial biosecurity measure.

Seafarms managing director and former manager of CSIRO climate research programs Chris Mitchell explains that the project is based on what he describes, and emphasises, as "fundamentals analysis".

Black Tiger Prawns
(*Penaeus monodon*)
Photo: Seafarms Group

OVERVIEW OF PROJECT SEA DRAGON FACILITIES



“Northern Australia is highly prospective, and its isolation and clean water gives it a high biosecurity status, but every enterprise proposed or attempted in this region is confronted with the realities of scale.”

Chris Mitchell

“The first fundamental was to look at demand and markets, to understand global population growth and, within this, a rising middle class that is increasing the demand for protein. The other fundamental is that the global wild catch has stabilised. These factors give us the macro problems – and the opportunities.”

In terms of aquaculture more broadly, Chris Mitchell sees it as part of the long continuum in food production, which has moved from hunting and wild catch to farming as the way to progressively lift food availability, yield, productivity and quality.

Large-scale start

Chris Mitchell says Seafarms closely studied global aquaculture to gauge what is working and what is not. In assessing prospective sites for a large-scale venture, northern Australia quickly

stood out – but with some well-known caveats.

“Northern Australia is highly prospective, and its isolation and clean water gives it a high biosecurity status, but every enterprise proposed or attempted in this region is confronted with the realities of scale. Unless you are able to conceive and implement something on a large enough scale, it is unlikely to succeed commercially. A small-scale operation simply cannot fund the infrastructure needed to operate profitably in the north,” he says.

Chris Mitchell says this also applies to markets and marketing – the need to demonstrate an enterprise has the capacity to reliably meet and grow demand, and to use scale to drive down production costs. He cites the Atlantic Salmon sector as a successful model. “So while we believe we have found the best grow-out site in the world at Legune Station, if we had sought to just put in 20 hectares on which to practise or prove the

concept, it would not work, because it would lack the scale needed to prove the market.”

Having ‘pulled apart’ the aquaculture model here and overseas, Seafarms undertook a concept study: a pre-feasibility study incorporating an options analysis, principally considering different locations for operations; then a full feasibility study; and finally a combined ‘bankability’, engineering and design study. All of these stages involved extensive research and intensive negotiations with the WA, Northern Territory and Australian governments, particularly with respect to land tenure. Legune Station is a pastoral lease over which there is also native title, necessitating the negotiation of an Indigenous Land Use Agreement (ILUA) with the native title holders.

Disease-free stock

While all this was happening, Seafarms acquired Crystal Bay Prawns at Cardwell and Ingham in North Queensland to gain operational experience.

“The initial idea was to use the Queensland operations as a pilot study for Sea Dragon, but it was a conundrum because at Cardwell, for example, the technology is old compared to what is planned for Sea Dragon. But it has still provided invaluable knowledge.”

One thing the Cardwell and Ingham operations did reinforce was the need to start the Sea Dragon project with pathogen-free founder stock. Chris Mitchell says everything stands on this, ➔



Left A technician holding a founder stock Black Tiger Prawn at Seafarms' Exmouth facility.
Photo: Violeta Jahnel Brosig

and this work is already underway at a quarantine facility at Exmouth, WA. There, wild stock is being tested and bred to provide disease-free founder stock for the production stages to come.

Once the whole enterprise is up and running, it will start with breeding disease-free founder stock at Exmouth, which will be flown to a core breeding and broodstock maturation centre at Bynoe Harbour near Darwin. It will then go to a hatchery at Gunn Point, 80 kilometres north-east of Darwin, back to the 1100 hectare grow-out facility at Legune Station, and then to a processing and packaging plant at Kununurra.

The geographic separation of the facilities is partly because of the different infrastructure requirements of the various stages, but also because biosecurity is fundamental to the whole production cycle. The facilities are separated geographically so that if a pathogen did breach the biosecurity defences in one location, the operation as a whole could be kept secure.

In terms of what comes next, Chris Mitchell says Seafarms is keen for people to understand that the project has already started. The Exmouth facility is into its second breeding generation and Seafarms is actively partnering with research bodies on improving the quality, health and productivity of farmed marine prawns.

"We are a partner in the Australian Research Council's Industry Transformative Hub with FRDC, CSIRO, James Cook University and the Australian Genome Research Facility, and this research is going to have a significant flow-on benefit to the whole sector," he says.

"For example, they have now mapped the entire transcriptome (the genes expressed in different tissue) of the Black Tiger Prawn and are well on the way to mapping the entire genome (the whole DNA set). This will be a major scientific resource."

Chris Mitchell says multi-government support has been critical to the venture reaching its 'ready-to-roll' stage. **F**

Marine aquaculture expands

In addition to land-based aquaculture, the Western Australian and Northern Territory governments are also preparing the foundations to support new developments in marine environments.

The WA Government has introduced dedicated aquaculture development zones off its mid-west coast and in the Kimberley to stimulate the development of large-scale aquaculture.

The state's aquaculture strategy, released in 2017, identifies initiatives needed to grow the industry. This includes the recently commissioned 3000-hectare Mid-West Aquaculture Development Zone in open water between Geraldton and the southern part of the Abrolhos Islands group. The zone comprises a northern area of 2200 hectares and a southern area of 800 hectares just north of several existing aquaculture licence areas.

The WA Government says the development zones provide 'investment ready' platforms for setting up large-scale commercial aquaculture operations. The sites have been chosen because of their deep, well-mixed water and large areas of a sandy benthic environment suitable for finfish aquaculture. Geraldton also provides ready access to support infrastructure, including road and airfreight services.

Aquaculture production systems will be in the form of floating sea cages, which use circular flotation rings to support nets that contain the fish being cultured. External nets on the cages exclude predators and minimise the risk of any adverse impacts on marine mammals, such as sea lions. These systems are usually set within a grid pattern and anchored to the seabed.

The WA aquaculture industry, excluding pearling, currently generates \$15 million per year in economic value. The state government says its new development zones are aimed at lifting this figure to more than \$600 million per year within the next decade.

The total allowable annual production of finfish inside the mid-west zone is set to a maximum biomass (weight of fish in the water) that would equate to an annual production or yield of 48,000 tonnes. For the species most

likely to be farmed, Yellowtail Kingfish (*Seriola lalandi*), this computes to an economic value of about \$400 million. See <http://frdc.com.au/Media-and-Publications/FISH/FISH-Vol-27-1/Yellowtail-Kingfish-growing-availability-for-consumers>.

The state government expects a further \$200 million per year to be generated by the Kimberley Aquaculture Development Zone in Cone Bay at the northern end of King Sound, about 215 kilometres north-east of Broome.

Cone Bay is a proven location for the culture of Barramundi (*Lates calcarifer*). The tidal influence creates substantial water flow through the sea cages in which the fish are grown, allowing for a high level of productivity with a low environmental impact.

The creation of the zone involved environmental assessment of the whole zone under the WA *Environmental Protection Act 1986*. A key environmental feature is the high rate of water exchange able to dilute nutrients, which is supported by strict management controls and environmental monitoring.

Northern Territory

The Northern Territory Government has not gone down the same development zones pathway as WA and SA, but it has been actively supporting aquaculture since 1988 when it constructed the Darwin Aquaculture Centre.

The centre was initially established to research and support the development of the Barramundi industry. But over the years it has helped to develop and improve hatchery techniques for Barramundi, Golden Snapper (*Lutjanus johnii*), Barramundi Cod (*Chromileptes altivelis*), mud crabs (*Scylla* spp.) and giant clams (*Tridacna squamosa*), and now has a strong focus on native rock oysters (such as *Saccostrea echinata*). The aim of the oyster program is to improve hatchery techniques and to develop oyster farms in regional communities.

The centre also leases space to private companies to help them develop their business and undertake research. Current private R&D includes Barramundi, Pearl Oysters (*Pinctada* spp.), sea cucumbers (such as *Holothuria fuscogilva*) and some aquarium species. **F**

New ministers appointed

Senator Bridget McKenzie has been appointed as Minister for Agriculture in the new Australian Government, and is the first woman to serve in this role. Senator McKenzie was first elected to Senate in Victoria in 2010, and is deputy leader of the National Party.

Senator Jonathon Duniam has been appointed as Assistant Minister for Forestry and Fisheries. Senator Duniam was first elected to the Senate in Tasmania in 2016, representing the Liberal Party.

They replace the former Minister for Agriculture David Littleproud and Assistant Minister for Fisheries and Forestry Senator Richard Colbeck. **F**

BLUE ECONOMY COOPERATIVE RESEARCH CENTRE ANNOUNCED

Australia's seafood sector is set to benefit from the creation of a new Blue Economy Cooperative Research Centre (CRC) announced in April.

The Australian Government announced \$70 million funding for the CRC, which will be based at the University of Tasmania in Launceston.

It is expected to help realise the aims of the National Aquaculture Strategy to double the value of this sector to \$2 billion per year by 2027.

The CRC will focus on five key areas of research: offshore engineering and technology, seafood and marine products, offshore renewable energy systems, the environment and ecosystems, and sustainable offshore developments.

The CRC has national and international partners, which will provide over \$258 million in financial and in-kind contributions to add to the \$70 million grant, which will be paid over 10 years. **F**

More information:
<https://blueeconomycrc.org.au/>



Sydney Royal Aquaculture winners

Gold Coast Marine Aquaculture and Tathra Oysters dominated the Sydney Royal Aquaculture Competition in the inaugural public judging of the event as part of the Sydney Royal Easter Show this year.

Gold Coast Marine Aquaculture, one of the largest Black Tiger Prawn farming companies in Australia, won the champion prawn and the champion aquaculture product perpetual trophy. This is the first year Gold Coast Marine has returned to production after white spot disease halted production at its Logan River site in 2017.

Tathra Oysters won the champion Sydney Rock Oyster award as part of the Sydney Royal Fine Food Show, which complements the Sydney Royal Easter Show. Tathra Oysters has been a consistent winner at the Sydney Royal Fine Food Show, winning several championships over the past 18 years.

It won the inaugural president's medal in 2006 and was a finalist for the 2019 president's medal, which is judged across all fine food categories (and was won by Meredith Dairy with a marinated feta).

Established in 2001, the Sydney Royal Aquaculture Competition judges the best of the best in aquaculture. This year the competition focused on supporting the growth of Australian prawns and oysters. **F**

GUIDE TO FISH HANDLING

Research-based information about the best fish handling practices has been added to the FRDC's Recfishing Research subprogram website.

This follows requests from stakeholders participating in a recreational fishing planning workshop held in Melbourne last year.

The information added includes the best techniques to aid the recovery and survival of a fish after its release, including what to do to prevent barotrauma in fish caught in deep water.

The collection of fish-handling practices is based on FRDC projects and other research, and a number of these information resources are available on the site. Further updates to the website will be made in response to requests from stakeholders. **F**

To request an update, email owenl@uow.edu.au

More information: www.recfishingresearch.com.au/fish-handling

IMPROVE VESSEL SAFETY SYSTEMS

The Australian Maritime Safety Authority (AMSA) is holding a series of workshops for owners and operators of domestic commercial vessels who have an existing safety management system (SMS) in place and want to improve and build on their current system.

The workshops will focus on applying a practical SMS, as well as building on an existing system so that it continues to keep vessels, crew and the environment safe.

Participants will learn the simple principles for an effective SMS, safety requirements under national law and tips on how to review, revise and continue to improve an SMS. They will also have an opportunity to discuss and ask questions about their own SMS with an AMSA representative. Workshops will commence from July 2019. **F**

More information:
amsa.gov.au/smsworkshops
to register.

TECHNOLOGY

TASMANIA NEARS CARP FREE STATUS

After 25 years of concerted effort, Tasmania is close to eradicating the invasive European Carp (*Cyprinus carpio*). It is estimated that fewer than 20 carp remain in Lake Sorrell, with the Inland Fisheries Services committed to removing every last one.

Carp were first found in Tasmania in 1995 in Lakes Sorrell and Crescent in the Derwent River Catchment. A concerted eradication program led Lake Crescent to be declared carp-free in 2009.

However flooding around the same time allowed carp populations to rebound in Lake Sorrell, and more than 41,000 carp have since been removed from the lake.

Nowhere else in the world have carp been successfully eradicated from water bodies as large as Lake Crescent and Lake Sorrell, which are 23 square kilometres and 53 square kilometres respectively. These lakes are also important recreational trout fisheries.

Tasmanian carp research has targeted the problem locally, while the National Carp Control Plan has been investigating how to control carp at a continental scale. Watch the Tasmanian carp story at <https://youtu.be/ftgTDSFipAw>

MEDICINE

BOX JELLYFISH VENOM ANTIDOTE

A team of pain researchers at the University of Sydney has discovered an antidote to the deadly sting delivered by Australian box jellyfish – the most venomous creature on earth.

The Australian box jellyfish (*Chironex fleckeri*) has about 60 tentacles that can grow up to three metres long, and each tentacle has millions of microscopic hooks filled with venom. One box jellyfish carries enough venom to kill more than 60 people.

A single sting to a human will cause necrosis of the skin, excruciating pain and, if the dose of venom is large enough, cardiac arrest and death within minutes.

Greg Neely, Raymond (Man-Tat) Lau and their team have uncovered a medicine that blocks the symptoms of a box jellyfish sting if administered to the skin within 15 minutes of contact. The antidote was shown to work on human cells outside the body and then tested effectively on live mice. Researchers now hope to develop a topical application for humans.

Box jellyfish are found in coastal waters in northern Australia, from Queensland to Western Australia, and into the waters around the Philippines. The venom used in the study was collected from a box jellyfish in the waters off Cairns. **F**



BIOLOGY



Sea sponge
Photo: Shutterstock

Sea sponges may help identify gut bacteria

Sea sponges are believed to have existed for about 750 million years, making them the world's longest-existing animal. But of more recent interest to researchers is the fact that as much as 60 per cent of a sea sponge's tissue is made of bacteria.

As each sea sponge is home to complex collections of bacteria, they provide an ideal testing ground for techniques that can identify multiple bacterial phyla, or groups, at once. These techniques have potential applications in mapping the similarly complex microbiome of the human gut.

Beginning with the ability to identify 41 bacterial phyla in 81 different species, the new, more sensitive multi-primer developed at Flinders University has been able to identify 57 phyla in just four local sponge species.

"From this initial examination of marine sponges, we are now confident that it can be applied across all microbiomes – including human microbiome studies," researcher Qi Yang says.

"This will have many possible implications. For example, to better understand the human gut, we will now be able to identify many more types of bacteria, to obtain a more complete picture of the human microbiome." **F**

WORDS

All fishing that takes place on open waters can be classified as either inshore or offshore. Between them, water depth is the biggest difference.

INSHORE

Typically categorised as fishing in waters less than 30 metres deep, closer to shore in smaller boats. This type of fishing generally uses lighter tackle.

OFFSHORE

Typically categorised as fishing in waters 30 metres deep or more, and warrants more sea-worthy vessels. This type of fishing generally uses heavier tackle and equipment.

IN PRINT

HOOKED ON HERRING

Australian Herring (*Arripis georgianus*) has high amounts of omega-3 fatty acids, is good

for heart and brain health, and is a sustainable species – all good reasons to eat the fish, which was added to the Status of Australian Fish Stocks reports for the first time in 2018 (fish.gov.au).

The species is most common off the south-west coast of Western Australia, but is also found along most of Australia's southern coastlines, with a single biological stock.

A fan of this popular recreational species, Jacqueline Hagan has produced the cookbook *Hooked on Herring*, published by Margaret River Press, featuring a range of international cuisines and preparation techniques adapted for the species.

Her recipes include techniques commonly used for Atlantic Herring, such as smoking, but she says Australians also have the opportunity to enjoy the fish fresh, unlike in the Northern Hemisphere where herring are generally only sold preserved – pickled, salted or smoked. **F**





New RD&E plan in the works

The FRDC will take a 10-year view of fishing and aquaculture to 2030 to help guide the development of its next five-year RD&E plan

By Annabel Boyer



Planning for the FRDC's next five-year research, development and extension (RD&E) plan is underway, with consultation and drafting to be undertaken during the next 12 months.

This plan will guide the direction and provide performance targets for the FRDC investment over that period.

The 2020–25 RD&E Plan will be the seventh plan since the FRDC's inception in 1992. Each plan takes a contemporary look at the operating landscape and outlines targets against that landscape, areas of high strategic focus (need) and a series of desired outcomes, with the view of further developing fishing and aquaculture in Australia.

Matt Barwick is coordinating and drafting the next RD&E plan. It will incorporate the needs and aspirations of the diverse sectors and industries that make up Australia's fishing and aquaculture community and will be shaped by the priorities of the Australian Government, the Australian Fisheries Management Forum and FRDC's five representative organisations.

"It is very clear that you can't chart a path to the future without knowing where you are," Matt Barwick says.

"We are starting with an evidence-based situational analysis that looks across all of the sectors of fishing and aquaculture in Australia to help us understand where we are today."

This kind of analysis has been a fundamental part of the FRDC's development of its RD&E

The FRDC 2020–25 RD&E Plan will be informed by:

- a contemporary snapshot of fishing and aquaculture today, updating earlier work conducted in 2014 (FRDC Project 2014- 503.20);
- a horizon-scanning process looking over a 10-year time horizon (2030) that considers geopolitical, social, economic, environmental and technical changes likely to occur over 2020–30; drivers of those changes; and implications for fisheries production/targeting, trade, pricing, fishing participation, expenditure, and the environment;
- the independent review of the FRDC's performance, and proposed independent review of Research Advisory Committees (RACs) and Industry Partnership Agreements (IPAs); and
- strategic plans for the FRDC's IPAs and RACs, which operate in parallel to the RD&E plan.

plan in the past, but Matt Barwick says that this time there will be some significant additions to the process. "We are also adding a forecasting project, which looks over a 10-year time horizon to ask the question, 'what are the big changes coming our way and what are the drivers for those changes, both for fishing and aquaculture and the country more broadly?'" Matt Barwick says.

The 2020–25 RD&E Plan will be informed by a three to four month period of consultation. The FRDC is looking to include a diverse range of participants in each stage of the consultative process, drawing from the breadth of the fishing and aquaculture industry, Matt Barwick says.

"That breadth and diversity is one of our bigger challenges, but also an opportunity in a process like this. We have people [who] derive income and livelihood catching fish; people for whom a great day of fishing means they come home without anything at all, having released everything; and, very importantly, Indigenous communities, which value fishing differently again."

The process will be designed to provoke thought and feedback on possible future states of fishing and aquaculture in Australia; to organise activities to respond to key internal and external driving forces; and to propose improvements to systems, investment frameworks and processes to improve efficiency in delivery of outcomes through investment in RD&E.

Matt Barwick says the FRDC will take a "mixed-methods" approach to ensure that different voices are heard. This will include face-to-face workshops and forum-style events, as well as online input that will solicit feedback on an insights paper expected to come from the "forecasting" project.

"One thing is clear from the early discussion we've had so far is that the world, not just fishing and aquaculture, is operating in a more uncertain environment. As those conditions amplify, so does the need for change. This means we need to plan for this change now."

F To have your say email FRDCplan@frdc.com.au. For more information on the FRDC's development of its 2020–25 RD&E Plan and a full consultation plan go to www.frdc.com.au/Research/RDE-planning-and-priorities/FRDC-RDE-Plan-2020-2025



Below Purse seined
Australian Salmon from
Lakes Entrance, Victoria,
iced at the point of harvest.



Story and photos
Catherine Norwood

Can collaboration between fishers and the seafood supply chain help the underrated wild-caught Australian Salmon find a place in a consumer market dominated by a red-fleshed import?

Australian Salmon's image problem is twofold. One is its poor reputation as a fresh fish offering. The other is its unfavourable comparison with the market-leading Atlantic Salmon. For commercial fishers, both issues have contributed to falling demand and prices so low the fish is hardly worth catching.

But chefs have been known to sing the praises of Australian Salmon unprompted. Speaking at the Slow Fish Festival in Melbourne earlier this year, Oliver Edwards of the

Aristologist restaurant in the Adelaide Hills said it was his all-time favourite fish to barbecue. At the same event, former chef and food writer Matthew Evans praised the fish as "a total joy". It was the perfect curry fish, he said, and with the right handling could even be served as sashimi.

Australian Salmon have a pinky-brown coloured flesh when raw, which turns pale – almost white – when cooked. They are more like herring than salmonids and the Australian Herring (*Arripis georgianus*), also known as Tommy Ruff in South Australia, is a member of the same family.

Fishers' challenge

During the past decade, the FRDC has invested in several research projects to identify ways to make better use of Australian Salmon. It is officially designated 'sustainable' in the 2018 Status of Australian Fish Stocks Reports (fish.gov.au), and it could be harvested in significantly larger quantities than it currently is.

As a fisheries resource, it has the potential to return a much greater value to fishers, and to the community more broadly, than it currently does. With Australians importing almost 70 per cent of the seafood they eat, there is a growing economic and social imperative to eat local.

But among fishers and fishmongers, Australian Salmon is often considered a bait species and not worth the care needed to prepare it for the dinner table. And this fish does need care; it is unforgiving of mistreatment.

A quick kill by brain spiking the fish, then bleeding and immediately chilling is considered best practice to maintain the quality of the flesh (see www.frdc.com.au/sitecore/content/frdc/industry-and-environment/aquatic-animal-welfare/aaw---research). However, Australian Salmon are often harvested in large numbers from shallow water by hauling nets onto beaches, which can make clean and speedy processing a challenge.

It may be difficult in these conditions, but not impossible to maintain fish quality, as an FRDC-funded project led by Ken Dods has demonstrated. This project developed best practice processing techniques and quality standards for the fish in Western Australia, which has previously provided the majority of the national harvest, although volumes have fallen in recent years.

In other states, fishers might also purse seine fish onto vessels rather than beaches. Some make this choice to avoid sand contamination and improve processing; for others it's part of compliance with state regulations that prohibit beach landings, such as in Tasmania and Victoria.

Consumer challenge

Tasmanian-grown Atlantic Salmon dominates consumer awareness so successfully that people expect Australian Salmon to be Atlantic Salmon grown in Australia, and so to have red flesh. Even canned salmon are red-fleshed species imported from the Northern Hemisphere.

Seafood providore and marketer John Susman has suggested that Australian Salmon may not just need rebranding – it may need a whole new name. He raised this prospect at the Australian Salmon

workshop held in Melbourne earlier this year.

This was the first event to bring together Australian Salmon fishers, seafood processors and wholesalers in the hospitality, retail and export markets. They represented all states harvesting the species and all parts of the supply chain.

While participants discussed the issue of consumer expectations, there was no consensus at the workshop to pursue a name change. They did agree that there was significant potential in working together to develop new markets, and to focus on increasing the value of fish, rather than on harvesting greater volumes.

Seafood post-harvest scientist Janet Howieson from Curtin University organised the workshop, saying some foundational work for the species has already been completed. This included the development of a quality index for grading the fish, assessment of processing practices to preserve quality, sensory comparison tests

with other fish species, and product development options. She said earlier research projects had also identified that the name and consumer expectations were a barrier to greater consumer acceptance. However, she said it was up to the industry itself to take action on these issues.

Collaborative action

Workshop participants developed three priorities for collaborative action to raise the profile and the value of the species, which were:

- collating national data;
- supplying detailed information on the species to supply chain partners; and
- jointly investigating new markets.

Workshop participants also agreed to support the Seafood Trade Advisory Group (www.seafoodtradeadvisory.com) in preparing submissions to have Australian Salmon added to the list of permitted species for export to China. **F**

RETAIL MARKET FORAYS

Galvanised by the first national workshop on Australian Salmon, NSW fisher Tom Richardson and Queensland seafood processor Andre Gorissen from Noosa Seafood Market are embarking on a quality and retail market trial for the species.

Tom Richardson is supplying up to 50 kilograms of premium Australian Salmon. Andre Gorissen will then process the fish using an organic modified atmosphere processing system called Fresh-tec, which he currently uses for up to 15 of the species he processes for domestic and export markets. This flavourless smoke technology stabilises the colour of fish and extends shelf life for both fresh and frozen products.

Stabilising the colour is crucial, Andre Gorissen says, because consumers “buy with their eyes”. No matter how fresh or tasty a fish is, it needs to look good too. One of the challenges with Australian Salmon, and similar pelagic fish, is that the bloodline oxidises and quickly changes from red to brown, which makes the fish look unappealing. But with the right handling by the fisher and appropriate processing, this colour change can be prevented.

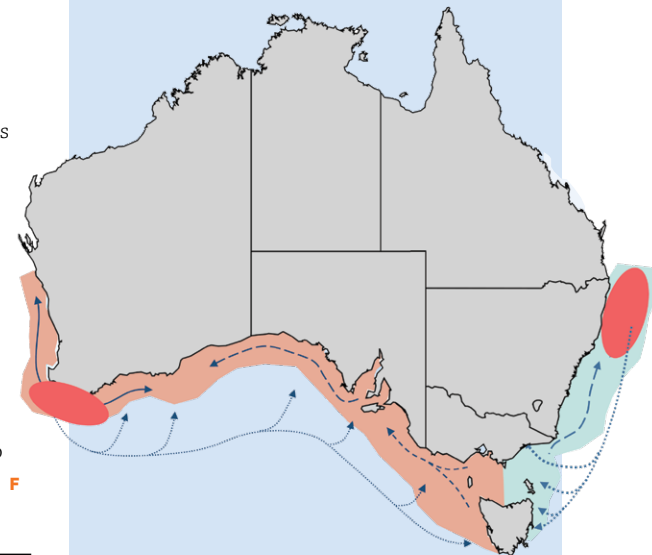
Testing the market with the processed product is the first step, and Andre Gorissen is excited about its potential for Australian Salmon and other underutilised species.

“We have a sustainable wild-caught product, from a clean, green environment, and the technology exists to process this the right way if the fisher can deliver a premium product.”

He says while Australian consumers are often unadventurous when it comes to seafood, and rely on the same few species over and over again, there are four billion people on Australia’s doorstep who think seafood “is the best thing going”. Samples of the fish processed by Fresh-tec will be sent along with other Noosa Seafood orders to domestic customers, as well as to Hong Kong and Singapore.

In Victoria, Mitchelson Fisheries at Lakes Entrance has also embarked on premium retail trials, in conjunction with the Fish Shoppe at the South Melbourne Market, and with Lakes Entrance chef Samantha Mahlook at Miriam’s Seafood Restaurant. The Mitchelson family purse seine their catch, with about 200 kilograms of fish immediately bled and set aside in ice. Feedback from the Fish Shoppe has led to refinements in the processing to include slicing the fish across the tail, as is done for tuna. Samantha Mahlook has also developed a menu special of Australian Salmon crusted with macadamia and lime that has been well received by customers. She’s keen to make the fish a regular part of her menu, which features several locally caught species. **F**

DISTRIBUTION OF AUSTRALIAN SALMON



LEGEND

- spawning grounds
- Western Australian Salmon *Arripis truttaceus*
- Eastern Australian Salmon *Arripis trutta*

There are two closely related species of Australian Salmon, each of which forms a single, independent biological stock that crosses several fisheries jurisdictions.

The Eastern Australian Salmon (*Arripis trutta*) is found in southern Queensland, NSW, Victoria and Tasmania. Large mature fish are most commonly found off the coast of NSW. Eggs and larvae disperse and maturing fish return north to spawn, usually aged two to four years.

The Western Australian Salmon (*Arripis truttaceus*) is found in south-western WA, SA, Victoria and Tasmania. It spawns off south-west WA, with eggs and larvae dispersing eastward. Fish return west to spawn, usually aged three to five years.

The Western Australian Salmon species grows to 85 centimetres and 10 kilograms. The Eastern Australian Salmon grows slightly longer, to 87 centimetres, but is lighter, at less than eight kilograms. **F**



What lies beneath . . .
a composite image of Deakin
University researchers on
the water, with ocean floor
mapping overlaid on the
right-hand side of the image.
Photo: Deakin University

Deep dive to new ocean frontiers

By **Gio Braidotti**

Victoria's new data-rich marine ecosystem maps and models have revealed important patterns in the dynamics of Southern Rock Lobster and Blacklip Abalone fisheries, which will improve management of these high-value species



Daniel Ierodionou
Research leader

"Our aim was to understand the primary drivers of productivity on local geographical scales, the resilience of fishing stocks, and threats associated with environmental change."

The amount of sunlight a landscape receives, the shape of the hills and valleys – even the flow of wind – all have clear implications for the vegetation that grows and the animals it supports. It's a similar story for marine environments, although there are different factors at play.

To better understand what those factors are, the interplay between them and the implications for fish populations, researchers have developed complex models that produce detailed maps of the ocean floor overlaid with myriad physical, biological, and oceanographic information.

This process has been completed recently for Victorian waters as part of an FRDC-funded project focusing specifically on the dynamics of Blacklip Abalone (*Haliotis rubra rubra*) and Southern Rock Lobster (*Jasus edwardsii*) fisheries. However, research leader Daniel Ierodionou, at Deakin University, says the work can be adapted for many other species.

"There is still a lot of work that needs to be done, but to our knowledge no one before has mapped an ecosystem the way we did and at a state-wide scale – a first in Australia," Daniel Ierodionou says. "Our aim was to understand the primary drivers of productivity on local geographical scales, the resilience of fishing stocks, and threats associated with environmental change."

The project mapped 2512 kilometres of Victorian coast and inshore waters – about 12,000 square kilometres of water out to three nautical miles – to produce highly detailed, localised and dynamic marine maps. This kind of approach requires expertise from a broad spectrum of disciplines to integrate the many different kinds of data used.

Sea floor data

Several different datasets were combined to map the sea floor. The Victorian Department of Environment, Land, Water and Planning provided bathymetry data (the ocean equivalent of topography) from its Future Coast Program, which

was collected to model storm surges. This data, generated by lasers (LiDAR) operated from an aeroplane, provided the first comprehensive statewide pictures of seabed structure.

However, as lasers are not effective where the water depth is 25 metres or more, Deakin University added its own sea floor data, which it has been collecting since 2014, using its in-house multi-beam sonar. This has filled substantial sea floor knowledge gaps, as sonar systems can provide seabed data to characterise deeper reefs and benthic habitats.

The mapping is generally at a scale of between one and 2.5 metres for laser-generated data and less than one metre for sonar data. These sea floor structural maps have been especially useful to the abalone and rock lobster industries, as both target species that rely on sea floor structures for habitat.

Oceanography

The sea floor maps were an important requirement for modelling the hydrodynamic characteristics that influence abalone and rock lobster larval dispersal patterns. Consultants Water Technology developed a 25-year hindcast model that researchers seeded with 'smart particles' to mimic the life histories of virtual larvae, comparing modelled dispersal patterns with the real-life recruitment outcomes in the fishery.

Daniel Ierodiaconou says this has provided unprecedented insights into larval dispersal and recruitment across the mapped area, and has identified dominant dispersal pathways. Further integration of catch and fish stocks data dating back to the early 1990s provided by fishers and Victorian fisheries managers has also helped better understand patterns of larval survival.

Combining these elements with information on sea floor structure and oceanographic and sea surface temperature data from the Integrated Marine Observing System (IMOS) has allowed the research team to model biomass changes through time.

Daniel Ierodiaconou says this has provided insight into the physical drivers behind those changes in biomass. For example, the team has identified hotspots for changes in wave energy along Victoria's southward-facing coasts that have had the greatest ramification for the state's western and central fisheries.

Variations in where storms occur can lead to changes in wave direction, with potential impacts on both coastal stability and sedimentation patterns in coastal reefs. He says coastal erosion impacts water turbidity, which affects the growth of algal beds. Sediments can inundate reef systems with sand and render them unsuitable for abalone. These changes can also influence the dispersal of larvae.

The research has identified the need for sustained monitoring of oceanographic conditions, such as waves, which is now being addressed through the Department of Environment, Land Water and Planning and the IMOS.

Abalone genetics

The team also collected the DNA of Blacklip Abalone across 30 sites, along with data on site seabed structures and environmental conditions. The resulting analysis shows how abalone has responded to environmental changes such as converging ocean currents, sea temperature and wave energy, not just at broad regional scales (10s to 100s of kilometres) but also at local spatial scales (100s to 1000s of metres).

Industry engagement was also a critical part of the project's success, including feedback on the abalone abundance models and patterns observed.

The research team collaborated with commercial fishers to sample 900 abalone for the genomic component of the study and characterised geomorphic traits of 30 reefs across the state's three abalone fishing zones.

For abalone and rock lobster, the project has successfully identified important reefs, dominant larval dispersal pathways and the role of selection on larval recruitment processes. For abalone, the project has additionally produced biomass distribution models.

Broader applications

Given the detail of the data, one of its many uses may well be to identify habitat important to abalone and rock lobster that could be subjected to seismic tests, says Markus Nolle, a Southern Rock Lobster fisher and chair of Seafood Industry Victoria. This is an issue of ongoing concern to Victorian fishers.

The data will also provide a guide to the most productive areas of ocean habitat, he says, where investment in restorative technologies, such as reef reseedling or translocation of animals, might get the best return on investment.

The stand-out trend for Daniel Ierodiaconou was the observed rise in sea surface temperatures, particularly on the east coast of Victoria, and the likely negative impact on fisheries productivity.

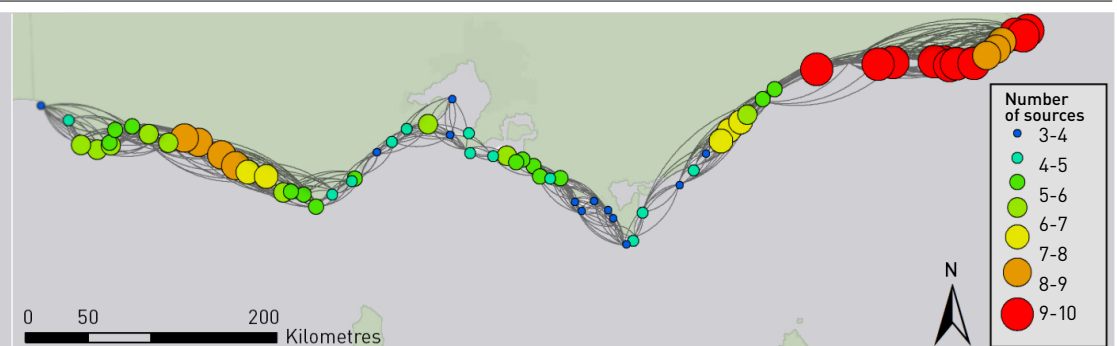
He says the project outputs will have multiple uses for fishers, conservation and our understanding of our geological history. The sea floor maps are accessible to the public. Other outputs and the models are currently not publicly available, but work is underway to make everything accessible through the Australian Ocean Data Network.

Daniel Ierodiaconou says the broad multi-disciplinary approach was essential to the success of the project. Among the collaborators were Mary Young, Adam Miller, Eric Treml and Craig Sherman of Deakin University, Steve Swearer of the University of Melbourne, Nicholas Murphy of La Trobe University, Jan Strugnell of James Cook University, Harry Gorfine of the Victorian Fisheries Authority in Queenscliff, Victoria, commercial rock lobster fishers and representatives from the three abalone fishing zones. **F**

NUMBER OF SOURCES CONTRIBUTING TO ABALONE ON VICTORIAN REEFS

The greater the number of sources, the more resilient an abalone population is likely to be.

Source: Deakin University





Aquaculture focus for science stars

Aquaculture is proving to be a fertile space for young researchers looking to have a tangible impact in a range of areas

By **Gio Braidotti**
and **Catherine Norwood**

Aquaculture is the beneficiary of the three most recent research projects to win the FRDC-sponsored Science and Innovation Awards for Young People in Agriculture, Fisheries and Forestry.

The awards are presented at the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) annual Outlook conference each March. The research awarded featured the microbiome of oysters, high-value nutritional supplements from algae, and systems to concentrate oxygen in aquaculture ponds.

2019 winner: Elliot Scanes

Combining marine biology and food production, marine biologist Elliot Scanes won this year's Science and Innovation Awards sponsored by the FRDC. He plans to investigate the microbiome of oysters, an area of research he says has the potential to improve oyster resilience in the face of disease and climate challenges.

The first step will be to assess what organisms make up the microbiota inside oysters, a process made possible by new technology and techniques. He says all animals, be they oysters or people, have microorganisms – bacteria, viruses, fungi and other single-celled animals – that live within them.

"These microorganisms are really important to our health and wellbeing, but we're really only just discovering how important they can be." He will then look at how climate change, especially the warming of the oceans, might affect the microbiota inside oysters.

The second part of the research will be to identify whether existing techniques, such as selective breeding, can be used to improve that microbiota.

Elliot Scanes says the immune systems



Above Australian Minister for Agriculture and Water Resources David Littleproud, 2019 fisheries award winner Elliot Scanes and FRDC managing director Patrick Hone. Photo: Steve Keough Photography

of oysters might not be as strong as that of mammals. This, combined with their exposure to changing environments, leaves them vulnerable to diseases and other pathogens.

"Microorganisms associated with oysters are really important in helping them fight disease, and also to be healthy in general," he says. "We know that diseases are one of the biggest issues with oyster growing. If we can wind that back a little bit, it'll be really rewarding to know that we actually helped the industry that way."

Elliot Scanes is based at the University of Sydney and will partner with the NSW Department of Primary Industries on the research.

Update: 2018 winner, Dale McClure

The 2018 award winner, Dale McClure, is part of a University of Sydney initiative, the Centre for Excellence in Advanced Food Enginomics.

He targeted aquaculture wastewater for the production of high-value nutritional supplements for both animals and humans. To date, processes have been developed to produce four high-value nutrients:

- **fucoxanthin:** a brown pigment found to promote weight loss in mice;
- **lutein:** a yellow pigment found to reduce age-related macular degeneration;
- **vitamin K1:** a vitamin essential for blood coagulation that also promotes improved bone and cardiovascular health; and
- **eicosapentaenoic acid:** an omega-3 fatty acid essential for health in fish and humans.

The biological 'engines' making these compounds are carefully selected microalgae species: single-celled, water-living organisms that can photosynthesise. Fifteen species with the ability to make the targeted compounds were

“Our research shows that the right microalgae grown under the right conditions can remove fish farm by-products, like nitrogen and phosphates, that have harmful environmental effects, while producing compounds humans obtain from fruit and vegetables”

Dale McClure

identified in a CSIRO microalgae library.

“Our research shows that the right microalgae grown under the right conditions can remove fish farm by-products, like nitrogen and phosphates, that have harmful environmental effects, while producing compounds humans obtain from fruit and vegetables,” Dale McClure says. “This allows fish farmers to value-add while doing something good for the environment.”

In 2019, operations using Dale McClure’s research began with Sydney-based industry partner Green Camel at its aquaculture facility where it grows Barramundi. Wastewater from the fish farming is also used to produce organically grown herbs for some of Australia’s largest supermarket chains.

Chitrakleha Adhinarayanan, Green Camel’s research and development manager, says the prospect of producing nutrient-rich microalgae in the Barramundi wastewater as part of its production loop is very positive, with potential to use the microalgae as a feed supplement to improve fish growth, as well as treating the water.

“Our intention is to investigate the opportunities of using algae that are rich in omega-3 fatty acids to increase the growth rate of our fish,” she says. “They seem to find it more palatable and put on weight faster, so there is a good business case for us.”

Update: 2017 winner, Kevin Rassool

The 2017 winner of the FRDC-sponsored ABARES Award was Kevin Rassool, one of five engineers who established the start-up company FREO2 Aqua in Melbourne. They invented and patented a system to concentrate atmospheric air into medical-grade oxygen using only the power of running water. The design also won the 2017



Eureka Prize for Innovative Use of Technology.

Following initial tank trials in Sydney, Kevin Rassool established a partnership with Huon Aquaculture, which has a FREO2 Aqua system installed at an Atlantic Salmon hatchery in Tasmania. It is powered by water being pumped between grow-out ponds, with the resulting oxygen supplied to a spare pond equipped with a sensor array.

“The system has been operating continuously for three months without interruption, proving it can produce oxygen for aquaculture producers,” Kevin Rassool says.

Benefits include reduced operating costs either by eliminating the need to purchase liquid oxygen or bypassing the need to concentrate oxygen on-site using electricity. As such, the system also reduces greenhouse gases, and improves plant profitability and efficiency. The oxygen improves



Above left

Dale McClure is investigating the production of high-value nutrients from algae grown in aquaculture wastewater.

Above

Kevin Rassool at the Huon aquaculture facility in Tasmania that is running trials with the FREO2 Aqua system.

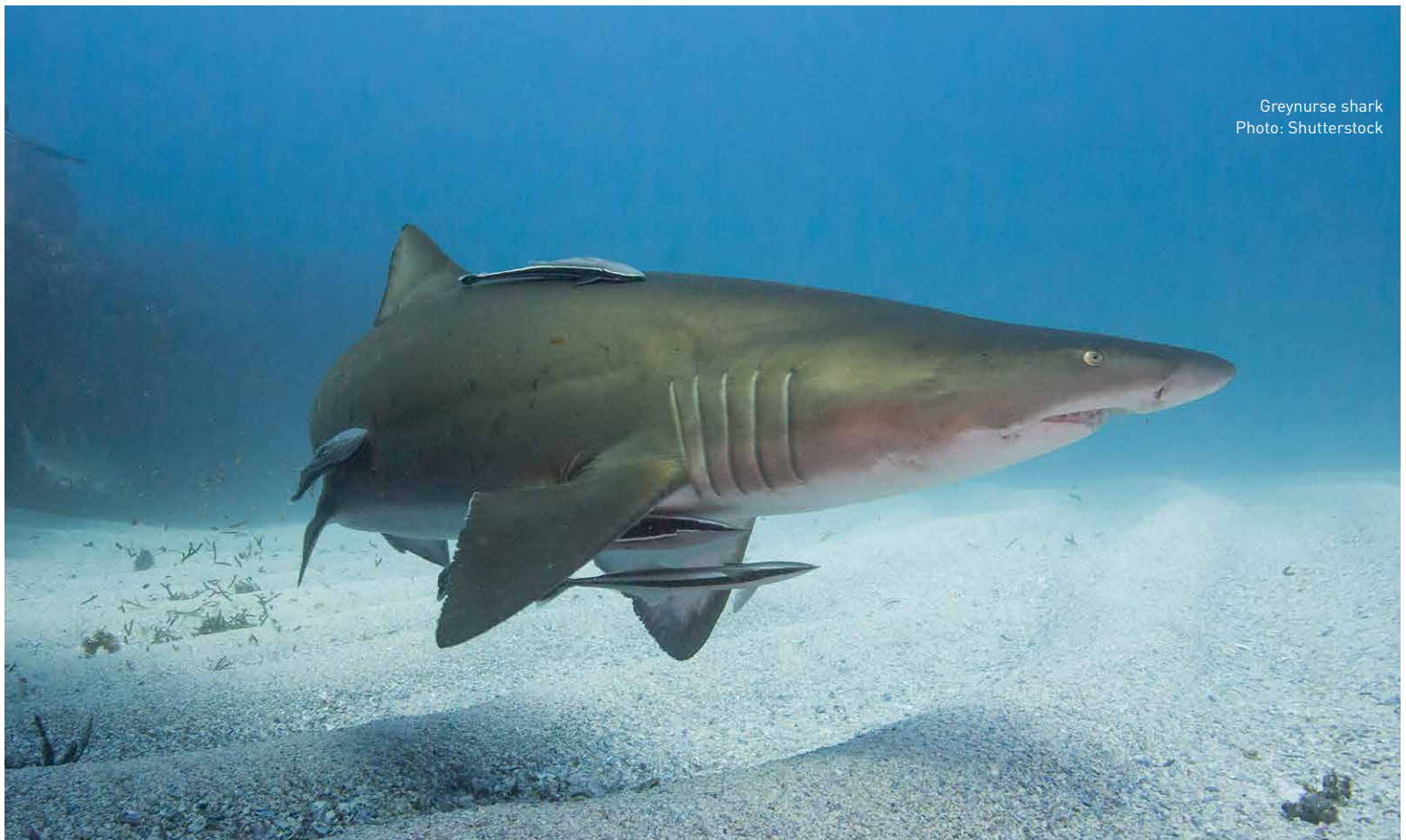
Left Dale McClure is testing 15 species of algae for their ability to produce nutritional compounds.

fish survival rates, growth and feed-conversion ratios, and reduces algal growth.

“The benefits can flow on to rural producers who often face unique challenges associated with delivery and electricity costs, enabling them to intensify operations in areas where it has not before been viable,” Kevin Rassool says.

The robust design features also make the system attractive to small-scale fish farmers in developing countries. Development work on these philanthropic applications is underway with in-country partner AQUADAPT in Thailand. There are also medical devices based on the FREO2 Aqua technology being rolled out in Africa by FREO2 Foundation.

The company’s focus is now on identifying manufacturing partners for the modular design used at the Huon hatchery, while work commences on designing a scaled-up version of the same system. **F**



Greynurse shark
Photo: Shutterstock

Australia's shark status update

By Bianca Nogrady

A report card on the health of Australia's shark and ray populations gives a tick to most species under Australia's care and identifies where action is needed



Colin Simpfendorfer
Professor of marine biology
James Cook University

"One of the things that we know is that where we have most of our problems is not with our target species, but with those that are taken as incidental bycatch."

One of the more heated debates to stir the blood of Australian shark experts has been the question of the health of the nation's Greynurse Shark (*Carcharias taurus*) populations. In 2003, experts from the east coast were calling for the species to be listed as critically endangered. But their colleagues from the west were adamant that populations were in good health. It took five days of intense discussion to reach the conclusion that there were in fact two populations, or stocks, of Greynurse Shark, not one.

This is just one example of the complexity faced by scientists when assessing the overall health of Australia's shark and ray populations. Tackling many of these challenges head-on is a new report funded by the FRDC.

Shark futures: A report card for Australia's sharks and rays has built the most comprehensive picture yet of the status of Australian sharks and shark-like rays, about half of which are endemic to Australian waters. The report has assessed 194 species, or 198 stocks, which includes the two independent populations of the Greynurse Shark, Endeavour Dogfish (*Centrophorus moluccensis*), Dusky Shark (*Carcharhinus obscurus*) and Sandbar Shark (*Carcharhinus plumbeus*).

The report was commissioned in response to ongoing concerns about the status of shark and ray populations, and to assess Australia's efforts to ensure the wellbeing of those populations under its jurisdiction.

At a basic level, sharks are fish from the taxonomic class *Chondrichthyes*, and the subclass *Elasmobranchii*, which also includes rays and skates. Modern sharks and rays fit into the clade *Selachii*, of which there are more than 1200 species worldwide.

Most are under one metre long, and some are as small as the human hand. Their lightweight cartilaginous skeleton is one defining feature, but another is the row of gills on either side of their heads. While bony fish

STATUS OF AUSTRALIA'S SHARK STOCKS

194 species assessed

124 sustainable stocks

9 recovering stocks

6 depleting stocks

18 depleted stocks

41 undefined stocks

only have one gill opening, sharks have five to seven pairs on each side.

Many sharks also give birth to live, well-developed young – something that distinguishes them from bony fish and can also make them more vulnerable, says Colin Simpfendorfer, professor of marine biology at James Cook University and lead author on the report.

“What that means is that some sharks have fairly limited reproductive output on an annual basis, and that really limits their ability to sustain fishing and recover from overfishing.”

Australian species assessed

Overall, *Shark futures: A report card for Australia's sharks and rays* tells a good news story: 124 of the 198 stocks are assessed as being in a sustainable state, and nine stocks that have been in decline in the past now show signs of recovery, including the eastern stock of the Endeavour Dogfish.

Twenty-one species were assessed as doing better in Australian waters than they are globally.

However, of concern, 18 stocks were classified as depleted. Those 18 are either protected or already have plans in place to aid their recovery.

“To me, this is a signal that Australia is good at knowing when a species needs attention and doing something about updating its status, and putting management in place,” Colin Simpfendorfer says. “We actually have very good fisheries management and enforcement of fisheries rules in this country.”

The report recommends further efforts to improve management of and research into the two species that don't have management plans – Whitefin Swellshark (*Cephaloscyllium albigpinnum*) and Colclough's Shark (*Brachaelurus colcloughi*). Both are caught incidentally in fisheries.

“One of the things that we know is that where we have most of our problems is not with our target species, but with those that are taken as incidental bycatch,” Colin Simpfendorfer says.

Six species were also assessed as depleting, which indicates a decline in abundance, but not yet to a state where the population is in jeopardy. The report recommends careful monitoring of these populations in the future.

Data gaps

It is not always easy to identify, classify and assess the health of shark species, particularly those found in deeper waters. The FRDC's shark report lists 41 stocks as 'undefined', where there simply was not enough information for experts to provide status assessments. The majority of these are rarely encountered deep-water species.

“There are some sharks that are only known from one specimen caught in 1000 metres of water, so no matter how you look at that data it can only be undefined,” says Will White, senior curator of the Australian National Fish Collection at CSIRO and a co-author on the sharks and rays report.

Species from deep water are also less likely to encounter fishing, so are of less concern than those from shallower regions. Will White says species known

REPRODUCTIVE DIVERSITY

Sharks are unusual in the animal world in that they reproduce in three different ways, depending on the species.

Some species are oviparous – the females lay fertilised eggs outside their body. The Port Jackson Shark (*Heterodontus portusjacksoni*) is an example of this. It produces eggs with a distinctive corkscrew casing that is often found washed up on beaches. It is assessed as sustainable in *Shark futures: A report card for Australia's sharks and rays*.

Some shark species are ovoviviparous – they produce eggs that stay in the female and hatch inside the parent with no placental connection. The Gummy Shark (*Mustelus antarcticus*) and School Shark (*Galeorhinus galeus*) are both examples of this.

Gummy Sharks have 'litters' of around 14 pups at a time, but can produce as many as 57 every one to two years, and the species is viewed as a sustainability success story.

In contrast, the School Shark, which has been commercially targeted in the past, can produce 15 to 43 pups, but only reproduces every three years and takes longer to reach maturity. It is now assessed as depleted in the 2018 Status of Australian Fish Stock (SAFS) reports, and a management plan has been put in place to help restore its numbers.

Some sharks are also viviparous – they give birth to live young, in the same way that mammals do. This includes the commercially fished Whiskery Shark (*Furgaleus macki*), which also matures quickly, has large litters of young, and gives birth every two years. It is assessed as sustainable in the SAFS reports.

“To me, this is a signal that Australia is good at knowing when a species needs attention and doing something about updating its status, and putting management in place.”

Colin Simpfendorfer

to occur within particular fisheries should be prioritised for further research. “You need to overlay the threat to the distribution of the animals,” he says.

Taxonomy

Identifying the species is the crucial first step in the stock assessment process. In the 1990s, when the book *Sharks and Rays of Australia* (an FRDC-funded project) was first published, it listed more than 60 species as “possibly undescribed”. By the second edition, published in 2009, experts had put names to most of those species, Will White says.

“The fundamental requirement of any sort of study is that you need to know what the animals are,” he says. “We are in a pretty good position with this in Australia now, so there are only a handful that we are working on now.”

The importance of getting the taxonomy right is illustrated by the case of the Whitefin Swellshark. For a long time, it was mistakenly identified as the Northern Droughtboard Shark, which is a sustainably managed species. Then when researchers realised the Whitefin Swellshark was a different species, things changed completely and it is now classified as depleted.



Colin Simpfendorfer
conducting shark research
for James Cook University.
Photo: James Cook University

Assessment approach

The process of writing Australia's report card on sharks followed the well-established approach used by the International Union for the Conservation of Nature – or IUCN – for curating its Red List of Threatened Species.

The organisers held a workshop of 23 of Australia's leading shark and ray experts, who all brought the latest information and evidence on their species of interest to the table. The group then applied the IUCN Red List criteria to the shark species being considered, to establish the health of each population.

It can be an intense process, says Will White. "There are lots of discussions, and you do get some strong disagreements, but you always come out with a stronger assessment at the end."

The IUCN sets a high bar for the evidence required to show a species is threatened, he says, which means there is very little chance that threat is being overstated. The report also incorporated Australian categories and criteria for sustainability, using the FRDC's Status of Australian Fish Stocks (SAFS) reports.

Future action

While there's plenty of good news to be found in this report, there is still work to be done for the species identified as depleting, depleted or of unknown status, Colin Simpfendorfer says.

"Because of the life history of these animals, some may take 20 or 30 years to reach maturity and have very small numbers of young, and so the recovery is going to be slow," he says. "They could remain depleted for quite some time, even though the populations are starting to potentially recover."

Will White says now the report card is in, the next step is an action plan, which should include repeating this assessment process on a more regular basis. While the second *National Plan of Action for the Conservation and Management of Sharks* has been in place since 2012, the report card will be an invaluable tool to inform future action.



Tiger Shark
Photo: Shutterstock

THE TIGER SHARK CONUNDRUM

Like the Grey Nurse Shark, the Tiger Shark (*Galeocerdo cuvier*) presents something of a conundrum. *Shark futures: A report card for Australia's sharks and rays* identifies it as depleting, but there is no management plan in place for the species, and it is also a target of shark control programs in Queensland.

The reason may be that it too has different populations experiencing different levels of threat. Colin Simpfendorfer says evidence suggests populations in the southern Queensland and NSW region are declining, but in northern Australia and the west coast, they're doing reasonably well.

"It's a sign that, again, we need to understand this situation more; we need to think about whether we need to put some sort of regulation in place in terms of making sure that enough of these animals are surviving or avoiding capture," he says. "That gets complicated because they are a target of the shark control program in Queensland, so it's going to be more difficult to resolve, because you have this tension between human safety and conservation and management outcomes."

Will White stresses that it is important to work out how some of the at-risk species might be linked, as that could offer the potential for synergies in research focus and management plans, and the best return on research investment to address threats.

The *National Plan of Action for the Conservation and Management of Sharks 2012* can be viewed at: www.agriculture.gov.au/SiteCollectionDocuments/fisheries/environment/sharks/sharkplan2-final/sharkplan2-action.pdf. **F**



Seafood Directions to make community connections

Plans to kickstart action on industry issues, and to bring consumers along on the seafood journey, are part of a new format for the national conference

Story and photo **Catherine Norwood**

Organisers of the 2019 Seafood Directions, to be held in Melbourne, hope to make the event an opportunity to strengthen connections between producers, the supply chain, key influencers and the broader community.

Seafood Industry Victoria (SIV) is the host organisation for this year's Seafood Directions. While the program is still being finalised, SIV executive director Johnathon Davey says that in addition to industry presentations, two new initiatives are being developed. One is a series of Seafood Directions satellite events at venues outside the main conference.

"The seafood industry involves more than the producers; as such we'd like to draw in local chefs, restaurants, seafood suppliers and others. We're planning events at cafes and restaurants, in conjunction with the conference, which will be branded and also ticketed for the general public.

"These will provide a chance for producers, suppliers and chefs to share what they do and why, and to showcase our love for Australian seafood.

"As much as we love what we do, we need the community and seafood consumers to be involved with us and supporting us. We need them to talk about our product too."

This strategy has proven a successful part of the Apollo Bay Seafood Festival, where a 'conversations' program with producers, researchers and chefs has drawn strong interest from food and seafood lovers keen to learn more about where their food comes from.

Johnathon Davey says the committee is also keen to see the conference become "an activation"

Seafood Industry Victoria executive director Johnathon Davey, pictured at the Apollo Bay Seafood Festival, says Seafood Directions provides an opportunity for the industry to take stock, and to connect the seafood sector with the community.



"The seafood industry involves more than the producers; as such we'd like to draw in local chefs, restaurants, seafood suppliers and others."

Johnathon Davey

point for the seafood sector through a series of workshops.

"For example, if plastic is an issue in the seafood sector, we want to provide a workshop for those with an interest in this to come together and develop an action plan that the industry can use to help eliminate plastic in the seafood industry," he says. "Mental health is an issue in our industry; can we use Seafood Directions to create a work plan to help the industry better recognise and address this problem? We certainly hope so!"

Seafood Directions will open with a welcome and registration event on Wednesday 9 October,

followed by the two-day conference with a series of presentations reflecting the state of the sector, the latest research, and issues-related workshops. It will conclude with a gala dinner on the evening of Friday 11 October. The conference itself will be held at the Melbourne Convention and Exhibition Centre.

The National Seafood Industry Awards will also be a feature event during the conference, as part of a luncheon on Thursday 10 October, and will include the winners of the National Fish and Chips Awards (see story page 36).

The FRDC and the Victorian Fisheries Authority have already signed up as sponsors for Seafood Directions 2019. "We're still seeking further sponsors, and if anyone has ideas about how they would like to be involved, we'd love to hear from them," Johnathon Davey says. **F**

Early-bird tickets for the conference and dinner are already on sale; visit the Seafood Directions website (www.sd2019.com.au). Follow the conference program and any updates on Facebook ('Seafood Directions Conference') and on Instagram ('seafooddirections').

Survey sets northern benchmarks

There is a heightened awareness of biosecurity issues in the aquaculture sector, but more information about relevant diseases and reporting channels could accelerate responses to potential threats

By Catherine Norwood

A survey of aquaculture and community stakeholders in northern Australia has identified that two-thirds of aquaculture operators fear a biosecurity outbreak is imminent, and likely to occur within the next 12 months.

More than 70 per cent of operators also believe the Australian Government isn't tough enough on the biosecurity and quarantine for imported seafood, a view also shared by 50 per cent of other fisheries stakeholders who took part in the recent survey.

The survey was commissioned by Animal Health Australia (AHA) and coordinated by Helen Jenkins, aquatic biosecurity liaison officer for northern Australia. She says the aim of the survey was to identify what aquaculture operators in the north require to improve biosecurity – what the attitudes and barriers were and what AHA could do to address those.

The survey targeted perspectives from both the aquaculture sector and the broader community and was undertaken by the independent research agency Instinct and Reason. In all, there were 103 responses: 39 from aquaculture operations and 64 from non-aquaculture stakeholders.

A major consideration in the selection of respondents was to assess to what degree respondents see biosecurity as a shared responsibility between governments and

community members. The survey found that the majority of aquaculture operators view biosecurity as the responsibility of governments, while non-aquaculture respondents were more likely to view the issue as a shared responsibility.

The survey found that there has been an increasing awareness of biosecurity issues in the aquaculture sector over the past three years, following increased training and major disease outbreaks such as white spot disease. The increased awareness also suggested a positive impact from a biosecurity awareness roadshow conducted in 2018 across northern Australia.

Practices in place

Seventy-nine per cent of operators surveyed said they had a biosecurity plan in place and that it was reviewed at least once a year. Passive surveillance of farmed animals is the most common biosecurity practice, with 75 per cent of farms visually checking stocks at least daily, usually during feeding, conducting mortality checks or water quality testing. Mortality rates are considered the most important trigger for an investigation.

Most farms rely on their own experience when deciding how to act (67 per cent). Just over one-third (36 per cent) contact a laboratory for tests or a health consultant (31 per cent), and 31 per cent check water quality.

However, just over one-quarter

(28 per cent) could not cite a notifiable disease in their industry. For those who could, 78 per cent would immediately notify the relevant state or territory department.

Future initiatives

Helen Jenkins says the survey identified a number of initiatives that could help increase awareness and reporting of biosecurity issues.

While most operators surveyed (79 per cent) indicated they had biosecurity plans, there was strong interest in the provision of generic biosecurity plans and guidelines, as well as assistance to tailor generic plans for individual business, identify risks and review existing plans.

Aquaculture operators were also interested in easy reference guides for notifiable diseases affecting aquaculture species, listing symptoms and actions that producers could take to contain any outbreak, and relevant government and emergency reporting contacts.

Helen Jenkins says promoting emergency contacts could be valuable for both the aquaculture industry and broader community, as the reporting of aquatic biosecurity incidents is not necessarily a straightforward process. There are different reporting protocols depending on the type of incident – a fish kill, pest or disease – and the fisheries jurisdiction where the incident occurs. **F**



MORE INFORMATION

Helen Jenkins, Animal Health Australia, 0477 744 637, hjenkins@animalhealthaustralia.com.au, www.frdc.com.au/en/Partners/National-Priorities-and-Subprograms/Aquatic-Health-and-Biosecurity/White-spot-syndrome

INDUSTRY EYES KEY TO DETECTION

In 2018 the FRDC funded the Queensland Seafood Industry Association to develop three short videos highlighting the importance of aquatic biosecurity for wild fisheries and the significant role of the sector in identifying and reporting potential biosecurity threats.

While national border security is the responsibility of the Australian Government, once a threat has breached the border, biosecurity becomes a responsibility shared by all industry and community members.

The videos highlight the consequences of biosecurity outbreaks, such as the recent outbreak of white spot disease, which affected both prawn farmers and fishers wild-harvesting prawns and other crustaceans. Stock on affected farms in south-east Queensland were killed, with quarantines put in place for locally wild-harvested crustaceans, including prawns. The videos show the important role that wild-harvest fishers and those in the post-harvest sector can play in terms of surveillance. Being out on the water, and constantly handling seafood, people working in the industry are well placed to identify any pests or diseases.

View the videos at: Harvest Sector <https://vimeo.com/281408689> Post-Harvest Sector <https://vimeo.com/280143348> Biosecurity Basics <https://vimeo.com/286307059>

REPORT EARLY

Early detection and notification of biosecurity risks is crucial to initiating the most effective response. If you identify something unusual such as an aquatic pest or disease:

1. Take a photo.
2. Collect a sample, if possible.
3. Refrigerate the sample to keep it fresh (unless it is already frozen).
4. Notify your local biosecurity agency, or call the **National Disease Watch hotline: 1800 675 888**. Call the national hotline if you suspect a connection with any of the Reportable Diseases of Aquatic Animals.

REPORTING IN THE NORTH

Northern Territory

Aquatic Biosecurity Unit:

0413 381 094,

aquaticbiosecurity@nt.gov.au

■ Report using the NT Fishing Mate app

■ To submit samples, contact the NT Fisheries veterinary laboratory: (08) 8999 2249

■ To submit samples, contact the Department of Agriculture and Fisheries biosecurity laboratory: (07) 3708 8736, bslclo@daf.qld.gov.au

Western Australia

Fishwatch hotline: 1800 815 507

DIPIRD biosecurity: biosecurity.compliance@dpiird.wa.gov.au

■ To submit samples, contact the Department of Fisheries Diagnostic Laboratory Services: (08) 9368 3357 or 0409 373 063, fishhealth@dpiird.wa.gov.au

Queensland

Biosecurity Queensland: 13 25 23

Queensland aquaculture licence holders disease outbreak report: 13 25 23

NATIONAL BIOSECURITY SURVEY

To help aquaculture farmers develop and implement biosecurity plans for their operations, the Department of Agriculture and Water Resources also recently completed a national biosecurity survey involving 122 farm owners and managers from a diverse range of enterprises.

These included the abalone, Barramundi, edible oyster, pearl oyster, prawn, salmonid, Southern Bluefin Tuna and Yellowtail Kingfish sectors.

The survey was completed in late 2018, by the independent research company Instinct and Reason, with funding provided by the department, through the FRDC.

The survey was divided into six sections:

- awareness, understanding and attitudes towards biosecurity;
- aquatic animal disease monitoring and reporting behaviours;
- biosecurity tools and practices used on-farm;
- understanding and uptake of on-farm biosecurity plans;
- preferred support tools to develop and implement on-farm biosecurity plans; and
- preferred information sources and needs.

Results indicated that all eight sectors wanted help to develop and

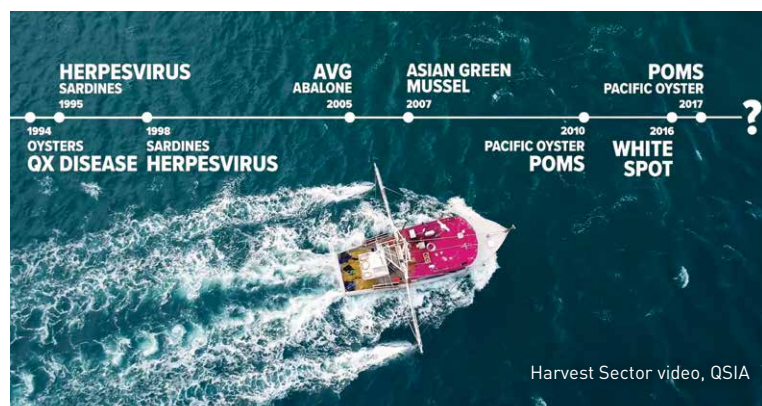
carry out on-farm biosecurity plans. The types of assistance sought varied according to the individual farms and sectors, however, a number of common key activities and measures for assistance were identified.

Farmers indicated they would like help with writing, improving and reviewing on-farm biosecurity plans specific to their property or business, as well as biosecurity training workshops tailored to their specific sector. Sampling kits and the development of further nationally consistent sector or system-specific biosecurity plan guidelines were also recommended.

Easy-to-read marketing and communication materials detailing sector-specific diseases and government contacts was a further recommendation. The survey showed the majority of farmers would contact the state or territory government if they suspected a notifiable disease on their farm, but the contact information needs to be more readily available.

Funding has been committed to complete follow-up activities for this project, such as developing the sector-specific workshops, support materials and resources.

More information: www.agriculture.gov.au/animal/aquatic/aquaplan





Fisher conversation helps shape industry pledge

Many community and industry values align, but further action is needed to help secure the social licence of the Australian seafood sector

By Jessica McInerney, SIA



Whether you call it trust, acceptance or social licence – listening to, acknowledging and responding to community concerns is critical to the future of the Australian seafood industry. So much so that Seafood Industry Australia's (SIA) members have made building the industry's social licence their number one priority, says the association's CEO Jane Lovell.

Assisted by the FRDC, SIA has assessed current and emerging community concerns using data from risk management agency Futureye, the FRDC and the Marine Stewardship Council. The primary concerns identified relate to sustainability, the environment, accountability, animal welfare and industry safety.

SIA also assessed the industry's values and current practices. These were found to mostly align well with community values such as responsible fishing practices, environmental stewardship, connecting with communities and sharing information about fisheries, fishing practices and products.

From this process has grown 'Our Pledge', a statement, still in development, from industry that responds to community concerns and acknowledges the industry's responsibility for the future.

"Social licence is front and centre for our members and the wider industry, and SIA is taking a proactive approach to ensure our industry's ongoing acceptance within the community by developing 'Our Pledge'," Jane Lovell says.

"Social licence is front and centre for our members and the wider industry, and SIA is taking a proactive approach to ensure our industry's ongoing acceptance within the community by developing 'Our Pledge'."

Jane Lovell

"It is based on Seafood New Zealand's 'Promise' and will include the development of an annual report card along with independent monitoring of community sentiment.

"It is critical we get the right balance; if we are making a promise it needs to be achievable, but not just 'business as usual'.

"We need to ensure the industry is consulted and accepts the pledge statements, before we make them public. It will require us to be proud enough to tell our story, but brave enough to listen and respond to the community."

SIA has taken 'Our Pledge' to workshops around the country to discuss it with SIA members and as many other industry participants as possible before it is finalised and made public.

SIA has consulted with a broad range of stakeholders at these meetings, including: SIA members at a forum in Brisbane, Seafood Industry Victoria, Wildcatch Fisheries SA, Spencer Gulf and West Coast Fishermen's Association, Australian Southern Bluefin Tuna Industry Association, Northern Territory Seafood Council, Western

Above Port Lincoln fishing industry representatives (L-R) Ross Hay, Ashley Lukin, Simon Clark, Chay Haldane, Seafood Industry Australia CEO Jane Lovell, Peter Lauer and Greg Palmer give 'Our Pledge' the thumbs up. Photo: Supplied

Australian Fishing Industry Council, Sydney Fish Market, the Abalone Association of Australasia, Tasmanian Seafood Industry Council, Australian Mariners Welfare Society, and Australian Fisheries Management Authority commissioners.

Northern Territory Seafood Council CEO Katherine Winchester says the workshop in the Northern Territory provided an important opportunity to help shape 'Our Pledge'.

"It was great to hear the thoughts and conversations from Territory professional fishers," she says. "These conversations build understanding and reiterate the importance for industry to do more than just tell its good story. There are concerns and issues the community wants to see the industry tackle."

Spencer Gulf and West Coast Fishermen's Association executive officer Simon Clark agrees, saying the industry is proud and excited to show the community what it does.

"There's a broad range of views about the industry from highly favourable to suspicious. We want to demonstrate our authentic practices that help us look after the marine environment and contribute to the community," he says. **F**

For information on where and when workshops will be held, or to take part in a webinar (which can be organised for groups on request), visit the SIA website (www.seafoodindustryaustralia.com.au).



Pitching in for a better seafood future

The Fish 2.0 Regional Innovators Forum in Brisbane has set the scene for Australian seafood innovators to take their products and ideas to the world

By Annabel Boyer



Coordinating Fish 2.0 in Australia, from left, Peter Horvat (FRDC), Monica Jain (Fish 2.0), Jenny Morrell (US Government), Ron Mack and Stuart Hazell (Accelerating Commercialisation) and Remy Garderet (Fish 2.0). Photo: Fish 2.0

The time for change in seafood is now, says Monica Jain, co-founder of Fish 2.0. Her reasoning? The emergence of five underlying forces that are driving the need for business innovation in the seafood sector globally.

These include the effects of climate change, the global pressure on fish stocks, product globalisation and online sales growth, a growing health-conscious middle class, and the rapid expansion of aquaculture. She says this puts the seafood sector in a sweet spot, where it is both ripe for disruption and starting to see innovation. Her comments were part of her address at the Fish 2.0 Regional Innovators Forum in Brisbane in April.

Fish 2.0 is a global connection platform created to bring entrepreneurs in the seafood sector together with investors. Since its inception in 2013, it has grown to operate as the linchpin for a pool of more than 500 investors and 500 entrepreneurs around the world.

Fish 2.0 runs a series of competitive 'tracks', including the Australia and Pacific Islands track, culminating in the opportunity for participants to present to a serious audience of investors in the US, at an event held in Palo Alto, California.

"At the event, there is over \$12 billion of investment capital in the room looking to invest," Monica Jain says. "The reason for this is that investing in seafood just makes sense."

"For Australia, there are opportunities. Australia has a number of unique species, a large coastline and marine resources, and strong environmental and regulatory frameworks."

The FRDC has partnered with Fish 2.0 to provide innovative would-be entrepreneurs from Australia's seafood sector with access to global business development expertise and investment opportunities linking research and development to commercialisation opportunities. Together with the US Department of State and the Australian Government's Department of Innovation, Industry and Science's Accelerating Commercialisation program, the FRDC has sponsored Fish 2.0 to run the Australia and Pacific Islands Fish 2.0 track.

This includes a series of workshops and pitch sessions held in Melbourne and Brisbane in 2018 and 2019, as well as in the Regional Innovators Forum in Brisbane held in April, 2019.

Many of the participants in the Brisbane events have also been nurtured through the FRDC's Fish-X program (www.fish-x.com.au), which schools participants in start-up science to test whether their ideas hold water at an early stage.

At the Regional Innovators Forum in Brisbane, 20 entrepreneurs presented bite-sized pitches outlining their case for investment, partnerships or cooperation, across three sessions. Ventures seeking investment spanned vastly different businesses in both size and scale, reflecting the diversity of seafood in general, but also giving a taste of what Australia has to offer, from abalone to seaweed aquaculture, freshwater crayfish and scampi caviar.

The day also included several panel discussions exploring issues such as opportunities for investment in seafood, value-adding in the food supply chain and the key ingredients required for

innovation and investment. Insights included the value of a collaborative mindset and getting to know your end user. Discussions pinpointed challenges such as the fact that many seafood producers fail to see themselves as food producers (a space in which there is enormous opportunity) and the fragmented nature of the seafood product and supply chains.

In the last pitch session of the day, presenters included those who have qualified through Fish 2.0's online process to compete to attend the Global Innovators Forum in Palo Alto in November 2019.

Kath Long presented on behalf of TomKat Line Fish, a husband and wife team who have developed a fully recycled and recyclable box for transporting fish that replicates the temperature stabilising properties of polystyrene, while being sustainable and able to be flat packed.

Sam Harrington, an environmental technologist from the Climate Foundation, pitched on the prospect of marine permaculture arrays designed to reduce ocean surface temperature and draw down carbon.

Michael O'Shea from Aquaculture Supplements sought investment to gain patent and regulatory approval for the processes and formulations of supplements used in aquaculture. The day also included pitches from representatives of Pacific nations, who were sponsored by the US State Department to participate.

Participants at the Regional Innovators Forum will be advised in August whether they've progressed to the next stage, to be held in November 2019 in California. **F**



Future at your fingertips

With the fisheries sector poised between paper and digital reporting systems, now is the time to create a national, industry-driven digital data system, says Nuffield Scholar Tom Robinson

Story and photos **Melissa Marino**

South Australian Pipi fisher Tom Robinson almost self-sabotaged his Nuffield Scholarship application at the last minute, concerned that, on the eve of his 50th birthday, he was too old for the program that generally accepts candidates younger than 45.

As “quite a reclusive person”, he also thought the program, which takes people from primary industries to travel around the world in groups – each investigating the topic of his or her choice – might be a bridge too far for him.

But he says the communal element of the program was one of the highlights. “Going to sleep in double beds with hairy Irish dairy farmers took me completely out of my comfort zone, but the whole thing was a really great experience,” he says.

Strange bedfellows aside, Tom Robinson says travelling with a group provided an insight into the commonalities across different agricultural industries. And this helped to crystallise his ideas around his research topic – how the collection of digital data can empower fishers and enhance fishery management by improving productivity and sustainability to provide a competitive edge.

“Data is going to be so important to how all agriculture will run in the future,” he says. “It was fantastic to learn from people who came from a completely different background, but had the same desire to think differently about their business.”

Tom Robinson already had a vested interest in digital data, having developed the Deckhand app, used by South Australian Pipi and Southern Rock Lobster fishers. It is also about to be rolled out across every fishing sector in New Zealand as part of the country’s move to the electronic reporting of commercial fishing.

The Nuffield Scholarship, he thought, would provide some insight into improving the offering. However, it has ended up doing much more, helping him develop ideas that could transform the collection of fisheries data around Australia.

Deckhand provides a ‘proof of concept’ that fisheries data can be collected in a consistent format and stored safely, but further than that Tom Robinson now envisages the creation of a national databank of fisheries data.

This would become a central repository of digital data, recorded to a common standard and administered by an industry board comprising commercial and recreational fishers, scientists and legal experts with the interests of fishers at heart. Recreational fishers could also report their catch data into the system, he says, enhancing the scope of the information and ultimately improving fishery management.

Technologically, he says, the solution is simple. Multiple examples of the software required already exist, and a data ‘warehouse’ could be established quickly and inexpensively. The difficult part, he says, is getting people across Australia’s multiple jurisdictions and fisheries, who currently collect and store data in different ways, to commit to a common standard and system.

Knowledge is power

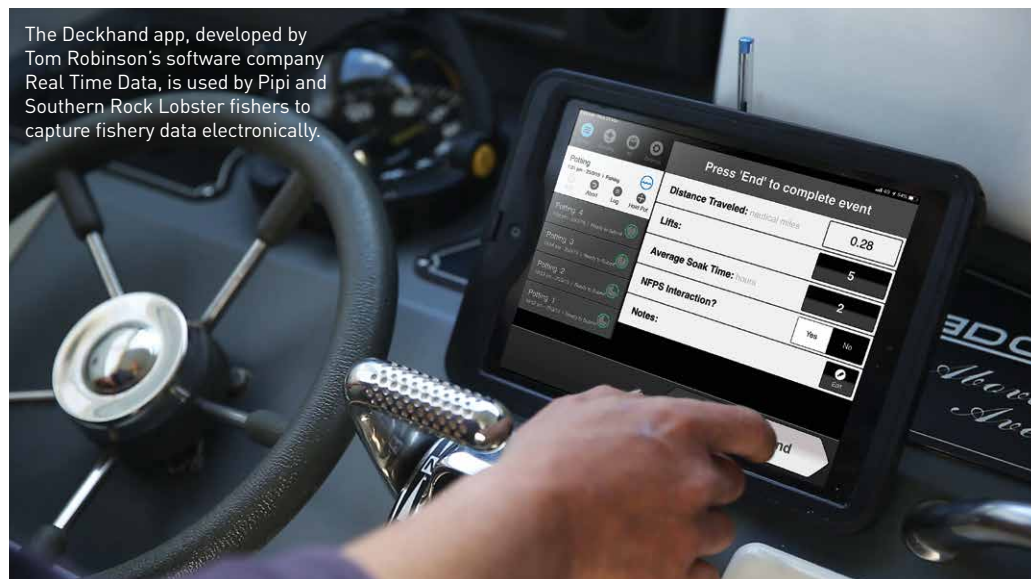
A bank of recreational and commercial data is a powerful tool for the fisheries sector moving forward and not just for improved, nationally consistent fishery management, Tom Robinson says.

Knowledge is power, and with more information about their resource, fishers themselves will be able to take greater control of their businesses and destinies in the broader community and international marketplace.

For example, he says, reliable data is important when it comes to countering scare campaigns and maintaining a social licence to operate. “Industry needs to do a much better job about telling its side of the story, and it can’t do that without the facts illustrated by data,” he says.

Nationally consistent, secure, fine-scale data is also of significant benefit to Australian producers in proving provenance in a crowded international market, Tom Robinson says. “As a producer, I need to tell a story about my Papis – that they come from clean, cold water and are

The Deckhand app, developed by Tom Robinson’s software company Real Time Data, is used by Pipi and Southern Rock Lobster fishers to capture fishery data electronically.



Right South Australian
Pipi fisher and Nuffield
Scholar Tom Robinson.

approved by the Marine Stewardship Council – because I compete against clams grown in Asia [and sold wholesale] for less than \$2 a kilo. So unless I can validate my story I’m in a commodity market, not a premium food market,” he says.

And Tom Robinson is not alone in this belief. The Nuffield Scholarship, he says, showed him there was a common agreement across agricultural industries about the need for improved, consistent, trusted data to maximise productivity and build social licence and market advantage.

But it also revealed common hurdles among producers to achieving such a goal. Whether they be dairy farmers using robots to milk cows or broadacre grain growers riding computerised tractors, they were all wary of where their data would be stored and how it could be accessed and used, particularly if it was for purposes for which it was not originally provided.

“Farmers feel like this technology means there are people looking over their shoulder and collecting data about their enterprises that they may not necessarily want to share,” he says.

For fishers, whose catch data is their commercial intellectual property and who “are obviously very sensitive about where that data goes and who uses it and for what purposes”, it’s a concern keenly felt, he says. But Deckhand and his Nuffield experience have shown there are ways to address these concerns both through technological and legal means.

Vision for the future

With the data system Tom Robinson has in mind, fishers could record and upload all the information they need to monitor and improve their own businesses and then, with their permission, provide data more broadly for the collective benefit of the industry.

“Fishers need to meet their regulatory requirements but there’s a lot of data that fishers collect that isn’t regulatory. It’s not what the regulator requires but it is helpful to other aspects of their business – around social licence, the environment, sustainability and provenance – and all these things are important to building successful fisheries and maximising the returns from these fisheries,” he says.

Regulatory data would be recorded and provided to authorities as required, but fine-scale data – fishers’ own intellectual property – could also be stored safely to be used as they wish.

“So we need to encourage fishers to recognise how valuable this fine-scale data is ... and a key



learning for me is we need to stop thinking about data being just a regulatory requirement, [but] as being something critical to the future of the way fisheries are managed moving forward.”

A national approach is required to bring such a concept to life, and Tom Robinson has been consulting with the peak body Seafood Industry Australia as well as attending recent FRDC-funded data workshops to begin to find a solution.

Fishers store and collect data individually in different ways, which makes it difficult to use it to assist discussions about the health of the resource or social licence issues, or provenance.

“Having silos of data is really working against the industry being able to manage itself into the future,” he says. “It needs industry and stakeholders to work in a collaborative way, where the majority sign off and say ‘yes, this is the pathway we want to go down’,” he says. “It’s

sort of a ‘build it and they will come’ approach.”

The window for such a national digital approach is open now, he says, because many people are still reporting via paper, and reporting systems and protocols around data collection are inconsistent across jurisdictions and fisheries.

Tom Robinson will present his findings in a paper at the 2019 Nuffield Australia conference in Brisbane in September. He says he would like his work to have an enduring, positive impact. “If we can get industry to see the value of collecting its own data and storing it, that would be a good legacy to leave behind,” he says.

Tom Robinson’s Nuffield Scholarship was sponsored by the FRDC. **F**

Applications for the 2020 Nuffield Scholarship program close on 14 June 2019.

Visit www.nuffield.com.au for more information.



Scat DNA reveals what a bird eats

Story Annabel Boyer

A research project has used genetic analysis techniques to investigate the diet of Australia's shy albatross populations, potentially helping fishers to prevent interactions with this at-risk species



Rachael Alderman
 Researcher

"We can learn from what they are eating, whether the nutritional requirements of the food selected and overall energy expenditure varies between breeding stages, and the extent that humans are in competition with albatross for fish."

Albatross are the endurance athletes of the bird world. They may be found fishing along windswept coastlines, cruising the remotest of seas or rearing their young on inhospitable rocky outcrops battered by the elements.

For birds with such tenacious lifestyles, it seems incongruous that many of the world's albatross species are also identified as at risk. Australia's own shy albatross is listed as 'vulnerable' under Australia's *Environment Protection and Conservation Act 1999* and as 'near threatened' by the International Union for Conservation of Nature.

This endemic species breeds only on three tiny islands off the coast of Tasmania – Albatross Island in the north-west, and Pedra Branca and Mewstone off the state's southern coast – with a total of just 15,350 breeding pairs. Over the last century or so, these populations have faced multiple challenges from humans, such as exploitation for eggs and feathers.

Fishers in Australia's southern waters have introduced bird deterrent devices on vessels, reducing dangerous interactions with trawl gear by 96 per cent in recent years. Despite this, interactions with seabirds, and particularly with shy albatross, are a continuing problem.

A recently completed FRDC project has used DNA collected from shy albatross scat to identify what the birds eat, which in turn is helping to identify the most likely locations for potential interactions with the birds, and possible competition with fishers for food.

In Tasmania, the state's Marine Conservation Program includes a shy albatross research program, which has been running since the 1980s, through the Department of Primary Industries Parks Water and Environment (DPIPWE).

Left Rachael Alderman retrieving a satellite tracker from an albatross. Photo: Mathew Newton

Below Researcher Julie McInnes collecting scat. Photo: DPIPWE

Albatross Island

Four times a year, a team of researchers visits Albatross Island, in Bass Strait, to collect data from nesting birds, chicks and the young juveniles who have not yet fledged. They measure eggs, check identification bands and record a variety of indicators to create a snapshot of the health of the population. The data is also compared to long-term trends.

However, as the shy albatross spends much of its life on the wing, foraging at sea, there is only so much that can be learned by studying breeding populations.

It is a large bird with energy-intensive needs that consumes large amounts of fish and other marine organisms. Time spent foraging at sea can bring birds into contact with fishing vessels, as they are attracted to the presence of fish and discarded offal from vessels. This puts them in danger of striking or becoming entangled in fishing gear.

To find out what is happening to the birds at sea, researchers tag individual birds and track their movements using satellite technology.

The recent FRDC project has added to the researchers' arsenal, validating a DNA-based technique that has shed light on what the birds eat when they are away from their islands, and the potential source of this food.

Rachael Alderman is the team leader of the DPIPWE Marine Conservation Program and has spent 15 years monitoring the shy albatross population that nests on Albatross Island.

"This project aims to better understand the risk of engagement with fisheries, the nature of these engagements, and to what extent external factors might be changing the albatross' diets," she says.

It is 20 years since research last focused on the diet of shy albatross. Historically, researchers had no other option but to induce the birds to vomit up the contents of their stomachs to investigate what they had eaten. This method was problematic ethically, and data tended to be biased because some food, such as squid beaks, takes longer to digest and shows up more frequently in the data than softer bodied organisms, which are digested far more rapidly.

Dietary detective tools

Julie McInnes, a researcher who works with the DPIPWE Marine Conservation Program, says that DNA analysis of scats has been in use in ecological research programs around the world for more than a decade. But it is only recently that improvements have made the technique both affordable and available on a scale large enough to generate suitable datasets for the albatross research.

She says using this process on shy albatross for the first time has involved a lot of groundwork to establish the right parameters to ensure success.

"We had to work out when is the best time to collect the scats, and how fresh they should be so that the DNA we are interested in is extractable or visible to us when we analyse it. Then we can focus on the diet DNA but not the other stuff that might exist in the scat," she says.

The scats are collected opportunistically across the entire colony 'as they happen', while researchers are checking nests for eggs or recording a bird's identification bands and age, and analysed at a population level. Working in collaboration with the Australian Antarctic Division, researchers extract the DNA from the scat in the lab before analysing it to see what species the birds have eaten and what the proportion of each species is in the diet.

The challenge is to detect only DNA in the scat that has come from a bird's recent meals. This means separating out the diet DNA from the bird's own DNA, that of any internal parasites, or anything from the soil on which the scat was deposited.



DNA database

As part of the project, the research team has compiled a large database of DNA from different fish species in southern Australia that might form part of the albatross diet. Correct identification of a strand of DNA requires a database of DNA against which to match the DNA found in the scat samples.

The database was compiled from three sources: the open access GenBank (an annotated collection of gene sequences freely available), CSIRO's Australian National Fish Collection, and samples provided by trawl fishers and fisheries observers working with the South East Trawl Fishing Industry Association (SETFIA). New DNA sequences generated during this project have been uploaded to the GenBank database, making them available to researchers around the world.

In order to identify the strand of DNA, scat samples are analysed using different markers. "There are different gene regions that can be used depending on what the DNA you have is like," Julie McInnes says. "For example there is a gene region that is regularly used for fish identification using flesh samples, but because of the degraded nature of the DNA found in albatross scats we often need to design shorter markers to detect the DNA found in the scats."

The process starts by using a general identifier or marker that will broadly distinguish all food groups. For instance, analysis might start with using a 'universal marker' for the presence of fish, squid and crustaceans. A second marker is then used to identify all the fish DNA found in the scat, which can be matched to the database to identify individual fish species.

The project analysed 1655 scat samples collected between March 2013 and March 2018. The analysis identified the DNA of 84 different fish species and 11 cephalopods, as well as salps and krill. The main fish species detected were



Left A large chick almost ready to fledge in April, begging for food from its parent. Photo: DPIPWE

Redbait, Jack Mackerel, Barracouta and Blue Mackerel; the main cephalopods found included Giant Cuttlefish and Gould's Squid.

Once researchers had analysed the birds' droppings, they compared what they discovered about the diet of shy albatross with other data, such as the annual occurrence of different fish species in different geographical locations, and satellite tracking data showing the movements of the albatross during the last 20 years.

For the project team, the analysis provides a wealth of insight into the albatross diet at different stages of their breeding cycles.

"We found there is not much difference in the diet between years, but what we find between the different periods of the year varies," Julie McInnes says.

"I've been quite impressed with the high prevalence of Giant Cuttlefish found in the diet during the period when the shy albatross are incubating their eggs. It raises the question of whether that behaviour is opportunistic – because that is when the Giant Cuttlefish are available – or whether there is some other reason such as nutritional requirements of the birds at that time."

Rachael Alderman says the findings will allow researchers to see if the diet is changing over time and why that might be. "We can learn from what they are eating, whether the nutritional requirements of the food selected and overall energy expenditure varies between breeding stages, and the extent that humans are in competition with albatross for fish."

Fishing vessel overlap

The new information about what albatross were eating, when and from where, was overlaid with Commonwealth fishery data using times, locations and species caught by vessels to give an indication of when bird and vessel activity overlaps both spatially and through the species targeted.

The project found that the majority of the shy albatross food is being sourced naturally by the birds, rather than from fishing vessels. The researchers drew this conclusion in instances where the fish or cephalopod identified was both naturally accessible to shy albatross and not caught by a fishery in the area.

Overall, 83 per cent of shy albatross from Albatross Island consumed natural prey. However, the analysis found that 13 per cent of birds consumed

"Our members have reduced interactions with seabirds by more than 90 per cent. By identifying the remaining risks we have more chance of taking further action that allows our members to continue to supply Australians with local seafood without doing harm to shy albatross populations."

Simon Boag

species that were likely to have been sourced from fishery discards. This level of engagement varied between years and between breeding stages, ranging from three to 29 per cent of birds sampled, but researchers are not yet sure what is driving these variations.

Blue Grenadier, ling and warehou are the three species shy albatross are most likely to have sourced from fishing vessels. Of the 84 fish species identified in the albatross' diet, only eight species have been identified as being targeted by both shy albatross and fishing vessels in south-east Australia. However, these eight species made up more than half of the diet, predominantly Gould's Squid, Redbait and Jack Mackerel.

The project found that shy albatross overlap spatially, to some extent, with six different Commonwealth fisheries, but overlaps occur regularly with only three. These are the Southern Squid Jig Fishery, during March when chicks are being reared; the scallop fishery, at all stages except chick rearing; and the Southern and Eastern Scalefish and Shark Fishery (SESSF) throughout the year.

Gear types used by the SESSF in areas where birds and vessels overlapped were most commonly bottom otter trawl gear and Danish seine. These overlaps do not necessarily correspond to an interaction between birds and fishing gear, just an increased potential for interaction.

The project has worked with SETFIA, seeking out fishers and fishery observers to compare this data with observations at sea. Simon Boag, SETFIA's executive officer, says the project has been a great example of cooperation between industry and researchers working towards the conservation of a species.

"Our members have reduced interactions with seabirds by more than 90 per cent. By identifying the remaining risks we have more chance of taking further action that allows our members to continue to supply Australians with local seafood without doing harm to shy albatross populations," he says.

Rachael Alderman says that one of the key aims of the project is to make this information available for the fishing industry and other researchers, to provide a baseline on what the albatross eat and any associated risks they may face from different food sources.

Future research will focus on understanding more about the impact of climate variability on foraging and breeding success, as well as the changes happening on Albatross Island – such as the effect of warmer temperatures. This project was part of a series of projects coordinated by DPIPWE, addressing how best to advise decision makers on conservation and management issues, directly related to the *National recovery plan for threatened albatrosses and giant petrels 2011-2016*. **F**



Largest foreign seafood market in trade talks

Negotiations for a free trade agreement with the European Union are underway, with important implications for the Australian seafood industry

By Gio Braidotti

High tariffs and the costs associated with accessing markets are the key issues raised by the seafood industry as Australia negotiates a free trade agreement (FTA) with the 28 countries of the European Union (EU).

Negotiations for the FTA began on 18 June 2018 and represent a once-in-a-generation opportunity to change trade settings with the world's largest seafood market.

According to the Food and Agriculture Organization (FAO), the EU collectively imported US\$53 billion worth of seafood in 2016, representing about 39 per cent of global seafood trade.

In preparation for the negotiations, the Australian Government invited formal submissions from industry sectors and interested parties. The FRDC has taken the lead in coordinating a submission on behalf of the seafood sector, which is being prepared by Jim Fitzgerald in consultation with those in the seafood industry interested in trade with the EU.

Jim Fitzgerald has 20 years of experience in the trade and market access with the Department of Agriculture and Water Resources and as a freelance consultant. He has represented seafood and agricultural interests in previous trade agreements, including with China, Japan and the US.

"Although the EU is a massive market, Australian seafood exports to the EU have declined over the past decade due to a range of factors, which we now want to address through the FTA negotiations," Jim Fitzgerald says.

In 2017–18, for instance, just \$28 million

worth of Australian seafood was exported to 15 countries in the EU, representing less than one per cent of total Australian seafood exports.

EU seafood tariffs are among the highest in the developed world at 12 to 26 per cent, and were identified as a key barrier during consultations with Australian seafood stakeholders. In fact, the EU in the past has been a notable exception to a worldwide trend to reduce tariffs. That, however, is now changing.

"The EU is pursuing a number of bilateral FTAs with major seafood trading countries, including Canada, New Zealand, Japan, Vietnam, Singapore, Mexico and the Mercosur grouping of countries in South America," Jim Fitzgerald says. As a guide, Canada recently concluded its trade negotiations with the EU and many seafood tariffs were reduced to zero.

"A similar result from the Australia–EU FTA would significantly lower seafood export costs, diversify export market options, reduce the risk associated with dependence on key Asian markets, and potentially put upward pressure on prices through increased competition," Jim Fitzgerald says.

The other major trade barrier is a complex set of trade rules and regulations relating to seafood imports. These are generally designed to protect consumers and the environment, but add considerably to the cost of accessing the EU market.

In addition to stakeholder consultations, market analysis and strategy development, the key objective is to develop a formal Australian

seafood industry paper for submission to the Department of Foreign Affairs and Trade (DFAT).

Jim Fitzgerald says this paper sets out industry aspirations and what would constitute a good outcome for industry. That paper was being finalised at the time he spoke to *FISH* magazine.

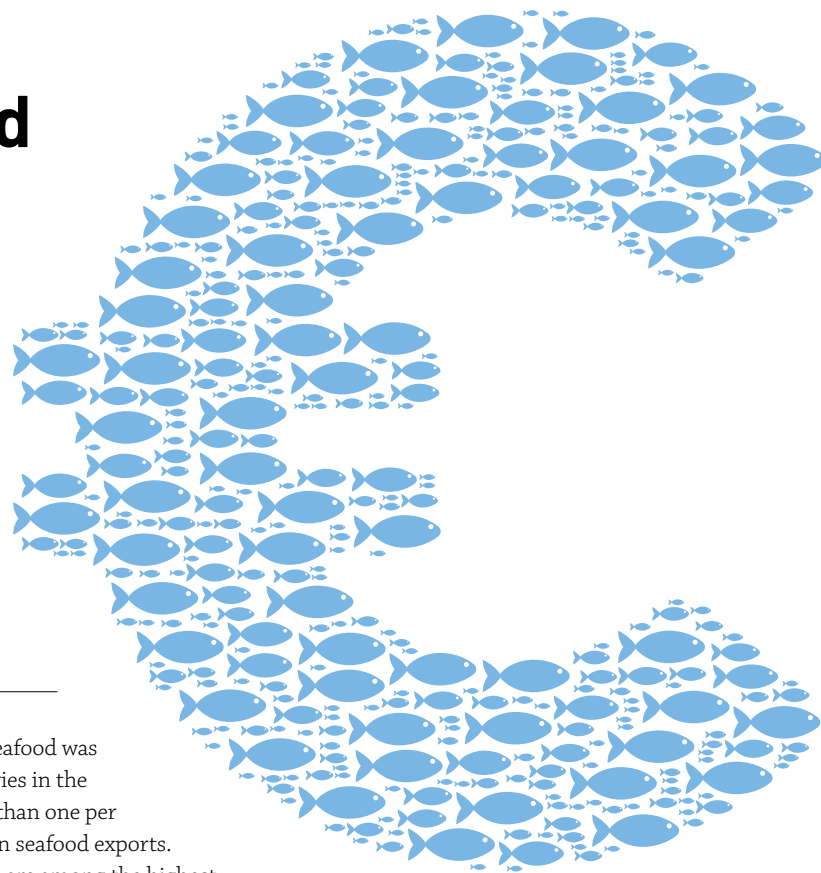
"The immediate goal is to achieve a significant reduction in tariffs and to open discussion on non-tariff measures, since these two issues are typically handled in separate phases of trade negotiations," Jim Fitzgerald says.

He adds that, traditionally, FTAs are successful in dealing with tariffs. Non-tariff measures are more difficult to negotiate, but having an FTA opens up a dialogue between countries that can help in the long run.

Four rounds of negotiations have been scheduled to date, with the third having occurred in Canberra in the last week of March 2019. The following meeting is scheduled for July.

For Australian seafood exporters, the impacts are potentially expansive. Currently, five markets account for 88 per cent of total Australian seafood exports. They are China, Vietnam, Japan, Hong Kong and the US.

China alone represents 42 per cent of the value of Australian seafood exports. The Australia–EU FTA represents an important opportunity to diversify, reduce risks and grow. **F**





Lessons from across the seas

Cultural pride, leadership and collaboration were highlights of an Australian delegation's trip to learn more about Māori involvement in New Zealand fisheries

By Annabel Boyer

Learning how to harness both economic benefits and cultural wellbeing for Indigenous Australians through involvement in seafood provided the drive for a recent trip to New Zealand by members of the FRDC's Indigenous Reference Group (IRG) and the Indigenous Land and Sea Corporation (ILSC).

The Australians were guests at the 2019 Māori Fisheries Conference, where they presented and were later honoured to be the first ever non-members to attend the annual general meeting – a collective of Māori fishing groups.

The purpose of the trip was to develop stronger relationships between New Zealand and Australian First Nations peoples, in order to share knowledge and experience related to operating in fisheries and aquaculture. The Australian delegation returned home buoyed by the experience and confident about the promise for Indigenous Australians in Australia's seafood industry.

"It was empowering to see how strong a voice the Māori people have in the New Zealand fishing industry, being involved at all levels, from fishers and workers right up to CEOs and board members or chairs," says Ashley Perez from Northern Territories Fisheries.



Other delegates included IRG members Bryan Denny, Chels Marshall, Frank Parriman, Matt Osborne, Michael Gilby, Shane Holland and Traceylee Forester, as well as executive officer for the IRG Chris Calogeras, and the FRDC's senior portfolio manager, Josh Fielding. The FRDC also provided bursaries for Delahay Miller from the Department of Primary Industries and Regions South Australia (PIRSA), and Lizzy Murrah Keys and Ashley Perez to attend.

Chris Calogeras says the trip provided insight into the strategies and policies that have either hindered or assisted the economic and cultural development of First Nations peoples in New Zealand, and how these learnings can assist in Australia.

United community

Now in its eighth consecutive year, the Māori Fisheries Conference was this year held in

Auckland in March, with more than 300 people attending. The theme of the 2019 conference was 'Te hā o Tangaroa kia ora ai tāua' – 'the breath of Tangaroa sustains us'. Tangaroa means 'God of the Sea', and the theme spoke to the interconnectedness of humanity with the environment, underpinning the purpose of the Māori Fisheries Trust, Te Ohu Kaimoana, and the work it undertakes to protect Māori fishing rights.

The conference explored topics surrounding humanity's relationship with Tangaroa – from eco-colonialism and Indigenous resilience, to Māori food gathering and traditional practices – and examined how businesses can preserve culture in commercial practices.

Though unable to understand the language,



Members of the IRG present a gift from the Australian group to fisheries peak body Te Ohu Kaimoana, at the Māori Fisheries Conference in New Zealand. Left to right: Matt Osborne, Jamie Tuuta (Chair; Te Ohu Kaimoana), Chels Marshall, Shane Holland.
Photo: TWA



the Australians were impressed by the power of a presentation by Danny Poihipi, speaking in Māori, on Māori food gathering and traditional practices. Educated in the art of gathering food since he was a child, Danny Poihipi is skilled in the arts of net making and seafood processing. He works presenting this knowledge to children in local schools.

The theme of a presentation by Chellie Spiller, of Wayfinding Leadership, was approaching leadership in a culturally grounded way, with an example of leadership development undertaken through a journey on a traditional *waka* (sailing canoe).

Delahay Miller says he has come back from the trip inspired. "I'm an Aboriginal man, and going to the conference – the most powerful people in the room were First Nations people. It was great to see," he says. "It empowered me to want to develop as a leader."

Members of the IRG delivered a presentation on Indigenous fisheries in Australia, with Matt Osborne presenting on the IRG's Indigenous fisheries research advisory role for the FRDC. Shane Holland gave an overview of native title and access to aquatic resources for Indigenous Australians and Chels Marshall spoke about some of the key research projects that have been funded, such as the identification of values placed on fishing by Indigenous Australians. Their combined presentations 'What's happening in Australian fisheries' can be viewed at www.youtube.com/watch?time_continue=455&v=ID9YbxYdRCA.

Two worlds combined

Conference presentations also demonstrated the increasing level of concern about the impact of climate change on aquatic resources in New Zealand, and for the Māori community. In a presentation regarding eco-colonialism and Indigenous resilience, Tina Ngata advocated for the protection of Indigenous rights, but also spoke about science working towards effective environmental stewardship along with traditional peoples.

"This really resonated with me and with my work at the Australian Institute of Marine

"It was empowering to see how strong a voice the Māori people have in the New Zealand fishing industry, being involved at all levels, from fishers and workers right up to CEOs and board members or chairs."

Ashley Perez

Sciences (AIMS)," Traceylee Forester says. "I work with AIMS scientists and Traditional Owners of sea country to build partnerships that connect Western science and traditional knowledge. So both Tina and I are working to bridge the divide."

Another presentation of note was from Rachel Taulelei, named the 2018 Māori Business Leader, who is CEO of family-owned Māori food and beverage producer Kono.

Traceylee Forester says Rachel Taulelei talked about combining Māori lore and law, trying to make a commercial enterprise work with traditional lore as a fundamental basis for the business. "It was about preserving Māori culture in a modern society and thinking that this isn't a choice but a must. Again this really affected me, as my own people are thinking along this line."

Traceylee Forester hopes that this will be the first of many opportunities for the First Nations peoples of Australia and New Zealand to learn from one another.

"In terms of moving forward into the future, both the Māori peoples, the Aboriginal peoples and the Torres Strait Islanders have a lot of experience and knowledge that can be shared between the three groups – there should be more opportunities for us to 'talk' with one another," she says.

Working together

Following the conference, the Australian delegation attended the annual general meeting of Te Ohu Kaimoana. This organisation, which hosted the Māori Fisheries Conference, operates as a Māori fisheries peak body to the New Zealand Government, negotiating policy to advance Māori interests in the marine environment, including fishing rights. It was the first time non-*iwi* (Māori clan) representatives have ever been allowed to attend this meeting, and the FRDC's Josh Fielding says the experience was incredibly valuable for the group.

"It gave great insights into the organisation and management of fishing rights that the Māori have in order to realise the benefits."

The following day, on a processing tour of the Port Nicholson Fisheries lobster plant in Auckland, the group also had the opportunity to spend time with Maru Samuals, general manager of the Iwi Collective Partnership, an entity that organises and manages commercial fishing quota on behalf of 14 *iwi*.

Maru Samuals emphasised how the partnership approach – working together as a collective – has been the hardest component of the journey for Māori people in gaining and accessing their fishing rights. While they are making gains, he said this component remains the hardest part on an ongoing basis.

Shane Holland, Traditional Fisheries Manager at PIRSA and an IRG member, says that the trip has really impressed upon him the need for unity. "I can see a future where Australia will get to where New Zealand is, but we have a way to go," he says.

"The conference really emphasised the strength of working together and that, although it can be slow, it is far more substantive than moving forward in isolation," he says. **F**



New guides to future fisheries

New science and technologies help managers build on the fundamentals of sustainable fisheries

By Catherine Norwood

Conversations around the sustainability of Australian fisheries have come a long way since the status of individual species was singled out as the primary indicator of performance.

From a single species, to multi-species fisheries, bycatch, habitats and now even the performance of fisheries managers themselves – all of these have come under scrutiny as fisheries management continues to evolve.

New guidelines released in November 2018 are part of this increasingly integrated approach, adding to the rigour of Australia's Commonwealth fisheries management processes. They provide an evidence-driven approach that could also provide value in other fisheries jurisdictions around Australia. They are:

- *Guidelines for the implementation of the Commonwealth Fisheries Harvest Strategy Policy*; and
- *Guidelines for the implementation of the Commonwealth Fisheries Bycatch Policy*.

The first of these, the revised Harvest Strategy Policy guidelines, was co-funded by the Department of Agriculture and Water Resources and the FRDC, and is a companion to the updated *Commonwealth Fisheries Harvest Strategy Policy*. The originals of both of these harvest strategy documents were released in 2007.

In launching the updated editions late last year, Assistant Minister for Agriculture and Water Resources Senator Richard Colbeck said they provided the foundation for the management of Commonwealth fisheries, carried out through the Australian Fisheries Management Authority (AFMA). This included a framework for an evidence-based approach to setting sustainable harvest levels.

"The policy now gives even greater guidance on

managing for variability in our ocean environment, and more explicit consideration of recreational and Indigenous fishers," Senator Richard Colbeck said.

"It also ensures consistency of management across fisheries to provide the industry with a more certain operating environment."

Harvest strategies

In the Commonwealth, harvest strategies are a set of pre-agreed rules designed to achieve defined biological and economic objectives for commercial fish stocks in a given fishery.

The key biological objective in the policy is to maintain with high confidence all fish stocks above a biomass limit where the risk to the stock is regarded as unacceptable (the biomass limit reference point).

When the original Commonwealth Harvest Strategy Policy was introduced more than a decade ago, a primary objective was to maximise economic returns from each fishery. It formally introduced maximum economic yield (MEY) as the target for Commonwealth fisheries management.

"In the guidelines we also suggest approaches that are suitable for smaller, lower value fisheries, and other kinds, that seek to balance the costs of implementing a harvest strategy while at the same time delivering on the policy requirements for sustainability and profitability."

James Larcombe

"MEY is usually a more biologically conservative approach than maximum sustainable yield (MSY), and it focuses on the economic performance of the fishery rather than the maximum yield that may be achieved for a stock," says James Larcombe, senior fisheries scientist with the Australian Bureau of Agricultural and Resource Economics and Sciences, who has led the redrafting of the harvest strategy guidelines. "In general, MEY focuses on maximising the value from fishing rather than maximising the quantity of catch. This often means that more fish are left in the water, increasing a fisher's catch rates, which in turn increases profitability."

Since the introduction of the first *Commonwealth Fisheries Harvest Strategy Policy* in 2007, overfished or depleted stocks have been rebuilding. No fish stock solely managed by the Commonwealth has been classified as subject to overfishing since 2012. The value of Commonwealth fisheries has seen improvements over the same period (Table 1).

James Larcombe says these results, and the generally positive feedback from stakeholders, pointed to the success of the original Harvest Strategy Policy and guidelines. But following an extensive review, the second edition of the Harvest Strategy Policy and guidelines have been updated to incorporate more than a decade of new fisheries science and experience in implementing harvest strategies along with feedback from stakeholders.

Some key changes include the application of the policy to byproduct species, more direction on meeting environmental and economic objectives in multi-species fisheries, additional clarity around internationally managed fisheries, and guidance on applying harvest strategies under changing environmental and climatic conditions.

"In this edition of the guidelines we have also really focused on how to design harvest strategies that target maximum economic returns across the wide range of fisheries that AFMA manages," James Larcombe says. "For example, in the valuable Northern Prawn Fishery, harvest levels are determined from a complex bioeconomic model designed to maximise future profits across four different species."

"In the guidelines we also suggest approaches that are suitable for smaller, lower value fisheries, and other kinds, that seek to balance the costs of implementing a harvest strategy while at the same time delivering on the policy requirements for sustainability and profitability."

Proactive management

Australian management agencies have been on the front foot for many years when it comes to managing for, and demonstrating, the sustainability of fisheries, says Alistair Hobday, research director of marine resources and industries at CSIRO Oceans and Atmosphere. “Many countries have a harvest strategy; we’re one of the few that has a bycatch policy as well.”

Alistair Hobday and his team have developed the new *Guidelines for the implementation of the Commonwealth Fisheries Bycatch Policy*, which supports the recently revised *Commonwealth Fisheries Bycatch Policy*, both released last year. The original Commonwealth bycatch policy dates back to 2000.

Key revisions in the policy include improved guidance on species classification and policy coverage for all species, and the inclusion of a risk-based approach to monitoring, assessing and managing bycatch. There is consideration of cumulative impacts on bycatch species, and a performance monitoring and reporting framework is also provided.

The development of the new bycatch guidelines was funded by the Department of Agriculture and Water Resources.

Alistair Hobday says the revised policy and new guidelines consolidate and extend existing practices to minimise the impact of fishing on bycatch. The aim is to reduce bycatch to the lowest levels possible through a process of continual improvement. “We don’t set any acceptable level of bycatch. If it has no commercial value our aim is to reduce it to zero.”

However, ‘value’ is a nuanced issue when it comes to bycatch, he says, as some species that could be consumed are often returned to the water because of their low market value. “It’s not just about the fishers; it’s also about the consumers. If Australian seafood consumers eat more broadly they can help us reduce bycatch by eating the things that are caught in association with other species.”

The bycatch guidelines in particular provide impetus to improve data collection to help fishers demonstrate that they are meeting the obligations. This was identified as a gap in existing practices, and has reinforced the need for cost-effective and smart data collection through technologies such as electronic monitoring and digital logbooks, which can provide fast, easy and accurate reporting, in near real time. **F**

Table 1: Commonwealth fisheries production 2006–07 to 2016–17

Year	Volume (t)	Value \$	\$/t
2006–07	56,855	294,191	5174
2007–08	56,277	288,933	5134
2008–09	51,467	314,692	6114
2009–10	46,630	305,994	6562
2010–11	46,840	320,811	6849
2011–12	43,186	308,244	7137
2012–13	39,118	317,814	8124
2013–14	42,907	340,453	7934
2014–15	41,868	350,276	8366
2015–16	56,773	438,829	7729
2016–17	48,592	403,350	8300

Source: *Australian fisheries and aquaculture statistics 2017*, Australian Bureau of Agricultural and Resource Economics and Sciences

“Many countries have a harvest strategy; we’re one of the few that has a bycatch policy as well.”

Alistair Hobday

National best practice guidelines for Australian fisheries management agencies

Alistair Hobday has also been involved in the development of the *Best practice guidelines for Australian fisheries management agencies*. Unlike the other documents, which have been developed to help AFMA deliver against specific policy requirements, these guidelines have much broader application.

They provide a voluntary framework to evaluate the core functions that a management agency is likely to undertake. There are 21 core functions, across the following five categories:

- development of policy and legislation – setting the stage for good management;
- operational management – day-to-day functions for management agencies;
- review and performance evaluation – checking agency performance;
- communication and reporting – outward-facing agency communication; and
- cross cutting – issues that are explicit or implicit in many management functions.

“In order to have a sustainable fish species and sustainable fisheries, management agencies need good practice, although that, by itself, is not enough for healthy fish stocks,” Alistair Hobday says. “But if all of these functions are done well, then an agency will be well positioned to deliver on the goal of sustainable fisheries.”

To test the guidelines, a series of 10 case studies was developed. These case studies involved the Tasmanian and Western Australian abalone fisheries, the Lakes and Coorong and emerging Periwinkle (turbo) fishery in South

Australia, the Northern Territory’s offshore snapper and mud crab fisheries, rock lobster in Victoria, Spanner Crab in NSW, the Coral Reef Fin Fish Fishery in Queensland and the Commonwealth Northern Prawn Fishery.

Alistair Hobday says it was a satisfying outcome to see that the guidelines could be applied equally across large and small, new and established fisheries.

He sees best practice as a process of continual improvement – one that could eventually lead to the creation of a fisheries management standard. “In the same way that we certify seafood as being safe by following certain food handling standards, agencies, in time, may want to demonstrate to the outside world that they are capable of being audited and passing performance standards,” he says.

“Adopting guidelines is a step on the journey. Sometimes actually moving to a standard might provide a benefit in transparency and market access. In other cases, guidelines will continue to be sufficient.” **F**

More information

The Commonwealth Fisheries Harvest Strategy Policy and guidelines are online at www.agriculture.gov.au/fisheries/domestic/harvest_strategy_policy. The Commonwealth Fisheries Bycatch Policy and guidelines are online at www.agriculture.gov.au/fisheries/environment/bycatch/review. The Best practice guidelines for Australian fisheries management agencies is available from the FRDC’s website (www.frdc.com.au).



Photo: Shutterstock



Connecting health professionals with sustainable seafood

Combined information on the health benefits and sustainability of Australian fish stocks will help health professionals confidently recommend that clients eat more Australian seafood

By Catherine Norwood



Nicole Senior
Nutritionist

"We wanted to provide an evidence-based guide to sustainability in Australia and how it is determined, and to introduce healthcare professionals to the SAFS reports."

Want to protect your brain, heart, eyesight and bones? Evidence from a growing body of international research shows that eating fish and other seafood has a powerful role to play in doing just that.

But confusion over which species are sustainable has often stymied Australian healthcare professionals who want to recommend that their clients eat fish.

To address this issue the FRDC has worked with dietitians to create new resources specifically for health professionals that combine information on both health benefits and sustainable Australian species.

The Status of Australian Fish Stocks (SAFS) reports already provide a publicly accessible and rigorously tested scientific benchmark for the sustainability of commercially wild-harvested fish species. The reports are updated every two years, and the latest release, in March 2019, includes 120 species that make up the bulk of available Australian seafood.

Supplementing this is the FRDC's new Health Care Professionals Resource on Sustainable Seafood, prepared by dietitian and nutritionist Nicole Senior, from Professional Nutrition Services in Sydney. In preparing the resources, she worked with fellow dietitian Shawn Somerset from the University of Canberra; and independent consultants Gabrielle O'Kane, who has researched sustainable seafood recommendations in nutrition professionals, and Michele Walton, who specialises in nutrition communications. The resource package has three elements: a review of available evidence about the health benefits of seafood; resource material combining health evidence with general information about seafood and sustainable Australian seafood species; and a collection of recipes.

Gathering health evidence

Nicole Senior says the FRDC has identified healthcare professionals as a key

influencer group to Australians selecting food and an excellent conduit for behaviour change in the broader community. The key audience for the resource material includes dietitians, nutritionists, primary healthcare nurses and public health practitioners. Secondary influencers who will also be included are home economists (such as food educators), food scientists and food technologists. All these groups share a commitment to scientific evidence that is also shared by the FRDC.

The evidence review written by Shawn Somerset has brought together international research findings about seafood and health, to underline the health benefits of seafood consumption. It addresses not just disease-related findings, but also the protective benefits of seafood that consumers can proactively take advantage of, to optimise their health throughout life. Shawn Somerset is no stranger to researching the health benefits of seafood, having worked, along with Mark Wahlqvist, on 'What's so healthy about seafood?' available on the FRDC website. "We looked for evidence showing seafood as protective from chronic disease, but also as a core food for optimal health and development, and we found plenty," Nicole Senior says.

Key findings include:

- Two serves of fish and other seafood a week is recommended as part of many national dietary guidelines, including Australia's.
- Seafood consumption is associated with better child health outcomes.
- Fish may help reduce the risk of obesity and improve cognitive performance in children and adolescents.
- Fish in the diet of children may reduce their risk of asthma.
- Evidence supports fish and other seafood as a cardioprotective food.
- Omega-3 fatty acids in seafood are important for metabolic health.
- Fish consumption is associated with better bone health in older people.
- Fish and other seafood consumption is associated with reduced risk of depression.
- Fish consumption supports eye health.

Sustainability links

The second part of the resource package explains seafood sustainability in more detail, focusing on Australian seafood species, and Nicole Senior says SAFS provides the baseline information for this.

"We wanted to provide an evidence-based guide to sustainability in Australia and how it is determined, and to introduce healthcare professionals to the SAFS reports. This audience does demand quite high levels of good quality information supported by science, which SAFS provides."

The launch of the new SAFS app, available for iOS and Android devices, in addition to the SAFS website, will make the information even more accessible, she says. SAFS provides information on wild-caught species, and identifies the status of different stocks of the same species; a particular fish may be sustainable in one fishery, but have a different status in another fishery. For the 120 species in SAFS, there are 406 different fish stocks assessed.

While SAFS does not assess broader sustainability issues, such as harvesting techniques and broader environmental impacts, it does provide an important starting point for selecting sustainable seafood.

The resource material also links to available information on the omega-3 status of Australian fish, as the long-chain omega-3s fatty acids specific to seafood are identified as important in optimising health.

Nicole Senior says an assessment at the start of the project found that healthcare professionals wanted online rather than printed resources.

They also wanted recipes to help clients, patients and communities to put sustainable seafood recommendations into action 'on the plate'. This has led to the third part of the project, a collection of 24 sustainable seafood recipes.

Recipe resources

The aim was to find everyday, family-friendly meals that dietitians could recommend. These have been sourced from the Australian Healthy Food Guide, a magazine well known to dietitians and a trusted reference.

"We've been able to bring together a collection of 24 very approachable, economical family recipes for familiar dishes. And we modified them to include sustainable Australian seafood species," Nicole Senior says.

The recipe collection is online at www.fishfiles.com.au/Experts/HealthProfessionals, along with the evidence review and the resource material on sustainable seafood.

Newsletters from the professional associations of the targeted audience group will help to promote the new resources. These include the Dietitians Association of Australia, Public Health Association of Australia, the Australian Primary Health Care Nurses Association, the Home Economics Institute of Australia and the Australian Institute of Food Science and Technology.

Nicole Senior says the evidence supporting the health benefits, combined with the SAFS reports, shows that there is a lot of good news to share about Australian seafood and how well Australia is doing by international standards.

"Let's hope we can encourage Australians to eat seafood twice a week, and to include more Australian product. About 70 per cent of the seafood we eat is imported, but our homegrown seafood is great quality and sourced from well-managed, sustainable fisheries. Health and sustainability are what many of us are looking for in our food and Australian seafood delivers that." **F**

OMEGA-3 CONTENT OF AUSTRALIAN SEAFOOD

• SUSTAINABLE WILD-CAUGHT SEAFOOD

★ ★ ★ **EXCELLENT SOURCE** (>400mg/100g)

Swordfish, Blue Mackerel

★ ★ **GOOD SOURCE** (200-400mg/100g)

Spanish Mackerel, Spotted Mackerel, Grey Mackerel, Australian Salmon Southern Bluefin Tuna, Blue-eye Trevalla, Sea Mullet, Baby Octopus Tailor, Australian Herring

★ **MODERATE SOURCE** (<200mg/100g)

Mirror Dory, Endeavour Prawn, Tiger Flathead, John Dory, Blue Threadfin Bigeye Tuna, Blue Grenadier, Coral Trout

AQUACULTURE SEAFOOD

★ ★ ★ **EXCELLENT SOURCE** (>400mg/100g)

Atlantic Salmon

★ ★ **GOOD SOURCE** (200-400mg/100g)

Rainbow Trout, Blue Mussel, Sydney Rock Oyster

★ **MODERATE SOURCE** (<200mg/100g)

Freshwater Barramundi, Murray Cod



Australia's fish 'n' chippers step back up to the plate

When it comes to that iconic Australian experience of sharing fish and chips, the national awards are upping the ante about what customers might expect

By Elisabeth Howie



Freshly cooked appetisers served at the 2018 Fish and Chips Awards.
 Photo: Kyaw Kyaw Soe Hlaing

The FRDC has once again begun its nationwide quest to crown Australia's best fish 'n' chippers. Kicking off in April, the 2019 Fish and Chips Awards were brought forward to align with the Seafood Industry Awards, which run in conjunction with the biennial Seafood Directions conference held this year in Melbourne, where the national winners will be awarded.

"The awards are a great opportunity to support local businesses and educate consumers on the sustainability of Australian fisheries and the seafood industry," says Peter Horvat, the FRDC's general manager of communications, trade and marketing.

"They provide us with a way to contribute to the improvement of fish shop practices, as well as address issues that consumers might have with seafood – in terms of purchasing, preparation and cooking."

The awards launch follows closely on the heels of the release of the FRDC's 2018 Status of Australian Fish Stocks (SAFS) reports. The SAFS reports are an invaluable source of scientifically robust information on the sustainability of the majority of Australia's commercial fish stocks.

Throughout the Fish and Chips Awards the FRDC will be promoting the reports to consumers and businesses participating in the competition.

This year the awards are continuing to run across two categories: Judged and People's Choice. Several changes were implemented based on last year's feedback.

- **National timetable:** voting for the People's Choice category began in all

states and territories on Friday 19 April 2019 and ran until Friday 31 May. This ensured a consistent timetable across the country and provides time to judge the entrants for the State and Territory Awards in the Judged category, from which a national winner will also be picked.

- **People's choice:** following last year's successful trial, vote verification continued to be used as part of the online voting system. Only votes that can be verified will be counted. In addition, the FRDC added a few extra features in the background to make the system more user-friendly and strengthen security.
- **Nomination for judging:** this year the FRDC trialled an online application system for shops to nominate themselves to be judged. The application was based on the criteria used by the judging panel. The application process aimed to allow shops across all regions to be assessed. Only the shops rated with the highest scores will be judged.

Judging criteria

Each of the criteria has been weighted to reinforce the importance of great tasting seafood and good service. But importantly, the criteria also highlight the importance of details such as labelling, information and choice.

- **Taste (40%):** Does the seafood taste good? Cooking method will be key here – using the right approach for the right fish and doing it well to make your seafood 'sing'.

- **Service (30%):** Does the service meet customer expectations? Everything from the welcome to the goodbye is important.
- **Choice (10%):** Does the menu offer customers options? This can be different types of fish or seafood, local or imported, different cooking methods (grilled, fried and so on), and different preparations (battered, crumbed or natural).
- **Information (10%):** Are customers provided with accurate information about the source and qualities of the seafood? The menu must comply with the Australian Fish Names Standard (www.fishnames.com.au) and accurately label the seafood's provenance to a national level, or better.
- **Presentation (10%):** Is the store clean and inviting? Is the food packaged to maintain quality?

Voting ended on 31 May and the national winner of the Judged category will be announced 10 October at the 2019 Seafood Directions conference in Melbourne. State winners of both categories – Judged and People's Choice – will be announced at their events to be held throughout June to August. **F**

LAST YEAR'S NATIONAL JUDGED WINNER
 National Fish and Chips Awards
 Hooked on Middleton Beach, WA

Further information can be found on the awards website www.fishandchipsawards.com.au.



MORE INFORMATION

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FRDC RESEARCH CODE: 2018-161

Tapping into fishers' motivations

Insight into what motivates recreational fishers across the nation is expected to help improve both the experience and fisheries management into the future

By **Tiffany Paczek**



Fishers of all ages are needed for the new national survey.
Photo: Matt Daniel, ABARES

It has been 18 years since the last national survey of recreational fishers was undertaken – so long ago that the phone diary system used to source survey participants in the original 2001 survey is no longer an effective way of collecting information.

But fewer and fewer people have landlines, or have their numbers listed in any kind of phone directory, says Josh Fielding, FRDC's senior portfolio manager, who manages the recreational fishing research program. For this kind of survey, he says, online participation is the new alternative.

The 2019 survey, launched in April, is seeking information about who fishes, why they fish, and their total expenditure on recreational fishing, including how much they spend in regional communities.

The previous survey focused more on how many and what kinds of fish were caught, but this kind of catch and effort data is now regularly collected by the state and territory agencies that manage recreational fisheries.

"Instead, at a national scale, we're hoping to get estimates of how many people are recreationally fishing and some of the demographics around them – gender, ages and so on, and how often they might participate," Josh Fielding says.

"We hope the survey will also provide some understanding of how recreational fishing fits in as an activity for Australians, including in relation to other recreational pursuits. For example, do people specifically go holidaying to recreationally fish, or do they recreationally fish opportunistically while they're on holiday?"

"We've been looking at how to sample across Australian populations and make sure we get lots of [one to five-day per year fishers] as well as the avid anglers."

Andy Moore

To implement the survey, the FRDC is working with the Department of Agriculture and Water Resources, the Australian Bureau of Agriculture and Resource Economics (ABARES) and the University of Canberra.

ABARES researcher Andy Moore is leading the project and says the survey will also collect detailed economic information, such as how much money people spend in the act of going fishing. This could identify whether the activity provides a flow of money into regional Australia, information that could support regional tourism activities and infrastructure developments.

The 2019 study will use online techniques including social media to identify relevant population groups to take part in the survey. Participation will be through a voluntary registration process, and the survey will run over 12 months.

However, online surveys bring with them their own unique set of challenges, Andy Moore says – namely collecting a sample of participants that accurately represents the Australian population. He says when surveys are based on voluntary participation, those who

are most eager to have input are typically 'avid anglers'. "The people who fish one to five days a year often don't feel like they have much to contribute – they don't fish much, they don't spend much, so therefore they believe their data isn't significant. But, of course, they make up the majority [of fishers], so their data really matters.

"We've been looking at how to sample across Australian populations and make sure we get lots of [one to five-day per year fishers] as well as the avid anglers. We need to have a good statistical representative sample of the population, and that can be quite difficult with internet surveys," Andy Moore says.

To overcome the risk of inaccurate data, the survey will ask questions to estimate some of the biases, which might help to screen participants to ensure a representative sample.

"What I've tried to do in this survey is design something that overcomes those problems and is statistically representative and cost effective," Andy Moore says. Using online surveys is also a cheaper process for researchers. Getting the sample method right will allow similar surveys to be rolled out more easily in future.

"If you can do it every few years you can get long-term trends in the data, and that's where the real beauty of this particular data is – what people are doing and how they're changing." **F**

To participate in the survey visit www.nationalrecsurvey.com.au. The main survey will remain open for 12 months. Participants can also opt to take part in a voluntary 12-month fishing diary survey, via the website.

Sustainability lesson from our ancient past

Insight gained from Indigenous customs has changed Bryan Denny's approach to commercial fishing and encouraged his efforts to share these perspectives

Story **Catherine Norwood**

Photos **Robyn Denny**

The Tasmanian coastline is dotted with middens – 'kitchen' areas from thousands of years of settlement by Indigenous communities. For commercial fisher Bryan Denny, the middens provide a fascinating glimpse into the past, with shells, bones and other remnants offering information about the fishing practices and the diets of local people – his people.

Walking the beaches where the middens are sometimes hundreds of metres long, he has infused his observations into his own commercial fishing practice as it has developed over more than three decades. Bryan Denny has been diving for Periwinkles ever since he first walked out of school at age 15 with a fishing licence in his hand.

He is officially recognised as a Melurkedee man, from south-east Tasmania, although his fisheries experience is based mostly on Western techniques rather than traditional Indigenous practices, and he grew up at Dover, in the south-west of the state. His adoption of a more traditional approach to his fishing has happened gradually, he says, and by learning from his own experiences and mistakes.

He says when he first started fishing for Periwinkles there was no quota and no size limit on the species, and he had no real reference to traditional knowledge either.

Periwinkles are commonly found at the sandy edges of reefs, and in the gutters between rocky outcrops where the seaweed detritus collects. He says it was, and still is, a common practice to strip harvest most animals from a site. But there are areas that he harvested this way as a young man that even 30 years later have not recovered their Periwinkle populations.

New insight

His early years as a fisher also included time as a deckhand on rock lobster boats, which gave him new insight into other harvesting practices and also introduced him to the middens.

"We used to go ashore and walk around, looking at middens on the west coast, some of which extend for 500 metres to a kilometre along beaches.

"Without really realising it, I started to base my fishing practices on the size of the shells that you see in those middens. Subconsciously, you look at it and say, if the ancestors were eating a Periwinkle that big, why am I taking them smaller? It's the same with abalone."

The initial official size limit for Periwinkles in Tasmania was 30 millimetres, and then increased to 45 millimetres. "But I still don't think that's big enough," Bryan Denny says. He targets Periwinkles 55 to 60 millimetres, or 105 to 110 grams, which

he says is the ideal meal size. He estimates the animals are six or seven years old by the time he harvests them, and he sells them direct to select restaurants in Melbourne and Sydney.

Over the past 10 years he has adopted the practice of harvesting only two-thirds of the legal-size animals at each site he visits, and he leaves small satellite populations to build into a larger biomass. He is much more focused on maintaining the ability to fish into the future, rather than maximising yields today ... although he cannot control what other fishers do.

With that in mind he is also active in contributing to discussions about fisheries management and how Indigenous Tasmanians can reconnect with and share their sea country.

In 2009 he undertook the FRDC's National Seafood Industry Leadership Program, and since 2011 he has been a member of its Indigenous Reference Group (IRG). In March this year he joined an IRG study tour to New Zealand to learn more about how Indigenous communities across the Tasman had developed their fishing rights, and how they operate their fisheries.

As an Indigenous commercial fisher, Bryan Denny feels he brings a practical understanding of fisheries rules and regulations and their impact on fishing enterprises to the IRG, as well as links to Indigenous communities. It adds to the perspectives of the IRG, which includes government, policy, research and non-commercial Indigenous representation.

"The IRG's aim is to get the best outcomes in research projects to help Indigenous communities enter different fishing enterprises. I think there are opportunities to build better relationships with government agencies, to get the right help, and to get some fisheries rights handed



Bryan Denny with a catch of Periwinkles.

Melurkedee man and commercial fisher Bryan Denny says taking the time to be involved in advisory committees is a way to ensure diverse perspectives are considered in decision-making processes.



back to Indigenous fishers,” he says. “Australia wasn’t uninhabited when white settlers came; there were people here who used the land and the sea, and who traded their harvest.”

While the Periwinkle fishery is already established in Tasmania, it is still to be developed in other states. Periwinkle is known as ‘warrener’ in one of the Tasmanian Indigenous languages, although Bryan Denny says he’s not sure which one. In South Australia, it’s called ‘turbo’, and he has been working with the Narungga people there to explore the development of a Periwinkle fishery in SA.

“For any new fishery that is developed, if it was historically used as a food source for Indigenous people, there is some potential to help Indigenous people get into those fisheries and help develop those fisheries.”

In Tasmania, wild angasi Native Oysters and Blue Mussels might be possible options. But one of the state’s major hurdles, he says, is that

many people think that there are no Aboriginal people in Tasmania, which is clearly not the case.

As a practical demonstration of both research and creating awareness of local Indigenous sea culture, he points to the FRDC-funded ‘Wave to Plate’ project conducted by Emma Lee, which included an Indigenous seafood dinner as part of the 2018 Dark Mofo festival (‘Seafood dining shares culture’, *FISH*, March 2019, pages 36–37).

“I think that project’s going to do a lot of good in actually getting people involved in the fishery. That is one of the issues – getting the projects we are supporting happening on the ground, not just getting a document at the end of it.”

Bryan Denny was recently re-elected as a director of the Tasmanian Seafood Industry Council and is currently vice-president. He is also a member of the Tasmania Research Advisory Council, which supports the research priorities and decision-making of the FRDC.

The committee meetings do take time

away from his fishing. While his main focus is on the Periwinkles, he also operates in the Commonwealth shark fishery. If the weather is good enough he will be at sea – unless he is in a meeting. But the time he spends on these advisory committees is important to him too.

“I think it’s important to be involved and to have a say. All Indigenous people know they want something to be done, to recognise their rights, to address disadvantage in their communities. And there’s no point in fishers standing around a boat ramp whingeing about the state of the fishery either.

“You have to put your bum on a seat and stick your hand up and start telling people. You do have to be proactive. If you’ve got a passion, then make your voice heard so that other people might be able to pick up that same idea.

“Hearing people say ‘that’s not such a bad idea’, or ‘we never really thought of it like that’ – that’s really important,” he says. **F**

Final reports

Australia's sharks and rays 2013-009

The Australian Shark Report Card presents a systematic assessment of the status of all of Australia's sharks, as well as rays with shark-like bodies (sawfishes, wedgefishes, guitarfishes, giant guitarfish and banjo rays – also referred to as shark-like rays). Importantly, the report card covers all Australian sharks, the majority of which are probably unknown to most Australians. In doing so, the report card provides a scientifically robust account of what is happening to Australia's shark resources, identifying the species and stocks that are currently healthy and likely to be healthy into the future, and those species that are in decline and need further management, intervention and conservation.

More information: Colin Simpfendorfer,
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The Australian industry and the social licence to operate 2016-407

The author visited nine countries as part of this research for an FRDC-supported Nuffield Scholarship, studying commercial fishing operations, aquaculture ventures, general agribusinesses, peak representative bodies, wholesalers, retailers, third-party certifiers and financial institutions, in both developing and developed nations. The aim of the study was to understand the importance of maintaining an industry's social licence to operate (SLO), while considering consumer confidence, modern markets, investor confidence, key motivators, brand development, politically motivated policy settings and general public perception.

The report makes a number of recommendations to ensure the Australian seafood industry maintains SLO, including the identification of the key indicators that affect industry SLO; the recognition that SLO is key to resource access rights; the consideration of SLO in harvest strategies; proactive, positive and consistent messaging based on independent science by industry organisations; and greater connection between producers and consumers.

More information: Steven Davies,
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Guidelines: updated Harvest Strategy Policy 2016-234

These guidelines aim to provide practical assistance in the development of fishery-specific harvest strategies in Commonwealth-managed fisheries that meet the intent of the Harvest Strategy Policy. The guidelines provide important contextual information to assist interpretation of the Harvest Strategy Policy and to support harvest strategy development and implementation. While the guidelines have made every attempt to cover the latest scientific and economic thinking, there will probably be technical and scientific advancement relevant to harvest strategies during the lifetime of these guidelines. Such advancements should be monitored for their utility in pursuing the objectives and requirements for harvest strategies in Commonwealth-managed fisheries. Throughout the document, examples are provided to illustrate key points or provide practical examples of how to address specific challenges associated with harvest strategy implementation.

More information: James Larcombe,
james.larcombe@agriculture.gov.au

Guidelines: bycatch management 2015-200

The 2018 Commonwealth Fisheries Bycatch Policy (Bycatch Policy) establishes the requirement for bycatch management in Commonwealth-managed fisheries. The *Guidelines for the implementation of the Commonwealth Fisheries Bycatch Policy* aims to provide assistance to Australian Government entities (principally the Australian Fisheries Management Authority (AFMA), as well as bodies (industry or otherwise) that AFMA outsources to, including industry-based co-management arrangements in interpreting and implementing the requirements of the Bycatch Policy.

More information: Simon Nicol,
simon.nicol@agriculture.gov.au

Aquatic animal welfare workshop 2017-221

In 2017, during the FRDC Lead, Collaborate, Partner Stakeholder Workshop, delegates identified a need to assess the success of the work undertaken by the Aquatic Animal Welfare Working Group (AAWWG) from 2005-2013, as well as research, development and extension activities to achieve greater adoption by the industry.

In response, the FRDC commissioned a workshop on Aquatic Animal Welfare, inviting delegates of various seafood bodies, industry representatives and members of the previous AAWWG. The workshop identified gaps or areas where increased support is required to achieve appropriate aquatic animal welfare outcomes including investment in communication activities; new stocktake of current industry processes; identifying data gaps; reviewing and updating current codes of practice/guidelines; and focused change management training.

More information: Mark Boulter,
safesustainableseafood@gmail.com

New technologies for fishing surveys 2017-198

Assessing and managing community-shared fisheries resources among various user groups and stakeholders is challenging, particularly where knowledge gaps exist surrounding the relative contribution by the recreational sector. Recreational fishing surveys provide key information used to inform fisheries management. A two-day national workshop was held from 10 to 12 July 2018 at the South Australian Research Development Institute (SARDI) to assess the usefulness of new technologies and techniques for enhancing the cost-effectiveness and reliability of recreational fishing surveys. The results provide a toolbox for building on the 'best practice' approach in survey design, execution and analysis.

More information: Mike Steer,
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Factors influencing reduced catches 2016-146

This project brought a wide range of stakeholders together from across all facets of fisheries to consider and prioritise the potential range of underlying factors causing the declining Southern and Eastern Scalefish and Shark Fishery (SESSF) indicators. Seven issues were explored by relevant experts: legislative or management impediments; fleet capacity and characteristics; fisher behaviour and vessel operation; climate change and oceanographic conditions; costs of production and changing markets; quota ownership and trading; and the assessment process. Findings were presented and discussed at a workshop involving SESSF fishers and other stakeholders, along with guidance on how to begin to address potential causes.

More information: Ian Knuckey,
ian@fishwell.com.au

Improved usage of underutilised species 2017-185

Underutilisation occurs in all wild-catch fisheries across the globe in the form of unwanted, avoided and unavoidable catches as well as fish of low market value. In Australia, an estimated 50,000 tonnes of fish, comprising 100 or more species, is underutilised each year. The objective of this project was to review previously funded FRDC research, and to prepare criteria for use by the FRDC in guiding the establishment of future RD&E projects that aim to create commercial seafood opportunities from currently underutilised wild-caught species. Forty-two projects with a total value of \$6.6 million were reviewed. These included 30 completed projects and 12 current projects. The review found that the FRDC investment over the past 25 years has achieved some useful results. The report suggests that a more important role for the FRDC might be in the investigation of policy options that drive better utilisation of species and the impact of those policies on the industry.

More information: Dr Leonard Stephens,
lstephens@bigpond.com

WCPFC Meeting attendance 2018-150

Through the FRDC Development Award, this project allowed the author to attend the 15th Regular Session of the Western and Central Pacific Fisheries Commission (WCPFC) Meeting in Honolulu, Hawaii, on 9–16 December 2018. The opportunity facilitated a better understanding of WCPFC meetings structures, and why these structures are necessary to create a productive environment for discussion and decision-making. It also provided educational opportunities surrounding the various conservation and management measures currently applied by the WCPFC and how they relate to the Australian Eastern Tuna and Billfish Fishery; as well as professional networking opportunities and the ability to apply learned knowledge and skills.

More information: Haley Abbott,
jandvabbott@bigpond.com

Sustainable Ocean Summit 2017 2017-142

As the principal investigator for the FRDC project 2013-209 'Optimising processes and policy to minimise business and operational impacts of seismic surveys on the fishing industry and oil and gas industry', the author was asked to present on how these sectors interact with each other in Australia, in the Ocean Sustainable Development forum at the World Ocean Council (WOC) Sustainable Ocean Summit (SOS) 29 November–1 December 2017 in Halifax, Canada.

More information: Aaron Irving,
aaron@pearlproducersaustralia.com

Reducing prawn fisheries bycatch 2017-097

This project took advantage of a travel grant for a PhD student at Danish Technical University Aqua to establish a link and exchange ideas between the Australian and Danish teams while exploring ways of refining anterior-trawl modifications to reduce bycatch in prawn fisheries. The research involved two experiments in Lake Wooloweyah (part of the Clarence River prawn trawl fishery). The results confirmed the utility of the design, developed by the Fisheries Conservation Technology Unit of the NSW Department of Primary Industries during the FRDC project 2011-010. But its combination with

the FLEXSELECT concept – a series of lines extending from the otter boards to the trawl in a cross configuration to herd fish outwards – did not perform any better in reducing bycatches. However, the lowering of headline height in the second experiment dramatically reduced the bycatches of small fish without any effects on prawn catches. This result showed that a very simple modification could be used by fishers to adapt their practices at key locations and in times of large fish abundances.

More information: Steven J. Kennelly,
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National bycatch reporting system 2015-208

Bycatch from fishing remains one of the most important issues concerning the world's fisheries. By examining the discard information available for four of Australia's eight fisheries jurisdictions, this project was able to develop a methodology by which all Australia's jurisdictions can compile, summarise and report on discards from their commercial fisheries.

This project has not only provided baseline information and metrics against which subsequent reports can be compared, but also identified the key gaps in our information about discarding in these fisheries, and where future work on discards in Australia should focus in terms of reporting, monitoring and reduction.

More information: Steven J. Kennelly,
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Building biosecurity capability across the wild-harvest fisheries 2017-193

This project addressed a need for information and education among the wild-catch commercial fishing sector regarding biosecurity preparedness. It involved the production of three video clips incorporating harvest and post-harvest commercial fishing operators and an animated video clip, delivering key biosecurity messages in a simple format.

Developing the material for this project has highlighted the need for greater industry preparedness for potential pathogen incursions into the Australian marine environment. The development of the videos complements material already developed by the Queensland Seafood Industry Association, and is part of an ongoing education and information sharing process.

More information: Eric Perez, eo@qsia.com.au

Barramundi aquaculture and aeration 2017-170

In Barramundi (*Lates calcarifer*) pond aquaculture, the use of 24-hour, seven-day mechanical aeration via paddlewheels represents a significant energy cost to companies, although it is not known if the paddlewheels need to be operated continuously to maintain dissolved oxygen (DO) at levels that do not affect production outcomes.

A field trial over 12 weeks was commissioned on a commercial Barramundi farm to evaluate DO sensors linked to paddlewheel controllers and to examine the impact such technology may have on production outcomes and financial savings, along with changes that may occur in the biological and chemical composition of ponds.

This pilot trial demonstrated that using automatic aeration controllers has the potential to significantly save on energy consumption, thus lowering production costs. It is recommended, however, that a larger trial be considered over the entire 18-month production cycle to fully evaluate the reliability of the automatic aeration controllers and longer term impacts on food conversion ratios and the pond ecosystem.

More information: Dean Jerry, dean.jerry@jcu.edu.au

National biosecurity guidelines for Australian Barramundi farms 2016-147

As the Australian Barramundi industry continues to expand, it is important to ensure that nationally consistent biosecurity measures are implemented across all enterprises. These guidelines have been developed to assist Australian Barramundi farms with the tools and templates to create basic through to comprehensive, fully auditable biosecurity plans.

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Aquatic Animal Health and Biosecurity Subprogram: Disinfection measures to support biosecurity for ISKNV at aquaculture facilities 2016-011

Megalocytiviruses are a group of closely related viruses that cause mass mortalities in both marine and freshwater aquaculture. They are difficult to control as they infect more than 125 fish species, and individuals can be carriers for life, with sporadic disease events resulting in considerable losses at farms. This project was developed by the University

of Sydney, following consultation with Department of Agriculture and Water Resources (DAWR), relevant state agencies dealing with aquatic biosecurity, and from advice received from native fish and ornamental fish aquaculture producers. There was a critical need to develop practical and efficacious disinfection protocols for recirculating aquaculture systems. The research findings will be used by biosecurity regulators and farm managers for disinfection efficacy data specific to the Infectious Spleen Kidney Necrosis Virus (ISKNV), a type of *megalocytivirus*. These virus-specific data enable interpretation of disinfection guidelines for the prevention and control of disease caused by ISKNV.

More information: Dr Joy Becker, joy.becker@sydney.edu.au

Seafood Trade Advisory Group (STAG) 2016-257

The aim of this project was to continue the work of the STAG, started as part of the Australian Seafood Cooperative Research Centre, by building industry expertise and capability to determine trade and market access priorities, and to work with the government to resolve them.

The STAG has managed to provide a conduit for engagement with the seafood industry on export matters. The creation of the market intelligence system has provided exporters with easy access to information about consumer trends, competitor behaviour and government decisions that impact on and provide opportunities for Australian seafood exporters.

Working together, members of the STAG have communicated cohesive and united messages to support international trade negotiations and have provided a level of technical detail that was previously absent in those negotiations.

More information: Jayne Gallagher, jayne@honeyandfox.com.au





Movers and ...

After working at the Sydney Fish Market for more than 44 years, general manager **Bryan Skepper** is retiring in July. He will take a part-time advisory role at the new Sydney Fish Market development at Blackwattle Bay. **Rob Delane** has been appointed Australia's Inspector-General of Biosecurity. **Wez Norris** has been appointed as the new CEO of the Australian Fisheries Management Authority (AFMA), replacing outgoing CEO **James Findlay** and acting CEO **Anna Willock**. Anna Willock has now taken the role of general manager, formerly held by **Nick Rayns**. James Findlay has been appointed as the new Director of Parks Australia. AFMA has

appointed new commissioners – **Brett McCullum**, **David C Smith** (ex CSIRO Hobart), **Sevaly Sen**, **Scott Spencer**, **Catherine Cooper** (reappointed). **Beth Gibson** has left her role at AFMA as senior manager for policy, environment, economics and research. **John Harrison** has stepped down as CEO at WA Fishing Industry Council (WAFIC). **Alex Ogg** has been appointed as the interim CEO. **Paul Murphy** has left his role as assistant secretary, wildlife trade and biosecurity at the Department of Environment and Energy, with **John Gibbs** stepping into the position. **Terry Lissiman** has been appointed as chair of Western Rock Lobster, replacing **Kim Colero**. **Andrew Sullivan** has

been appointed as executive officer at Commonwealth Fisheries Association, taking over from **Renee Vajtauer**. Andrew is also the new executive officer for the new Bass Strait Scallop Industry Association. **Brigitte Smith** has been appointed as the chief executive of Munderoo's Flourishing Oceans initiative. **Ian Cartwright** has been appointed as chair of the Abalone Council of Australia. **Gina Mamouzelos** has taken on the role of media and communications manager for Seafood Industry Australia, replacing **Jess McInerny** who will be taking maternity leave. **Neil MacDonald** has been appointed as executive officer for the Great Australian Bite Fishing Industry Association. **Simon Boag** has been appointed as executive officer for the Southern Shark Industry Alliance.

Jodie Redcliffe is acting CEO of Nuffield Australia while Jodie Dean is on maternity leave. **Jo Starling** and **Cassie Price** have both come on board as members of the FRDCs refishing research subprogram. **Tom McCue**, senior manager of business development with Animal Health Australia has commenced a new position with AgriFutures Australia. **Robert Michael**, previously program manager at WA's Department of Primary Industries and Regional Development, has recently accepted the position of research lead for Harvest Road Group. **Joshua Thomas** has been appointed as the new chief executive officer of the Great Barrier Reef Marine Park Authority, taking over from **Bruce Elliot**, who had been acting in the role.

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

Calendar of events

DATE	EVENT	MORE INFORMATION
2019		
10–14 June	SeaWeb Seafood Summit 2019, Thailand	www.seafoodsummit.org
11–12 June	FRDC Board Meeting, Perth	02 6285 0400
18–21 June	Asian Pacific Aquaculture 2019, India	www.was.org/meeting/code/APA2019
7–11 July	Australian Maritime Sciences Association Conference 2019, Perth	http://amsa19.amsa.asn.au
8–12 July	5th Australasian Scientific Conference on Aquatic Animal Health and Biosecurity, Cairns	https://events.csiro.au/Events/2019/February/27/5th-FRDC-Conference-on-Aquatic-Animal-Health-Biosecurity
29–31 July	Australian Prawn Farmers Association, Brisbane	http://apfa.com.au/presenter-expressions-of-interest-for-2019-apfa-symposium-open-now/
29–31 July	Trans Tasman Abalone/Paua Convention, Hobart	www.abalonecouncil.com.au/national-abalone-convention/2019-hobart-tas
6–8 August	2019 NSW Oyster Conference, Forster	www.nswoysters.com.au
8–9 August	NZ Seafood Industry Technical Day and Conference, Queenstown	www.seafood.co.nz/conference-2019
10–18 August	National Science Week	www.scienceweek.net.au
11–13 August	Rock Lobster Conference 2019, Queenstown	www.lobsterconference2019.co.nz
28–30 August	World Seafood Shanghai	www.worldseafoodshanghai.com/en
3–5 September	Seafood Expo Asia, Hong Kong	www.seafoodexpo.com/asia
9–11 September	World Seafood Congress, Malaysia	https://wsc2019.com
14 September	San Remo Fishing Festival	www.srfishfest.com.au
16–20 September	Ocean Obs 19, Hawaii	www.oceanobs19.net/#main
9–11 October	Seafood Directions 2019, Melbourne	www.sd2019.com.au



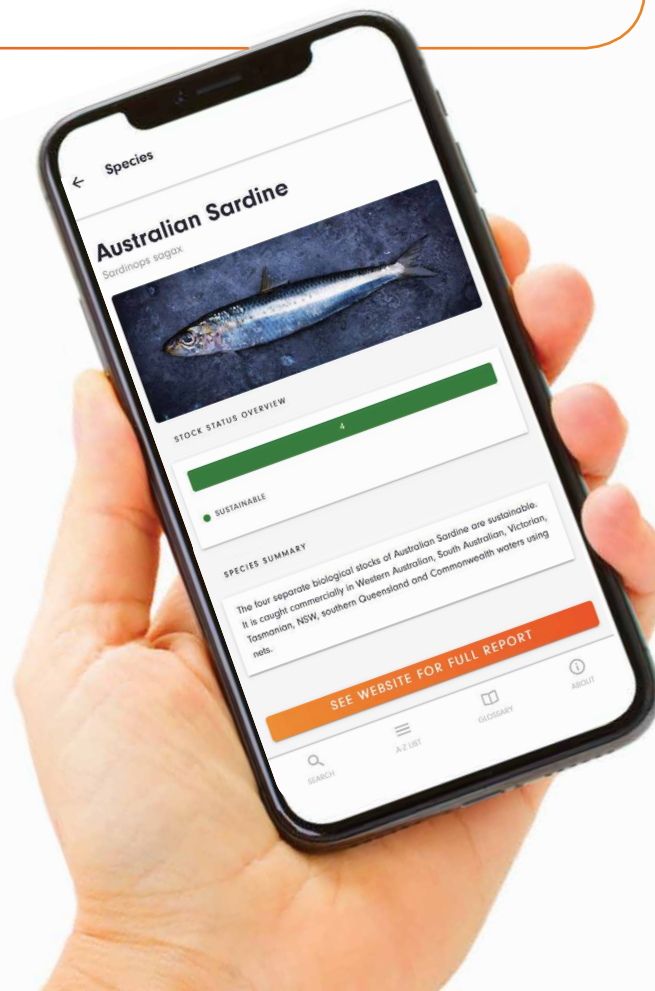
SAFS- Sustainable fish stocks

Be in the know about your seafood



Fish stocks are constantly changing and require constant monitoring. Everyone should keep an eye on what is going on and this app helps you do that.

It gives you access to the 2018 Status of Australian Fish Stocks Reports which bring together the best available information to determine the sustainability status of Australia's wild fish stocks, against a national reporting framework.



Features

- Search over 120 of Australia's commercial fish species
- The most up-to-date, scientifically rigorous information on the status of Australia's fish stocks, at your fingertips
- Run searches based on where and how fish are caught
- Links to the full Status of Australian Fish Stocks Reports - giving you the science that informs the status, worked on by over 100 of Australia's leading fisheries scientists

This app allows you to easily browse the information in The Status of Australian Fish Stocks Reports. These are the most comprehensive guide to how Australia's fish stocks are going.

Australia's fish stocks are well managed and a majority are very healthy. The majority of Australian caught fish, eaten in Australia are included in the Reports. These are reviewed every two years and more species are added every time.



Available from the app store and Google Play