

The background image shows a close-up of fish, likely salmon, on a bed of crushed ice. Below the ice, a white conveyor belt with metal fasteners is visible, with fish being transported along it. The fish are fresh and have a silvery-gold hue.

# FISH

FISHERIES RESEARCH & DEVELOPMENT CORPORATION NEWS



VOLUME 25  
NUMBER 1

MARCH 2017

**BYCATCH UNDER  
SCRUTINY**

**RESTORING RIVER  
HABITATS**

**Value-added  
markets**

# Status of Australian Fish Stocks Reports

**Third report**

- **83 species (or species complexes)**
- **More accessible, up-to-date information on the status of Australia's wild-catch fish stocks**
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- **Independently peer reviewed by more than 50 scientists**
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The reports collate available biological, catch and effort information to determine the status of Australia's wild catch fish stocks against a nationally agreed reporting framework.



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# Whiting on its way

The small but sweet fillets of Eastern School Whiting are reaching local markets, thanks to an initiative to invest in automated processing

Story and photos

By Catherine Norwood



Eastern School Whiting, cleaned, graded and scaled, ready for filleting

Automated processing, helped along by timely FRDC investment, is allowing the Victorian-based Lakes Entrance Fishermen's Co-operative Ltd (LEFCOL) to develop its first value-added products of Eastern School Whiting (*Sillago flindersi*).

Commercialisation of the crumbed and battered whiting fillet products has taken almost five years, since LEFCOL first began the search for suitable processing equipment. Eastern School Whiting is less well known than its larger relation, the King George Whiting (*Sillaginodes punctatus*). It grows to 30 centimetres, but more commonly reaches only 20-25 centimetres in the colder waters off southern Australia.

LEFCOL receives about one-third of the national school whiting catch, which totals 1200 to 1300 tonnes. In the past, much of Australia's whiting catch was frozen and sold whole to South-East Asia.

However, the co-op has been keen to develop local markets for the whiting and offer an alternative to imported products, which make up about 72 per cent of seafood consumed in Australia (FRDC 2010-222).

LEFCOL's operations manager Chris Kyle says there was a short period a decade ago when supermarkets in Queensland were interested in a pre-prepared product, and LEFCOL arranged to have the fish processed into butterfly fillets overseas and re-imported. But food trends changed and the whiting fell out of favour due to cheaper alternatives being available.

## Market-ready concept

However the potential for a consumer-ready product remained on LEFCOL's radar, and for the past five years the co-op has been actively investigating new processing and market opportunities.

Eastern School Whiting is one of the more abundant species for the fishers who deliver to LEFCOL's facilities in southern Victoria, along with Tiger Flathead (*Platycephalus richardsoni*) and Gummy Shark (*Mustelus antarcticus*).

They are caught in Commonwealth, NSW, Victorian and Tasmanian fisheries year-round and are a good alternative when the weather is too rough.

Eastern School Whiting fillets may be small, with fillets averaging 15 grams (or 30 grams

for a butterfly fillet), but they are sweet and succulent. The size of the fish means hand-filleting is difficult and time-consuming; only 30 per cent of the fish is recovered as fillets.

Given the twin issues of high labour costs in Australia and a shortage of skilled staff, automation has proven the key to reducing the costs enough to make volumes of filleting worthwhile.

Four years ago the search for suitable filleting equipment led LEFCOL to a pelagic fisheries processor at Eden on the NSW South Coast which had been filleting sardines. But after six months of processing the whiting, a fire put the processor out of business.

## Custom technology

So the co-op took the plunge to invest in its own filleting machine, custom-made for school whiting by the Danish company that had manufactured the sardine filleting machine.

"The whiting are a similar size to sardines, but they have a different bone structure," says Chris Kyle. "So the manufacturer was able to copy some of the features of the machines used to process sardines."

With the filleting machine in place, the next

Clockwise from top left Gerard Kelly prepares whiting for delivery to the grading line; operations manager



Chris Kyle oversees grading; crumbed whiting fillets are sold in one-kilogram packs.



hurdles were to develop an accurate grading system and to provide a consistent feedstock for the filleter. Existing seafood feed-in technology proved prohibitively expensive and it didn't work effectively with a variation in fish size of almost 70 per cent, from 15-25 centimetres long.

The morphology of the fish was also problematic. When not in rigor mortis, the fish are highly flexible; firm-fleshed in winter, but softer, or with distended bellies during the summer spawning.

After investing more than \$150,000 in the filleting equipment, FRDC invested a further \$150,000, which allowed LEFCOL to design its own feed-in system. It is manufactured in Gippsland by a local engineering firm and incorporates known technologies into a new sorting system suited to whiting and which could also be adapted to other species. In addition to the financial investment, LEFCOL staff have spent hundreds of hours working to design, develop and optimise the processing system.

### Problem sorted

Customisable cleats proved a valuable innovation. These are used to separate fish, keep them on

the conveyor belt during cleaning and deliver them single file onto another conveyor belt for weighing, accurate to within one gram. Air jets triggered by the weights then sort the fish into predetermined categories – currently four, but with options for up to six.

Fish less than 65 grams are too small for processing and are usually sold for bait or pet food. Fish of 65-85 grams are set aside for automated filleting. Larger fish are sold fresh and frozen to domestic wholesale markets or are hand-filleted and sold either through LEFCOL's retail shop or to a wholesale distributor.

Before fish are filleted they are scaled, by tumbling them together in 50 or 100-kilogram batches for two minutes or so; the action of scales rubbing against scales produces effective results.

The automated system – grading and filleting – has been operating for almost 18 months, although it's only been running efficiently for six months, according to LEFCOL's general manager Brad Duncan. They can handle up to 200 fish per minute.

Brad Duncan says fishers have been working with the co-op to ensure the catch is a suitable size for processing. "If it is too small to cut it,

we can't get a better price for it at market, so the processing encourages fishers to catch larger fish. They change the cod ends on their nets so that the smaller fish can escape and have a chance to grow. The fishers here have been brilliant, they've really embraced it," he says.

About 45 vessels regularly unload at LEFCOL's facilities on Bullock Island, the bulk of which are Danish seine trawlers that target flathead, whiting and Gummy Shark. In 2016 LEFCOL received 451 tonnes of Eastern School Whiting, all of which went to domestic markets.

Brad Duncan says the automated processing has allowed the co-op to increase its filleting of whiting from 50 kilograms a week by hand, up to 1200 kilograms a week. "In 2016 we processed 45 tonnes of whiting for fillets," he said.

### Product development

"And as far as we know our fillets are the only 100 per cent Australian caught and processed, battered or crumbed whiting product on the market. We tested several batters and crumbs, working with food distribution company PFD before agreeing on the two options we have now."

The crumbed product has been developed with Queensland and northern NSW markets in mind, while tempura battered fillets are preferred in southern NSW and Victoria. Both products are sold in one-kilogram bags, and four-kilogram boxes, exclusively through PFD.

Brad Duncan says the partnership with PFD has been crucial in developing the product, from advice on batters and crumbs to access to the food service sector via the company's extensive distribution network.

He says feedback from PFD is that the whiting fillets are selling well to hotels and clubs, where they are sold as entrees, snacks and a children's meal option. "We even made the menu at the Melbourne Spring Racing Carnival last year. We're taking baby steps at the moment and what we process depends on what the fishers catch and how the product is selling. There is definitely an opportunity for us to target import replacements."

He says LEFCOL is confident the market for the crumbed and battered fillets will continue to grow and production could be quickly scaled up if need be with a second grading and feed-in line. The existing grading system could also be modified for different fish species, such as gurnard, flathead or Yelloweye Mullet, although automated filleting would require a different machine suited to the larger size and different morphology of the species. **F**



# White spot disease update

The arrival in Australia of a highly contagious crustacean disease has prompted an emergency response to protect the prawn industry

Until late 2016, Australia was one of two remaining prawn farming countries in the world that were free of white spot disease. However, on 22 November, 2016, potential signs of white spot disease were detected on the first farm in Australia and, subsequently, on 30 November, Queensland's Biosecurity Sciences Laboratory identified the white spot syndrome virus. Samples were sent to the Australian Animal Health Laboratory in Geelong and it confirmed these findings on 1 December. The prawns affected were farmed Black Tiger Prawns (*Penaeus monodon*).

White spot disease is a highly contagious viral disease that affects prawns. It is caused by a virus known as white spot syndrome virus. The virus that causes it is exotic to Australia and poses a significant threat to Australia's farmed crustacean industries.

Since the initial infection, the disease has spread in South East Queensland. Additionally,

## Human impacts

The disease does not pose a threat to human health or food safety. It is important to note that affected prawns will not enter any domestic or international markets or be processed for human consumption. **It is crucial that people fishing or crabbing in any of Australia's waterways do not to use prawns meant for human consumption as bait.** This has the potential to spread the virus.

about 100 infected Black Tiger Prawns were found in the wild, outside the affected farms, in February.

Treatment work is ongoing across all infected properties to ensure the virus is destroyed as quickly as possible. This includes the gradual and methodical draining, drying and clearing out of all sediment from farms that have already been decontaminated. This work is expected to take a number of months to complete.

To date, about 3.8 million litres of chlorine have been used to treat ponds, water channels and settlement ponds. This is the largest emergency aquatic animal disease response ever

in Queensland. The Queensland Government has spent \$4.4 million on disease control activities, including more than 100 staff members and more than 50,000 laboratory tests to detect the spread of the disease.

## Research needs

Since the outbreak was detected, both government and industry have initiated research programs to better understand it. The primary focus of research is testing and analysing infected prawns and pathways for transmission, with a view to stopping further transmission and, ultimately, eradication.

However, should the white spot virus be found to persist in Australian waterways, research will focus on addressing how to minimise the impact on the fishing and aquaculture sectors. Should the disease become entrenched, the research strategy will be to focus on selective breeding, diagnostics, biosecurity and treatment.

To date, scientific evidence shows that white spot disease has not established in the wild, demonstrating that current biosecurity and eradication measures have been effective in keeping the virus contained. Should future testing fail to detect the virus in the wild, research and monitoring will need to be undertaken to document and justify the reinstatement of Australia's white spot disease-free status. A Senate inquiry has been announced to investigate how white spot disease entered and infected Australian prawn farms. **F**

## About the disease

- White spot disease is a highly contagious viral disease of crustaceans, including prawns, lobsters and crabs, caused by white spot syndrome virus.
- It is generally found in semi-tropical and tropical zones; there is little evidence of infection in temperate waters.
- In farms it is known to have a mortality rate of more than 90%.
- White spot disease is widespread throughout prawn farming regions in Asia and the Americas, where it has caused severe losses.
- Other crustacean species can be infected and also act as carriers.
- Based on experience in other countries, the impact on wild stocks is markedly different to that of farmed prawns. While present in the wild overseas, the virus has not had an impact on mortality or productivity.
- Freezing does not kill the virus, but cooking does.
- Transmission of the virus can occur in a number of ways – from crustacean to crustacean (when one prawn eats another), through contaminated raw prawn products, from contaminated feed including probiotics, from brood stock which contains the virus, or by human transmission via gear such as aerators or shoes.
- Terrestrially the virus can be spread by birds, crabs, water rats and some land-based animals.



## Food safety priorities

Six high-priority issues have been identified in a SafeFish review of current and emerging food safety and market access issues in Australia.

These include:

- export restrictions for canned abalone into China based on Chinese sulphite regulations;
- harmful algal blooms and their impact on seafood;
- ciguatera toxins in fish;
- *Vibrio* species in bivalve shellfish;
- food fraud and food authenticity; and
- potential accumulation of arsenic in *Amusium* scallops species (Saucer Scallops).

An additional seven issues or hazards, of medium to low priority, were identified in the process of developing a program of work for SafeFish for the next two to three years. Medium-priority issues were: off-label chemical use in Australia; per and poly fluoroalkyl substances (PFAS), formally known as perfluorinated compounds (PFC); and parasites in finfish.

The development and validation of rapid biotoxin test kits was highlighted as beneficial work that could be undertaken on behalf of industry to manage the risk from harmful algal blooms (FRDC research code 2014-032).

The SafeFish partners used a risk matrix to assess and rank each issue, considering impacts to trade and market access, public health, regulation, economics, reputation (media/political) and environment/sustainability. **F**

For more information or a copy of the risk-ranking report, or to help progress any of the issues identified as high priority, email SafeFish program manager Alison Turnbull ([alison.turnbull@sa.gov.au](mailto:alison.turnbull@sa.gov.au)).  
More information:  
[www.safefish.com.au](http://www.safefish.com.au)



## Rock Lobster Congress

Hobart will host the 10th Trans Tasman Rock Lobster Congress on 23-25 September, 2017, which has the theme 'Are we on course?'

The Tasmanian Rock Lobster Fishermen's Association is coordinating the congress, and registrations are now open via the congress website.

Presentations will focus on the industry's current position and future challenges and whether the sector is on course for a future it has control over.

The event will be held at the Hotel Grand Chancellor and provides an opportunity for attendees from different rock lobster fisheries to compare their experiences with others and share knowledge.

The event will finish with a gala dinner on 24 September. **F**

More information and registration:  
[www.rocklobstercongress2017.com](http://www.rocklobstercongress2017.com)

## Industry leadership

This year's National Seafood Industry Leadership Program (NSILP) will begin with a workshop in Darwin during March, following the announcement of successful applicants in February.

The 2017 participants represent the diversity of the fisheries sector and include wild harvest, aquaculture, marketing, retail, food service, research, environmental, recreational government and indigenous fisheries interests.

### Participants include:

**Michael Burnes**, NSW fisher; **Melanie Carrington**, Maxima Pearling Company, WA; **Brett Colley**, seafood retailer, NSW; **Tiger Davey**, fisher, Queensland; **Charles David**, Torres Strait Regional Authority, Thursday Island, Torres Strait, Queensland;

**Meredith Epp**, Marine Stewardship Council, NSW; **John Ford**, market research, Victoria; **Emily Grilly**, scientific support officer for Antarctic fisheries and conservation, Tasmania; **Michelle Hansen**, seafood marketing, Victoria; **Lief Hendrikz**, Sydney Fish Market, NSW; **Justin Holgate**, aquaculture feeds, Queensland; **Kelly Morgan**, seafood retailer and fish and chippery, Queensland; **James Newman**, fisheries assessment officer, Department of the Environment and Energy, Canberra; **Robert Redmayne**, oyster producer, NSW; **Daniela Schwarz**, seafood marketing, Queensland; **Michael Ramsey**, skipper and fisher, New Zealand; **Michael Tropiano**, habitat officer, Recfishwest, WA; and **Flora Warrior**, Mabuig Seafood Cooperative Working Group, Mabuig Island, Torres Strait and Queensland. **F**



Western Rock Lobster



## DISCOVERY



Monsoon Fairy Wrasse  
Photo: M. Hammer © MAGNT

## NEW REEF WRASSE DISCOVERED

Australian scientists have discovered a colourful new tropical reef fish from the eastern Timor Sea. The Monsoon Fairy Wrasse (*Cirrhilabrus hygroxerus*) is a small, elongated fish which reaches a size of seven centimetres. It was discovered in the Northern Territory by scientists from the Museum and Art Gallery of the NT and the Western Australian Museum.

The Monsoon Fairy Wrasse, like many reef fish, displays spectacular colours and has a peculiar life cycle. Wrasse species typically start out as females, after which dominant fish transition into males – each phase with a different colour. The females of the Monsoon Fairy Wrasse are a peachy red with blue body stripes, while the male has a black body speckled with iridescent blue and large red pelvic fins.

Unique colour combinations help to distinguish the Monsoon Fairy Wrasse from close relatives isolated in pockets of habitat in the western Timor Sea in Western Australia and Timor-Leste. The naming of the species reflects the tropical monsoon climate in the region where the fish are found, and also recognises industry partner Monsoon Aquatics ([www.monsoonaquatics.com.au](http://www.monsoonaquatics.com.au)), which found the fish and worked with scientists to name the species. **F**

## WORD WISE

Each issue we will try to clarify the meaning and use of some commonly misunderstood words in fisheries science, beginning with the basics.

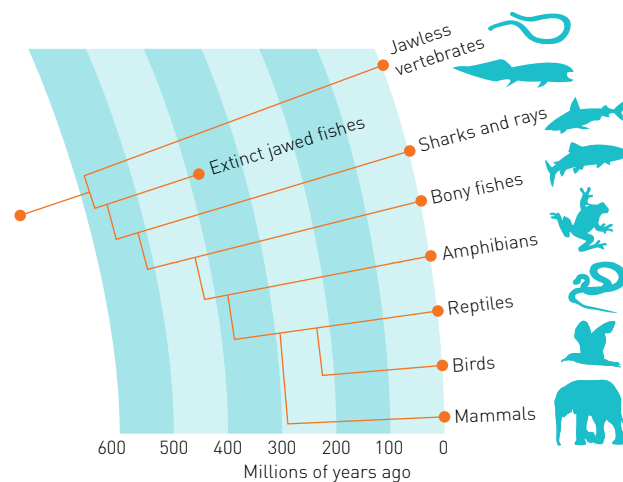
### WHAT IS A FISH?

The word 'fish' is a convenient way to refer to a variety of diverse aquatic creatures, some of which are not, strictly speaking, fish. Starfish and jellyfish, for example, are not really fish. While they live in water, they don't have gills, fins or vertebrae – important characteristics of all 'real' fish.

In fact, by some accounts, there's no such thing as 'fish' at all. Evolutionary scientists use a different criteria – the paraphyletic classification system – to group animals based on their common evolutionary ancestry. All 'birds', for example, have the same common ancestor.

There are several groups we often refer to as 'fish', including sharks and rays, bony fishes and creatures such as lampreys, but each of these have distinctly different ancestry. Tracing evolution backwards to find an ancestor that is common to all of these 'fish' groups reveals the same ancestor from which the un-fishlike groups of mammals, birds, reptiles and amphibians have also evolved.

So in the absence of the same common ancestor, the rationale for a discrete group of organisms – called 'fish' – disappears. **F**



## TECHNOLOGY

### Public mapping of fishing activity

A new international initiative has been launched with the aim of identifying illegal, unreported and unregulated (IUU) fishing around the world, which is recognised as a major threat to the sustainability of fisheries. Global Fishing Watch is a free public initiative, in beta testing, that allows anyone with an internet connection to track vessels fitted with automatic identification systems (AIS) anywhere in the world. Founding partners for the

project are Oceana, SkyTruth and Google. The CSIRO and the Australian National Centre for Ocean Resources and Security at the University of Wollongong are among several research partners working with the initiative.

The United Nations estimates that IUU involves up to 26 million tonnes of fish a year globally, representing as much as \$23.5 billion in lost revenue, while also undermining management efforts to ensure the sustainability of fish stocks. **F**

**More information:** [www.globalfishingwatch.org](http://www.globalfishingwatch.org)



## IN PRINT

**Australian Fish & Seafood: The ultimate kitchen companion**

Set to become a benchmark reference for anyone interested in cooking and eating fish and seafood, this publication provides detailed information on selecting and preparing more than 60 types of fish and seafood, including catching methods, notes on sustainability, flavour profiles and cooking guidelines.

More than 130 recipes showcase the delicious potential of the vast array of seafood available in Australia. Many of the species were chosen because they are under-utilised or unfamiliar to the public, despite their excellent eating characteristics.

The authors include: John Susman, a leading seafood providore who is currently a director of the FRDC; restaurant reviewer and former chef Anthony Huckstep; Stephen Hodges, who is regarded as one of Australia's best seafood chefs; and Sarah Swan, a chef and recipe developer who worked for Neil Perry's Rockpool group for 14 years.





Kelp forests have been disappearing from Tasmania's shorelines, but globally they are demonstrating resilience and the ability to re-establish themselves. Photo: Craig Sanderson

# Search for kelp survival factors

Tasmanian researchers are at the forefront of research into kelp ecology to better understand the resilience of this pivotal marine organism

By Catherine Norwood

In contrast to widespread global declines in corals, seagrasses and oyster beds, kelp forests have proved surprisingly resilient in some regions, according to a new international study.

Researchers at the University of Tasmania (UTAS) have contributed to the study, which provides the first global picture of how kelp forests have changed over the past 50 years in response to stresses caused by human activity.

Based at the UTAS Institute for Marine and Antarctic Studies (IMAS), Craig Johnson, Graham Edgar, Neville Barrett and Scott Ling co-authored the report as part of a team of 37 scientists who analysed trends from 1138 sites across 35 regions of the world.

Craig Johnson says that while kelp has declined in 13 of the regions studied (38 per cent), it remained stable in 12 regions (35 per cent) and increased in 10 regions (27 per cent).

The study suggests that one of the likely reasons that kelp is faring better than some other marine species is its unique capacity to recover quickly from disturbances.

But Craig Johnson says Australian kelp forests are among those in decline. "There are several regions in Australia where there have been significant and widespread losses of kelp –

in Western Australia, around Sydney, north of Sydney, and in south-east Australia, including Tasmania. In each region the mechanism of loss is quite different," he says. These include coastal development, invasive species and climate change.

Researching the rapid collapse of Tasmania's Giant Kelp beds, Scott Ling suggests it may be difficult for this region to recover, due to the continuing presence of Long-spined Sea Urchin (*Centrostephanus rodgersii*). Significant long-term warming of the coastal waters of eastern Tasmania has allowed the migration of the northern urchin species into Tasmania's Giant Kelp beds. The urchins are capable of overgrazing kelp beds in just six months.

Scott Ling says sea urchin overgrazing creates extensive bare rock barrens. "And in the process we lose something like 150 species that are associated with kelp beds, as well as commercially lucrative species such as rocklobster and abalone.

"Once the kelp has been overgrazed, sea urchins switch diet to feed on micro and encrusting algae that grows on the barren reef. This means you virtually have to remove every last sea urchin from a barren for the kelp bed habitat to recover."

Part of his research has been to examine how predators of sea urchins could mitigate

the risk of the urchins overgrazing kelp beds.

In a related project, IMAS researchers have transplanted hundreds of kelp plants into artificial patch reefs, covering more than a hectare, to test the resilience and stability of the kelp *Ecklonia radiata*, an important species found throughout Australia's cooler coastal waters.

Believed to be a world-first project, 28 patch reefs were installed at seven metres depth in Mercury Passage between Maria Island and the Tasmanian mainland in early 2015, with the final results of the 20-month project due to be reported later this year.

IMAS PhD researcher Cayne Layton, who worked on the project, says the research is examining how kelp forests change their surrounding environment and how these changes in turn benefit future generations of juvenile kelp. "Our transplanting method may also be used to restore and rejuvenate areas which have already suffered widespread kelp loss due to impacts such as marine heatwaves, increased nutrients or invasive sea urchins," he says.

This project is supported by IMAS at the University of Tasmania, the Australian Research Council and the Holsworth Wildlife Research Endowment. **F**



# Plans to expand for stock status reports

A new approach to reporting the status of Australian fish stocks improves transparency and provides public access to dynamic data on the status of stocks

By Peter Horvat

The future of Australia's fishing sector depends on healthy aquatic habitats, environments and fisheries. To ensure the aquatic ecosystems continue to produce seafood for the present and future, Australia needs a scientifically rigorous independent assessment of fished stocks.

The latest edition of the *Status of Australian Fish Stocks (SAFS) Reports*, released in December 2016, shows Australia's fish stocks are in good shape, with almost 60 per cent of included stocks assessed as sustainable.

Among the best-performing stocks, in terms of sustainability, are prawns, which also have the highest number of Marine Stewardship Council certified fisheries.

The 83 species and species complexes assessed represent approximately 90 per cent of both the volume and value of Australia's total fisheries production and include 294 individual fish stocks.

This third edition of the reports has added 15 new species, including iconic species such as the Western Australian Dhufish and the popular Orange Roughy, which have both endured severe population declines. The FRDC coordinated the production of the reports in 2016, for the first time, and plans to expand the species reported on to 200 by 2020.

FRDC executive director Patrick Hone says the reports provide a simple way for seafood consumers, fishers, managers and the public to understand how Australia's fish stocks are performing. The reports bring together the best available information to determine the status of Australia's wild fish stocks against a national reporting framework that provides transparency and consistency across all jurisdictions.

Almost 100 of Australia's fisheries scientists

**Table 1: Stock status classifications summary, Status of Australian Fish Stocks Reports 2016**

Stock status	Number of stocks					
	Biological stock	Management unit	Jurisdiction	Total stocks	Catch ('000 t)	% of catch species
Sustainable stock	85	56	34	175	114.84	85.41
Transitional-depleting ↓↓	7	15	4	26	3.91	2.90
Transitional-recovering ↑	5	4		9	1.29	0.96
Overfished	7	7	3	17	8.51	6.33
Environmentally limited		4	1	5	0.03	0.02
Undefined	12	17	20	49	5.87	4.36
Negligible	2	2	9	13	0.01	0.01
<b>Total</b>	<b>118</b>	<b>105</b>	<b>71</b>	<b>294</b>	<b>134.45</b>	<b>100</b>

were tasked with producing the 83 species reports. In addition, a further 50 fisheries scientists anonymously reviewed the reports to ensure they are as accurate as possible. "A scientifically rigorous approach to the stock status assessment and the reporting process is crucial," Patrick Hone says. The reports could not have been produced without the significant assistance of the fisheries science community and the dedication of the FRDC team.

## Findings

The reports highlight the dynamic nature of fisheries and reinforce the need for constant monitoring and management. Managers and fishers alike cannot rest on their laurels.

The reports highlight two key categories that should remain the focus for both – 'transitional depleting' and 'overfished'.

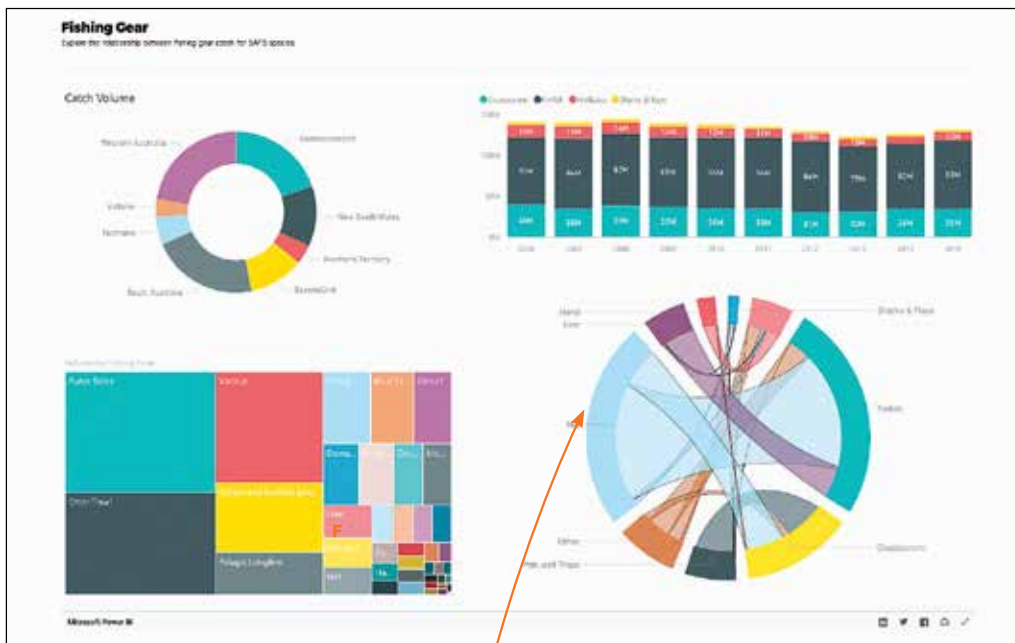
The number of stocks in both categories has increased – partly due to the inclusion of the 15 new species – with 26 stocks, representing 14 species, reported as 'transitional depleting'.

There were 17 'overfished' fisheries, representing 13 species, which is of concern. Close monitoring of these stocks will continue as part of the recovery and management plans in place to restore their numbers.

All of the 49 stocks classified as 'undefined' also have management in place; however, there was insufficient data available to confidently



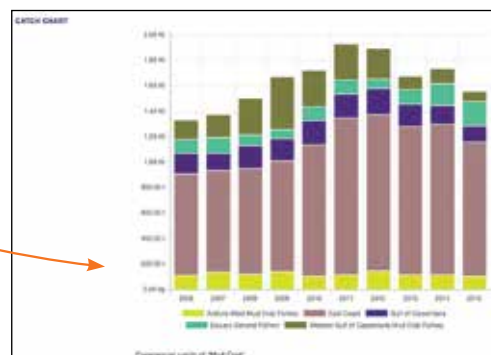
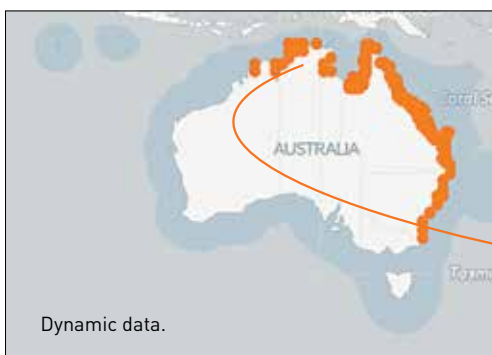
Left The SAFS reports are available online at a new website, [www.fish.gov.au](http://www.fish.gov.au). The website provides species specific information.



Above Data can be interrogated by users.

“A scientifically rigorous approach to the stock status assessment and the reporting process is crucial.”

Patrick Hone, Executive director, FRDC



classify the stocks. The 13 stocks classified as ‘negligible’ have a very small commercial catch.

The SAFS reports are available online at a new website, [www.fish.gov.au](http://www.fish.gov.au). The website provides easy access to dive into this wealth of information.

**New design**

The design of the reports has undergone a significant makeover and expansion of online functionality. New photographs of species have been added to enhance the visual appeal of the website.

Data has become the backbone of the website’s functionality. This, combined with new web technology, means readers can not only see the data, they can explore and interrogate it (see [www.fish.gov.au/summary/data-tools](http://www.fish.gov.au/summary/data-tools)).

One advantage of putting this new design in place has been the ability to generate jurisdiction-based reports. The jurisdictional reports only show the species and stocks found in their waters. Going forward, the FRDC aims to ensure the new data structure will enable national data to be extracted for international data sets and assessments.

**The future**

The FRDC will further develop and expand the *Status of Australian Fish Stocks Reports* over the next year to encompass a more comprehensive and holistic view of Australian seafood sustainability. In addition to information on fish stocks, information on bycatch (non-target) species, fisheries management and impacts on aquatic habitat will be included.

The continuing development of the *Status of Australian Fish Stocks Reports* and the commitment to the highest level of scientific input and process means that Australians can be confident that locally caught seafood is being sourced from fisheries that are being managed for sustainability. **F**



# What consumers (don't) want

The latest research into seafood shopping experiences identifies opportunities to make seafood buying simpler for consumers

The difficulties in determining how fresh seafood is and how long it will last in the refrigerator have been identified as key barriers for consumers when it comes to buying seafood – even among those who eat it on a regular basis.

This is one of the findings to come from the FRDC's latest market research, conducted in mid 2016 and summarised in the report *Unpacking the consumer seafood experience*.

Peter Horvat, the manager of communications, marketing and trade at FRDC, says the research is aimed at more than fine-tuning marketing messages. It has been valuable in identifying issues that prevent consumers buying seafood – issues that could be addressed by research, development and education.

"We know why people like seafood. What we don't know is why they don't, what stops them from buying it and what just annoys them," he says. "We have been focusing on the issues of consumer preferences and seafood marketing so that we can better link and integrate it with the FRDC's research and development program – to ultimately deliver on FRDC's priority of improving productivity and profitability."

The research consisted of an online survey of 2000 adult Australian grocery buyers undertaken from 21 June to 2 July, 2016. It collected information on a wide range of consumer seafood buying, cooking and eating experiences to document the problems people have with seafood and identify where the opportunities for improvement lie.

The survey targeted three key experiences in depth – purchasing, preparation/cooking and eating.



Level of confidence in buying seafood



It found that 95 per cent of respondents ate some seafood at least once a year, with 91 per cent eating fresh seafood. However, 36 per cent ate seafood infrequently (no more than once every two months), or not at all. Almost one in three households also have at least one person who won't or can't eat seafood, which affects the overall incentive for buying seafood.

More than half of consumers (57 per cent) said they bought their seafood from supermarkets as part of a regular shop, with 17 per cent buying from seafood markets, 9 per cent from seafood shops and 7 per cent from other markets. This finding is likely to reflect the wide range of tinned and frozen seafood available from supermarkets.

However, for many people seafood remains an occasion-based experience; there are fewer who include it as part of the weekly food plan.

And while there is a common perception that seafood is expensive, 42 per cent of respondents found its value to be on par with other forms of meat, while one-third indicated seafood was better value.

"It's clear that price is not as big an issue for consumers as previously thought," says Peter Horvat.

## New opportunities

Table 1 (see page 13) summarises seven of the issues consumers identified as reasons they did not buy seafood more often, and cross-references them against consumption frequency to identify the impact addressing a particular issue could have.

Barriers include determining freshness, making it value for money through improved shelf life, the smell and mess involved, frozen and tinned products and confidence in product knowledge.

"We have undertaken some basic analysis of the results to highlight key opportunities. It seems clear from the results that if we can address some

## How addressing the issue could grow the market – for example determining the freshness

<p><b>TARGET</b> People who consume fresh seafood as a main meal once a week.</p> <p><b>22%</b></p>	<p><b>NUMBER</b> People who consume fresh seafood as a main meal once a week (22% of 15-65-year-olds).</p> <p><b>3.3m</b></p>	<p><b>CHANGE</b> Extra meals consumed annually if 7.8% of people who eat seafood weekly increase to twice weekly.</p> <p><b>13.4m</b></p>	<p><b>IMPACT</b> Approximate value of 13.4m additional serves of seafood per year (at \$2 each).</p> <p><b>\$26.9m</b> (1349t)</p>
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**Table 1: Key barriers to seafood consumption**

Barrier to consumption is...	Consumption frequency										
	All consumers	More than once a week	Once a week	Once a fortnight	Once a month	Once every two months	Once every three months	Once every four months	Once every six months	Once a year	Less often
This represents % of all fresh seafood meals	100%	12%	22%	16%	20%	8%	5%	4%	5%	2%	5%
They consume % of all fresh seafood meals	100%	39%	37%	14%	8%	2%	1%	0.4%	0.3%	0.1%	0.1%
Determining the freshness	71%	76%	72%	71%	70%	77%	68%	69%	67%	71%	65%
Making it a value-for-money buy – certainty of fridge life	61%	65%	60%	57%	59%	66%	64%	59%	64%	67%	57%
The smell – before, during and after	48%	43%	42%	44%	51%	49%	52%	58%	60%	58%	57%
What’s the difference: fresh v frozen v tinned	48%	56%	49%	47%	47%	51%	46%	36%	45%	49%	36%
Build my confidence – in what I can and might buy and where I buy it from	46%	57%	49%	43%	42%	47%	40%	38%	45%	49%	42%
Taking the uncertainty away – selecting, preparing seafood – making it easier and faster to prepare	41%	40%	38%	38%	40%	43%	35%	46%	55%	49%	48%
The mess – during and after	33%	32%	30%	30%	33%	29%	40%	49%	40%	44%	34%

“Almost one in three households also have at least one person who won’t or can’t eat seafood, which affects the overall incentive for buying seafood.” *Unpacking the consumer seafood experience*

of the reasons why people don’t eat seafood, we could increase consumption,” says Peter Horvat.

Take, for example, the issue of determining freshness, which all consumers reported as a deterrent, regardless of how often they ate fish.

If it was possible to make this easier to determine and even a third of those who already eat fish for a main meal once a week increased their intake to two main meals a week, that could increase seafood sales by up to \$27 million a year.

Potential solutions could come from better information, new technology, or new products and packaging.

“The report highlights key issues such as this, where FRDC and industry could target investment in order to have a tangible impact.

Ultimately, if we are successful this will equate to an improvement in the bottom line for the industry (more sales, less waste) and improved consumer satisfaction and purchases.”

This kind of research demonstrates the need for a strong understanding of the end consumer and can provide insight into the areas that require investment, and it provides a mechanism for evaluating the success of improved marketing and other initiatives.

Peter Horvat says *Unpacking the consumer seafood experience* also contains a wealth of information for producers, retailers and marketers to use as a base for improving direct consumer marketing and for developing their product offerings. **F**

### The purchasing experience

Supermarket	57%
Seafood market	17%
Seafood shop	9%
Market	7%
Seafood wholesaler	3%
Caught it myself	3%
At the docks	1%
Other	3%

### Five key things that are important to people when they purchase seafood

1. Knowing where the seafood was caught.
2. Knowing how long it’s been in store.
3. Knowing if the seafood is fresh or has been frozen.
4. Whether the seafood was caught in Australia or overseas.
5. Knowing how long the seafood will last at home.



The fate of unwanted catch has become an increasingly hot topic in the debate about sustainable fisheries.

Photo: Paul Jones

# No need to go overboard

With a global focus on making better use of our fisheries resources, an age-old issue gains renewed focus

By Catherine Norwood

Internationally, fisheries discards – that part of the catch that fishers throw back – have been an issue of rising concern in recent decades.

While some element of unwanted catch is inherent in the practice of fishing, discards have become integral to concerns about declining wild fish stocks and food security. If resources are under threat, and people are starving, why then are we ‘throwing fish away’?

This was a key theme underpinning the high-profile anti-discard Fish Fight campaign launched in 2010 by UK celebrity chef and broadcaster Hugh Fearnley-Whittingstall and supported by various NGOs including the Marine Conservation Society.

The campaign gained widespread community support throughout Europe and in 2013 the European Union reformed its Common Fisheries Policy to place a ban on the discard of commercial quota species.

The aim is to gradually eliminate discards of quota species in European fisheries. Generally, in cases where juvenile fish of commercial species are caught and where fishers do not have specific quota for the species caught,

this catch must be landed, rather than discarded. However, many non-commercial quota species will continue to be discarded.

The EU’s move has heightened the focus on bycatch and discard policies and practices around the world, including in Australia, challenging fisheries managers and fishers to either fish more selectively or to make greater use of the total catch.

Fisheries managers globally are also watching closely how the EU’s ‘landings obligations’ – as it is officially known – will affect fisheries resources, fisher behaviour and seafood markets, as it continues its staged implementation over the next three years.

## Catch details

There is often confusion in some of the basic terminology used in the bycatch and discards debates. The ‘catch’, for instance, represents everything that is brought on board when fishing, not just the target species.

Bycatch is a broader term that incorporates everything that is caught unintentionally. It includes byproduct species kept for sale as well

as animals discarded, either because fishers are required to do so by law, or because they choose to do so. It also includes species affected by fishing gear which are not brought on board.

In Australia, fish or other animals that are not the target species, but which can be legally kept and are retained by fishers for sale, are referred to as byproduct. Each jurisdiction sets its own regulations about what can and cannot be retained in its fisheries.

Discards include any part of the catch that is returned to sea, whether dead or alive – including animals that cannot legally be retained because of their species, size or gender, or because the fisher has insufficient quota. It also includes animals that could be kept, but which are discarded because they are perceived to have a low market value.

Sometimes threatened, endangered and protected species (TEPS) are among the bycatch. In Australia these can include turtles, seabirds, seals, dolphins and many shark species, which must be released by law. TEPS are not generally considered from a discard perspective.

In Australia, the FRDC and other fisheries



agencies have invested extensively in research over many years, working with fishers to reduce discards and improve fishing selectivity. Bycatch and discards are already considered in many fisheries management decisions, including Commonwealth legislation related to TEPS.

For fishers, discards represent a cost in terms of time, fuel and labour on which there is no return. To maximise their returns and to be as efficient as possible, the fewer discards to deal with the better.

Research has also shown that discards can potentially affect the future yields of some commercial fisheries as well as the dynamics of ecosystems, and managers are keen to reduce these potential impacts.

### New research initiatives

The increased profile of discards has triggered a new suite of research to detail more accurately exactly what is discarded and to make better use of a larger portion of the catch, which will effectively reduce discards.

This work may not be timely enough for the United Nations' third update of its reporting on *Discards of the world's marine fisheries*, which is in the process of being compiled for release later this year. The UN's second report on the issue, released in 2005, provided a major impetus for Fish Fight and other discard reduction campaigns. In this report, it was estimated that Australian fishers landed less than half of the marine life they actually caught. Produced by the UN's Food and Agriculture Organisation (FAO), the report put Australian discards at 55.3 per cent of the national catch.

Fisheries management consultant and research scientist Steve Kennelly believes the 2005 FAO figure overstates the level of discards in Australia and is confident more-accurate data will reveal a better performance, supported by many improvements in fishing techniques and management in the interim.

He is leading an FRDC-funded project to improve Australia's discard data collection and reporting. The national bycatch and discard reporting system being developed will complement and help shape the next generation of *Status of Australian Fish Stocks (SAFS) Reports*, he says.

The SAFS reports have been well-received and acknowledged as harmonising the reporting of commercially harvested species across Australia's seven fisheries jurisdictions. The discards report will harmonise the reporting of the 'other',

**“Fish stocks are a publicly owned resource. And it is incumbent on those who manage that resource on behalf of the community to report on its status to those owners. While the retained catch becomes the property of the fisher, discards remain public property all the time.”** Steve Kennelly

often unaccounted for, part of the catch.

“Fish stocks are a publicly owned resource,” Steve Kennelly says. “And it is incumbent on those who manage that resource on behalf of the community to report on its status to those owners. While the retained catch becomes the property of the fisher, discards remain public property all the time. So, from this perspective, it is as important, or even more important, to report to the public on discards than the harvested stocks.”

### Reporting details

Information about bycatch and discards comes primarily from observer programs and self-reported industry logbooks. In future, alternative approaches such as Environmental Risk Assessments and electronic monitoring will play a greater role in monitoring catches and discards. Electronic monitoring has already been implemented in some Commonwealth fisheries, where new reporting systems are also being developed to help fishers begin to report on discards.

Steve Kennelly is also examining existing data and reporting systems in NSW, Queensland, Tasmania and the Northern Territory as the basis for recommendations on a national system. Some fisheries have detailed discard data, while others have virtually no data. “And there is everything in between,” he says.

However, even where data is good, it is not yet linked into a consistent, public, national reporting framework, which could then feed more accurate information into global reports such as those produced by the FAO.

Steve Kennelly says establishing benchmarks for current levels of discards in each fishery will help managers, fishers and the public to track improvements. Evaluating the quality of the information available will also help track improvements in its reliability.

He suggests national reports may be produced once every five years or so. The FAO produces its global discards report once a decade, and its third report is underway, scheduled for release in 2017. He is overseeing the collection and analysis of data for the UN for countries in South Asia, South-East Asia and the Pacific, including Australia and New Zealand, as well as global information on TEPS.

### Impact assessment

Depending on the fishery and the fisher's gear type, a large proportion of discards could either be dead or in a poor condition with a low likelihood of survival when returned to the water. But fishing is not the only reason these animals die. From a management perspective, a key issue in evaluating discards involves quantifying natural mortality and predation on discarded species, against →

## DiscardLess consortium

In response to the introduction of a landings obligation in the European Union fisheries in 2013, a group of 31 research organisations from 12 countries across Europe have come together to form the DiscardLess consortium.

The aim of the four-year, A\$7.7 million project is to develop the knowledge, tools and methods to support practical and cost-effective discard mitigation strategies. More selective fishing gear and new markets for previously discarded fish will be major foci of the research.

Australian fisheries scientist Steve Kennelly is a member of the external scientific advisory board for the DiscardLess consortium. He says the landings

obligation is still being bedded down, with a staged introduction between 2014 and 2019 that is allowing different fisheries time to adjust.

Finding new uses for fish that would otherwise have been discarded is a major research objective. “In some fisheries it is a substantial amount of fish protein coming in that would otherwise have been discarded,” he says.

New processing facilities are being planned throughout Europe to cater for the expected increase in production of non-food products from juvenile or low-value fish, for uses ranging from fishmeal to pharmaceuticals and cosmetics.

**More information:** [www.discardless.eu](http://www.discardless.eu)



**Left** Fishers at Yamba, on the Clarence River in NSW, are among those who changed their gear to improve fishing selectivity and reduce discards.

**Below** Using hoppers to sort the catch can help improve the survival rates of fish and other species that are then discarded. Photos: NSW Fisheries



the mortality attributed to fishing impacts. With limited data, fisheries managers traditionally take a conservative approach in these assessments.

A senior research scientist with NSW Fisheries, Matt Broadhurst, defines the crux of the issue as “unaccounted fishing mortality” or “collateral mortality”: the animals that lose their life as a consequence of fishing activities, which must also be considered when setting fishing quotas of target species.

Much of his research with NSW Fisheries has focused on reducing discards and improving the survival rates of discarded animals. However improving survival rates is a last resort, he says. Ideally, the most effective strategy is not to catch unwanted species at all.

### Strategic approaches

There are three basic approaches to minimising discards.

The first approach is to avoid bycatch altogether. This is done through voluntary or compulsory closed seasons or closed waters to avoid catching fish or other species that will be discarded. This often includes closing water to fishing where there is a high likelihood of interactions with TEPS.

The second approach uses selective or alternative fishing equipment to reduce bycatch, by either preventing certain species from entering nets, or providing escape mechanisms for unwanted catch. Changed mesh sizes and net configurations, panels and grid inserts and new hook designs have all been introduced.

In the NSW South West Rocks region, for example, beach seine fishers targeting Yellowfin

Bream, Luderick and Tarwhine were concerned about large numbers of juvenile fish being caught in their nets. Successful trials resulted in legislated changes allowing fishers to increase their mesh size from 65 millimetres to 102 millimetres, which reduced the bycatch by as much as 80 per cent.

A third approach aims to create a value for bycatch that would otherwise be discarded, providing market incentives to retain more catch and discard less. A current FRDC-funded project, led by Ian Knuckey of Fishwell Consulting, is examining the potential marketability of bycatch fish species in the Great Australian Bight trawl fishery that have generally been discarded in the past (see story page 17).

### Better survival

Another approach involves optimising the survival rates for discarded catch. Australia has been at the forefront of research into hoppers, or onboard containers of seawater, where the catch is held for sorting. While improving the quality of retained catch, hoppers also improve the survival of discards.

In recent research with prawn fishers in the NSW Clarence and Hunter rivers, Matt Broadhurst found hoppers provided significant improvements, particularly for juvenile prawns discarded. These made up about nine per cent of the catch, and survival rates rose from 70 to 90 per cent by using hoppers as part of the sorting process.

For fish bycatch, which can make up 10 to 20 per cent of the total catch, survival rates improved by almost 25 per cent, but total survival remained at less than 50 per cent.

## Terminology

**Bycatch** is a species that is (a) returned to the sea because it has no commercial value or because regulations preclude it being retained, or (b) is affected by interaction with the fishing gear but does not reach the vessel’s deck. It includes:

**Byproduct** – a species taken incidentally in a fishery while fishing for another species.

The species is retained for sale because it has commercial value, but usually does not contribute significantly to economic yield.

**Discards** – any part of the catch that is returned to the sea, whether dead or alive.

Source: [www.fish.gov.au/overview/glossary](http://www.fish.gov.au/overview/glossary)

Clarence River prawn fisher Don Johnson was one of those to take part in Matt Broadhurst’s research. He has adopted hoppers as part of his sorting process and also uses a grader that quickly separates the juvenile prawns from the catch. They are deposited into water that flows overboard back into the river estuary, which helps to maximise their survival.

He says several different gear changes adopted in the fishery during the past decade have also substantially reduced bycatch. Mandatory bycatch reduction devices in the nets allow larger fish to escape, and square mesh cod ends in the nets have also helped to reduce the number of juvenile prawns caught. **F**





# Ocean Jackets, Latchets and liquid fish

Raising demand for selected bycatch species or creating a protein blend are potential outcomes from research that aims to create value from fish that would otherwise be discarded

By Catherine Norwood

Just two species – Deepwater Flathead (*Platycephalus conatus*) and Bight Redfish (*Centroberyx gerrardi*) – make up the bulk of the catch for fishers in the Great Australian Bight Trawl Sector (GABTS) off the South Australian coast.

Yet over the years, fishers in the sector have identified almost 300 different species in their nets.

Small quantities of non-target species are often retained for sale; however, discards can account for a significant portion of the catch, depending on the time of year and fishing location. It is something the Great Australian Bight Fishing Industry Association is keen to change.

The association has been working with researchers from CSIRO and Ian Knuckey, of Fishwell Consulting, as part of an FRDC-funded project to identify ways to reduce discards and increase the viability of the fishery.

Ten years worth of data from vessel logbooks, onboard observer reports and independent fisheries surveys have been collated to assess the mix and catch volumes of different species, in order to

identify those with market potential. “There are two species that make up to 40 per cent of the bycatch: Ocean Jacket (*Nelusetta ayraudi*) and Latchet (*Pterygotrigla polyommata*),” Ian Knuckey says. “If we can develop markets for these, we can immediately reduce discards by a substantial volume.”

The project has investigated export sales of these species into Asia and potential new markets and product opportunities. Ian Knuckey says some species that are not well known or commonly eaten by Australian consumers are valued by Asian consumers.

“We need to better understand the market acceptability and obtain realistic prices for non-traditional species,” he says. “We’re working with skippers to send small quantities of selected bycatch species to seafood retailers in Australian and Asian markets.

“This will help test the market and gather vital data including sale price, species, volume, desired fish characteristics and seasonality.”

CSIRO is using additional information on processing, packing and transportation

costs to assess the economic viability of retaining these species.

Ian Knuckey says in trying to maximise economic yields in Australian fisheries, people often overlook the potential value of using all of the catch.

However, he says many Asian countries, which also target high-value species and have substantial volumes of bycatch, make greater use of bycatch through a range of processing techniques. These include curing, fermenting, hydrolysis, mincing and dehydrating lower-value seafood to produce protein-rich foods and other products.

In addition to new markets, the GABTS project has also evaluated potential processing techniques that could be adopted for either onboard or land-based processing of bycatch, particularly mincing or liquefying fish protein through hydrolysis.

These processes would allow fishers to value-add to the entire catch and effectively eliminate discards.

Use of an onboard processing plant is being investigated to hydrolyse fish protein, with the liquid potentially sold into fish feed or fertiliser markets. Ian Knuckey says while the targeted catch might sell for \$4 to \$5 per kilogram, hydrolysed fish protein might be 30 to 40 cents per kilogram.

“We’re also looking at whether the boats can be modified to incorporate a mincer and storage for the product,” he says.

Trawlers in the GABTS have enough storage capacity to process all of their bycatch. Markets and support for new products in the supply chain are more crucial issues to the success of greater resource use.

The project will include an economic analysis and modelling of the supply chain for distribution of bycatch species and alternative fish products, and is expected to be finalised later in 2017. **F**



Left Identifying bycatch species that are worth sorting and keeping for potential new markets is part of the research underway to assist fishers in the Great Australian Bight. Photo: Fishwell Consulting



# Seafood Escapes

Pairing professional fishing crews with leading Australian chefs has provided the formula for a special television series to showcase the hard work involved in bringing Australia's diverse and high-quality seafood to consumers

By Peter Horvat

The FRDC has partnered with well-known water warrior and recreational fishing host Andrew 'ET' Ettingshausen to develop the six-part pilot series *Seafood Escape*. From the depths of the ocean to the heights of culinary experience, *Seafood Escape* takes the viewer along for the ride.

*Seafood Escape* aired on Channel 10 and Southern Cross nationally across Australia in January and February 2017. As well as showcasing the action and adventure involved in sourcing sustainable seafood, the show goes an extra step to examine how seafood has been incorporated into our national cuisine. It also highlights the environment, taking viewers to some of the country's most scenic coastal communities.

Over the past decade, the FRDC has invested in activities aimed at raising the profile of Australia's fisheries and its Research, Development and Extension Plan 2015-20 places even greater emphasis on this. It's about letting the Australian community know that our fisheries are well-managed, professional operations.

## Program format

*Seafood Escape* aims to take advantage of the current appetite Australian viewers have to learn where their food comes from, typified by the success of shows such as *MasterChef*. A key component of the series is to highlight the research that underpins our fisheries management and fisher practice.

The show features six fisheries, from Queensland, down the east coast of Victoria and across to Western Australia. Each episode covers a different fishing method and species that is undervalued or unfamiliar to viewers. The FRDC worked with Andrew Ettingshausen to identify the fisheries that feature in the shows. This was

based on discussion with seafood councils in WA, NSW, Victoria and Queensland.

Through its investment in the Appetite for Excellence program, the FRDC was able to identify chefs to participate, asking past finalists of the program to join Andrew Ettingshausen on his quest and experience first-hand where the fish they use in their restaurants comes from. The biggest challenge was fitting in with everyone's busy schedules for filming and then, of course, getting the weather to cooperate. Filming took a tight 16 to 18 weeks from start to finish.

## National showcase

Each of the six half-hour episodes is set in a different part of Australia. The shows then follow a steady format, first setting the scene of whichever coastal community is the destination for that week's *Seafood Escape*. We then get to meet the local fishing skippers and crews – and, crucially, a local chef and their restaurant. The show combines both observational documentary and contemporary cooking show style.

Western Australian fisher Brendon Watts was keen to be involved and showcase the Mandurah mullet fishery. Despite his initial apprehension

Below Andrew Ettingshausen (centre) and Josh Niland.





Photos: Courtesy of Andrew Ettingshausen

Through its investment in the Appetite for Excellence program, the FRDC was able to identify chefs to participate, asking past finalists of the program to join Andrew Ettingshausen on his quest and experience first-hand where the fish they use in their restaurants comes from.

about taking out the television crew and Adam Sayles – the head chef at Perth’s St Michael 6003 restaurant – he managed to enjoy himself. “We all had a whole lot of fun,” he says. “Everything went well, ET was great, chef Adam was great.”

Brendan Pratt, head chef at Indiana Cottesloe, who spent the day with the fishers from Fremantle Octopus, is very supportive of the show. “We had a great few days. We spent the day on Friday out with the occy boys learning about what they do and how they do it. I had no idea of the work these boys put in. It was a great few days and not only is Andrew a great bloke, his team were fantastic.”

### Shooting challenges

But life as a TV presenter isn’t always glamorous or fun. Andrew Ettingshausen says the Queensland shoot – reef fishing for coral trout with chef Jacob Nicolson – was the most difficult he has done. He became ill the night before the shoot, which started at 3am, but still went ahead, although he spent most of his time on board, curled up on the back deck, drenched and sick.

Jacob Nicolson paid tribute to Andrew’s perseverance, noting that after being sick he would feel okay for a short while and join the others, before whatever he had caught brought him back to his knees. He counts it as miraculous

that Andrew was again well enough to sample the dish that was cooked back at the restaurant.

One of Sydney’s best seafood chefs, Josh Niland, owner of Saint Peter in Paddington, went out with skipper Richard Bagnatto and experienced deep sea trawling. Josh Niland was impressed with the professionalism of Richard and his crew. “It didn’t hurt that we had perfect weather and had a good day catching flathead, jackets, gurnard, whiting and other species which I use regularly at Saint Peter,” he says.

*Seafood Escape* has been well received by viewers, the fishing industry and the network, which will replay the series on Saturday afternoons at 4.30, starting in early March. Importantly for the FRDC, there has been strong support from industry, which sees the program as a positive effort to showcase its stories and the sector’s place in the community. Many fishers were very keen to be involved and the show could not have been produced without the support of the seafood industry councils and commercial fishers.

The FRDC and Andrew Ettingshausen are also keen to see the pilot progress into a longer series, to showcase how more fisheries and aquaculture operations supply great fish to consumers across the country and the globe. **F**

### Seafood Escape Series 1 locations and chefs

**Show 1: Western Australia, Fremantle Octopus** – featuring head chef Brendan Pratt, Indiana Restaurant, Cottesloe

#### Show 2: Queensland

**Coral Trout** – featuring executive chef Jacob Nicolson at Blackbird Bar & Grill, Brisbane

#### Show 3: Victoria

**Eastern School Whiting** – featuring head chef Simon Tarlington, Highline Restaurant, Melbourne

#### Show 4: New South Wales

**Leatherjacket and flathead** – featuring head chef Josh Niland, St Peter Restaurant, Sydney

#### Show 5: Western Australia, Mandurah

**Mullet** – featuring head chef Adam Sayles, St Michael 6003 restaurant, Perth

#### Show 6: New South Wales, Hawkesbury River

**Prawns** – featuring head chef Jacob Davey, est. restaurant, Sydney



# A question of sourcing

Is there a case for Australian suppliers and processors to unite on seafood sourcing claims?

By Catherine Norwood

**R**esponsible sourcing of seafood for restaurateurs and retailers is the focus of new efforts to raise consumer confidence in the integrity of Australia's seafood sector.

Fisheries economist Sevaly Sen is leading an evaluation of responsible sourcing codes and buying approaches for seafood.

This is part of her role in leading the FRDC's national priority-one program: 'Ensuring that Australian fishing and aquaculture products are sustainable and acknowledged to be so'.

"Our aim is to develop a decision tool to allow or assist seafood businesses to make informed choices around their seafood," she says.

As part of this, she is evaluating existing domestic and international examples of responsible sourcing codes of practice and risk-assessment approaches for seafood buyers.

Australia is already on the path to developing and providing information for business and consumers with the *Status of Australian Fish Stocks (SAFS) Reports*.

The FRDC published the third edition (see

page 10) and has been actively progressing the further development of the reports.

This includes expanding the information that business can then use to support their buying decisions and labelling claims. With seafood sourced globally and fisheries managed by multiple countries, it also makes sense to ensure Australia is part of the global conversation on these issues and to learn from those who already have relevant systems in place.

In the United Kingdom, the Sustainable Seafood Coalition (SSC) has developed



the Voluntary Code of Conduct on Environmentally Responsible Fish and Seafood Sourcing and the Voluntary Code of Conduct on Environmental Claims.

Also in the UK, the Seafish industry authority has developed the Risk Assessment for Sourcing Seafood (RASS) tool as a business-to-business tool. And while not targeted at consumers, they may also find it useful.

Katie Miller from the SSC and Alex Caveen from Seafish have both made presentations to the FRDC and seafood sector stakeholders in recent months.

### Voluntary codes

Katie Miller says one of the aims of the codes of conduct developed by SSC was to inform the public debate on seafood and to harmonise labelling around “sustainability”.

For businesses, she says, being part of this approach is about building and maintaining trust and reputation.

The code for responsible sourcing is a minimum commitment designed for both large and small businesses, supported by a guidance document that details what this commitment might look like in practice and also what best practice might be.

### Risk assessment

To help businesses undertake a risk assessment, Seafish developed the business-to-business RASS tool. The tool scores risk from one (very low) to five (very high) for each of four criteria: stock levels, fisheries management, bycatch and impacts on habitat. It includes about 300 fish stocks from UK waters, or which are landed in the UK.

Identification of one or more of the criteria as high-risk makes seafood buyers aware of impacts that may be of concern to their customers. The RASS tool is being used by a range of seafood companies, including those which undertake their own assessments as a way of fine-tuning or aligning their purchasing with their risk appetite.

### Local evaluation

Working with Seafood New Zealand, the FRDC project has assessed four species against the Seafish RASS methodology and other risk methodology tools to test whether they could be adapted for use here.

Sevaly Sen says information already collected for the SAFS reports will be used to provide some

**It is clear the future approaches in assessing the sustainability of fisheries will be much broader than stock status and will include the key areas of management, bycatch and habitat impact.**

of the ‘back-end’ data for a risk assessment tool, particularly in relation to stock sustainability.

“I expect that we may have better stock data for many Australian fisheries than they have in the UK, and we have done four Australian case studies for the RASS to see how it suits the Australian context. We also want to see whether aquaculture could be considered, as well as social risk issues, in the future.”

It is clear the future approaches in assessing the sustainability of fisheries will be much broader than stock status and will include the key areas of management, bycatch and habitat impact.

This is consistent with the benchmark tool of the Global Sustainable Seafood Initiative (the FRDC is a member of the GSSI; [www.ourgssi.org](http://www.ourgssi.org)), the SSC and RASS tools.

### Terms of agreement

The FRDC’s National Priority One is also looking at “pre-competitive agreements”, such as the SSC, between the key seafood buyers (supermarkets and wholesalers), about what ‘sustainability’ and ‘responsibly sourced’ terminology used in Australia could include. “In the end, it is

consumers that would benefit from agreement on these claims and processes, because they become defensible – businesses aren’t using these words or making claims without any substance behind them,” Sevaly Sen says.

“For example, consumers would know that if it is ‘responsibly sourced’, companies have done some risk assessment.

“It also benefits the companies involved because they’re all talking the same language, with agreement on what it means and the methods involved. It also defends their brand reputation.

“It’s not the whole picture of improving consumer and business confidence in Australian seafood, but it is part of the puzzle.” **F**

**Below** Katie Miller and Sydney Fish Market general manager Bryan Skepper. **Photos:** Catherine Norwood



## Sustainable seafood coalition initiative

The Sustainable Seafood Coalition (SSC) is a partnership of businesses whose vision is that all fish and seafood sold in the UK come from sustainable sources. During a presentation at the Sydney Fish Market in October 2016, Katie Miller from the SSC secretariat said there were three major drivers that led to the creation of the coalition and the codes of conduct in the UK. These were:

- A report by the European NGO ClientEarth in 2011, which had evaluated the sustainability claims on the labels of 100 seafood products purchased from supermarkets in the UK.

- The Fish Fight campaign, launched in 2010 by celebrity chef Hugh Fearnley-Whittingstall, to ban seafood discards in the European Union. Fish Fight was designed to push for the third driver.
- The reform of the EU’s Common Fisheries Policy, the legislation that regulates European fisheries management. After years of negotiations, the EU reforms were endorsed in 2013 and included a ban on the discards of commercial quota species, which is being progressively implemented.



# Carp clean-up campaign on the cards

As the FRDC investigates whether or not it is feasible to release a carp-killing virus, one fisher contemplates a future without his nemesis

By Tom Bicknell

While the rivers of the Murray Darling Basin heave with carp fingerlings after the highest level of recruitment in years, long-time carp fisher Steve Hounsell is considering a future river system without them.

Over the next two years, the FRDC will investigate whether and how to develop a plan for release of a naturally occurring, species-specific virus that could kill more than 70 per cent of the invasive carp in the river system.

As one of Australia's foremost carp fishers, Steve Hounsell has mixed feelings about the plan. On one hand, he sees the virus as a chance to address the ecological damage done by a fish he considers a plague. On the other, it could remove the foundation of his business.

## Planned approach

In May 2016, the Australian Government announced \$15 million in funding to develop the National Carp Control Plan for the potential release of the carp virus (also known as CyHV-3).

The plan, to be finalised at the end of 2018, is about figuring out how, when and where the virus would be released and managed. The government will then decide whether, as a nation, we should invest in executing the plan, once the environmental, social and economic benefits and costs of doing so have been carefully evaluated.

The plan will consider how to release the virus in the most effective way, how to monitor its impact on aquatic ecosystems, and how to avoid or minimise any adverse public health and environmental impacts. The question of what

legislation is required in Queensland, NSW, the ACT, Victoria, South Australia and the Commonwealth is also an important consideration. Should the virus be released, follow-up activities will also have to be managed. This will be accompanied by a community consultation and engagement process.

Steve Hounsell has been fishing in Victorian and NSW inland waterways for almost 40 years, initially targeting native fish before these commercial fisheries were closed. For the past 15 years he has focused on carp, and is responsible for more than half of the NSW carp catch, most of which is provided to fertiliser manufacturer Charlie Carp, based in Deniliquin. Commercial fishers like him are likely to have an important role in the clean-up and are also involved in the consultation process.

He's cautious, but keen to see what the carp virus can do. "I've watched the commercial inland fishery decline for 38 years because of carp. I hate carp with a passion," he says. "Environmentally, I like the idea. I think if it works as well as hoped it will be a good thing."

Apart from pushing out redfin and native fish species, Steve Hounsell says carp's bottom feeding stirs up silt, which contributes to algal outbreaks and reduces aquatic vegetation.

## Clean up critical

Carp now make up more than 80 per cent of fish biomass in many of Australia's inland waterways, and up to 93 per cent in some places.

Initial estimates – admittedly rough – suggest there may be upwards of 500,000 tonnes of carp in the Murray Darling Basin. If the virus kills more than 70 per cent of this biomass, that's



about 350,000 tonnes of fish. In comparison, Australia's total annual wild catch harvest is only about 150,000 tonnes. "That's a shitload of fish," sums up Steve Hounsell. And it's why planning for the staged release of the virus is critical. As part of the planning process biomass estimates will be refined, to understand more accurately the extent of the clean-up required, should the virus be released. A key priority of the plan is also to ensure that no public health or environmental issues arise from the release of the virus, so these risks will also be considered.

Options to handle the large volume of carp will be explored this year by the FRDC in a sub-project as part of the plan's development.

"We're in the process of setting up a project looking at how post-release follow-up activities could be safely and effectively undertaken," says FRDC project manager Toby Piddocke, who is overseeing this aspect of the plan. "A



**Above** Catch a Carp Day in the Mallee

Photo David Sickerdick

**Left** Matt Barwick is leading the National Carp Control Plan.

Photo Tom Chesson

**Far left** Carp make up more than 80 per cent of fish biomass in the Murray-Darling Basin.

Photo: Tom Chesson

level of resistance could be expected in those fish that survive. It is uncertain whether carp numbers would remain too low to support the continuation of business by Steven Hounsell and others, or whether they would rebound.

“The concern I have is a build-up of resistance or immunity to the virus, and the reproductive capacity of carp,” says Steve Hounsell. “I’ve seen lakes that within three years of being dry have a carp biomass density of 600 to 700 kilograms per hectare. Their reproductive capacity is incredible.”

FRDC’s National Carp Control Plan coordinator Matt Barwick says the potential for populations that don’t succumb to the virus will be taken into account.

“Eradication is extremely improbable. That’s why we need to have other tools in our arsenal to continue to suppress the carp numbers,” he says. These include more virulent strains of the virus, and strategies to skew the sex ratio of remaining carp populations, so that they effectively breed themselves out of existence.

Also critical will be expanding efforts to recover native species and improving habitat so that native species can effectively compete with carp.

Traditional measures including commercial fishing, trapping, carp-buster events and controlling access to carp breeding grounds will continue to be important components of an integrated strategy to control the fish. So too will measures to recover native fish species to help prevent carp numbers rebuilding.

Using this integrated approach, the long-term goal of the National Carp Control Plan is a 95 per cent reduction in carp numbers by 2045. **F**

part of that is talking to the people who are already harvesting carp to discuss appropriate methods, their strengths and limitations.” One much-discussed option for disposing of the dead or dying fish is to use them for fertiliser, but there are challenges to that.

“Once they die, bloating will bring them to the surface, and they’ll be easy to scoop up,” says Steve Hounsell. “But they’re starting to decompose then, and they’re no value for fish emulsion fertiliser at that stage. That needs food grade fish.”

### Controlled rollout

Managing the dead carp will be significantly easier with a regionally staged rollout of the virus. However, controlling the virus spread won’t be simple. Dispersal of the virus will be affected by water flow, and animals such as birds may further facilitate the spread of the virus. Steve Hounsell says he expects that the “human vector” could be

the most unpredictable in spreading the disease.

Modelling will be used to map the likely spread of the virus on release, and community communication and education to highlight the risks of unplanned spread of the virus will be incorporated into the plan.

### Post-virus future

Despite wanting to see the virus release happen, he has conflicting emotions about what it will mean for him.

“We’re in limbo at the moment,” he says. “I’ve been building the business up by 20 to 25 per cent per annum for the last five years, since the Millennium Drought, but now I’ve put the brakes on. There’s no point investing until we know what’s going to happen.”

Immediately after the release of the virus it is expected that carp numbers will drop dramatically. In the longer term, however, some



# Trace tech combats fraud

New initiatives are targeting mislabelling, fraud and quality control throughout the supply chain

By Annabel Boyer

**M**any Australian seafood producers target high-value markets, achieving premium prices by trading internationally on Australia's reputation as a 'clean and green' country with one of the world's most rigorous fisheries management systems.

Consumers also rely on Australia's reputation for safe, quality seafood and, increasingly, for seafood recognised as sustainable. But how easy is it to verify that the fish you're buying is

what it's supposed to be? Whole fish of similar species can be difficult to tell apart, and a single species can have multiple colloquial names, or multiple species the same common name, which can lead to unintended mislabelling.

Once a fish has been skinned and filleted, distinguishing different species can be virtually impossible. Even fillets from the same fish may look like they come from different fish, depending on who has done the filleting.

In addition to the unintentional mislabelling,

deliberate seafood substitution and fraud are reported to be widespread. A recent publication by Oceana, an ocean conservation group – *Deceptive Dishes: Seafood Swaps Found Worldwide* – produced to inform a US presidential taskforce to address illegal, unreported and unregulated (IUU) fishing and seafood fraud, found seafood fraud in all of the 55 countries investigated. It reports that, on average, one in five of 25,000 samples of seafood tested worldwide were mislabelled. While the report suggests that in Australia the problem is





Illustration: Sonia Kretschmer

more often one of identity confusion, intentional mislabelling cannot always be ruled out.

Two strategies that can be used to address identification issues are biologically based product validation and information-based supply chain traceability systems. These approaches often work in tandem and are becoming more affordable and accessible as a result of technological advances.

### Biological approach

Every organism has a unique genetic code, so DNA has the advantage of being tamper-proof. However, the costs of DNA analysis have until recently been too high to be commercially viable. But that is changing. New technology is making DNA analysis more affordable and accurate. A recent collaboration between the CSIRO and the Marine Stewardship Council (MSC) has been used to validate an individual fish, its species

“The prawn industry and the FRDC are set to join forces on a project that will test trace element fingerprinting as a method to validate the provenance of Australian prawns, identifying the locations where they have been farmed or fished.”

and the population or stock it came from, which in turn can identify where it was caught.

Geneticist Peter Grewe, population researcher Campbell Davies and the CSIRO are involved in a project using new techniques of DNA analysis to validate tuna stocks for the MSC.

Jaco Barendse, MSC’s product integrity traceability manager, says the research “was initiated in 2013 due to a need of the MSC to be able to confirm the origin of certified tuna, and therefore be able to detect any substitution should it occur”.

The next-generation DNA sequencing techniques used in the project have been able to identify ‘population signatures’ for discrete populations of Yellowfin Tuna in particular locations. The project sampled tuna from three different locations in the Pacific Ocean.

“This population signature has allowed for the ability to identify the point of origin of a fish with almost 100 per cent accuracy,” Peter Grewe says. The research also points out the fact that low development costs and high throughput of these techniques mean they can be applied on large enough scales to be relevant to fisheries assessment and management.

The research demonstrated that the Yellowfin Tuna population in the Pacific Ocean is made up of three discrete biological populations rather than just one, as previously thought. Thus the CSIRO findings have implications for management of the billion-dollar Yellowfin Tuna fisheries, which have been managed on geopolitical lines. New management strategies may be needed to better support the sustainability of separate biological stocks.

Campbell Davies says the wider use of DNA to validate both species and provenance will be contingent on a reference library of genetic information with which to compare samples. “If we look at the oceans as a jigsaw puzzle, three pieces have been put together. The next step is a global survey.”

Jaco Barendse says the next step in the MSC project is to confirm the origin of Skipjack Tuna as well as to test the technique on canned tuna

products. The MSC already conducts random DNA tests on many MSC-labelled products. However, this has been challenging for cooked and canned products, from which it has proven difficult to extract identifiable DNA. Much of the most commonly consumed and valuable fish species in the world, such as tuna and salmon, are consumed in canned products.

However, Peter Grewe says a proof-of-concept project that demonstrates DNA of sufficient quality for analysis can be extracted from these processed products has already been completed. The next step will be to test this concept more widely and ultimately determine its commercial viability.

### Trace element fingerprinting

Trace element fingerprinting (TEF) is a technique that was originally developed to authenticate diamonds from particular parts of Western Australia.

It has since been adapted for agriculture by the Australian pork industry, which has developed a tool called Physi-Trace™ to identify the provenance of Australian-grown pork. It does this by matching trace mineral markers from within the sample (this could include flesh, bones, shells or hooves) to a producer database and is more than 95 per cent accurate.

Now the prawn industry, Curtin University and the FRDC are set to join forces on a project (FRDC research code: 2016-261) that will test TEF as a method to validate the provenance of Australian prawns, identifying the locations where they have been farmed or fished. TEF has been selected for testing as a validation technique rather than DNA analysis because many prawns grown in South-East Asia come from Australian spawning stock and are likely to have similar genetic markers.

Warren Lewis of Aqua-Marine Marketing says the Australian industry has been concerned for some time that cheaper prawns grown in Vietnam or Thailand have been substituted for local product at the point of retail sale. Substitution has adverse consequences in regard to brand recognition →

“The Australian industry has been concerned for some time that cheaper prawns grown in Vietnam or Thailand have been substituted for local product at the point of retail sale.”

Warren Lewis, Aqua-Marine marketing

and development if an inferior product is sold under the brand of higher-quality product.

TEF has the potential to trace prawns back to the locations where they were farmed or fished, allowing confirmation of provenance and safe seafood. “In Australia, there is a lot of variation in the environmental conditions where farms are, and this technique could trace back to that,” Warren Lewis says. It will mean that producers – both fishers and farmers – can validate their product to ensure Australian prawns and different brands are being correctly labelled, valued and recognised.

### Traceability

Full supply chain traceability means being able to track a product through the supply chain to its source. It is another approach that can be used to validate product identity, at the same time as it protects food safety and quality.

Seafood is the world’s most traded commodity; the more players handling the product, the more difficult it becomes to confirm what it is and where it came from. From fisher to wholesalers and processors, food service distributors, restaurants and retailers, it’s often a long way before some products reach the consumer.

For businesses that supply food it is more important than ever to be able to track a product. This is as much true to ensure everything flows smoothly as it is to ensure contamination or food safety issues can be identified should something go awry.

Any system of traceability requires good organisation, communication, record-keeping and management to give certainty – and control – over the location and handling of a product through the supply chain.

New forms of barcoding and tagging are being developed to support seafood traceability. Smartphone technology and cloud computing are combining to make it easier to collect, record and access information as a product moves along a supply chain.

Several FRDC projects have investigated the suitability of electronic traceability systems on commercial prawn trawlers in Australia. Systems investigated and underway include

radio-frequency identification (RFID) chips – tiny devices that can store and transmit information – along with the application of barcoding of product on trawlers (FRDC research codes: 2012-702 and 2015-711).

Australian Wild Abalone has adopted a brand protection system, developed with support from the FRDC (2009-723). Tiny nickel tags suspended in an ultraviolet-light-sensitive adhesive are attached to the shells of abalone. The tags include a certification mark and an individual export code. An ultraviolet light is then used to scan the tag and validate this high-value, high-quality Australian product.

Tamper-proof tags have also been developed for the Southern Rocklobster fishery (FRDC research code: 2004-412). The development of robust, individually branded and barcoded lobster tags and a functional traceability system allow industry to offer a branded, quality guaranteed product. While individual industry sectors have been active in developing systems for specific products, Australia’s seafood sector as a whole does not have a coherent and overarching policy on traceability.

To that end, a series of workshops on traceability in the seafood industry have been convened by the World Wildlife Fund (WWF) during the past year to look at both traceability best practice and the need for a traceability system in Australia.

Ensuring seafood safety, meeting independent sustainability certification requirements, and protecting the marketing advantages gained from knowing product identity and provenance are among the growing number of drivers for whole-of-chain traceability.

The aim of the WWF workshops is to bring together all stakeholders from along the supply chain to discuss the basic requirements of a traceability system. The ultimate aim is to arrive at a ‘traceability statement’ around which different players in Australia’s seafood sector can base their traceability systems. The FRDC’s Josh Fielding attended the workshops and says they brought together a broad range of stakeholders to discuss the merits of seafood traceability. **F**

### FISHFACE VISUAL RECOGNITION TECHNOLOGY

The Australian-based arm of international green group The Nature Conservancy (TNC) is testing technology to identify fish caught on fishing boats using visual recognition software.

Peter Mous, from TNC’s Indonesia Fisheries Conservation Program, says the idea for the FishFace recognition program came about because it proved difficult to train quality control personnel in diverse fisheries in Indonesia to identify specific fish species.

The technology uses visual recognition software to accurately identify species.

Used on fishing vessels to identify species at the point of capture, FishFace is expected to provide more accurate information to improve sustainable fisheries management.

“So far, we have only tried it out on laboratory scale, with standardised pictures (ie, pictures that were all taken under the same conditions). We provided the software with a set of standardised ‘training’ images of 20 fish species and then provided the software with ‘test’ images of these same 20 fish species. Results were promising; the software got it wrong for only one species, despite the very small set of training images,” says Peter Mous.

The technology is powered by a machine learning engine developed by Swedish firm Refind Technologies. In standard conditions in the lab, photos are taken with a smartphone. However, use on a fishing vessel would require a system that could capture images more quickly and efficiently, he says. TNC won \$750,000 funding from the 2016 Google Impact Challenge to further develop the technology, building a library of fish images and to test the technology on fishing vessels. FishFace is being tested in Australia and will be trialled initially in Indonesia’s deep-water Snapper and grouper fisheries, with the potential to be rolled out for fisheries everywhere.

It could also be used to establish traceability by ensuring accuracy at the point of capture, which can then more accurately be validated through the supply chain. The Australian Fisheries Management Authority is also assisting with the project.



# Urchin harvest spikes demand

Many Australians remain unfamiliar with sea urchin roe as an ingredient, but efforts to develop a quality product are paying dividends both economically and environmentally

By Annabel Boyer

**“This is the sea on a rough day. It’s got some punch to it,” says Keith Browne, describing the taste of sea urchin roe. “It’s in the same league of flavour as an oyster but it has more of a lingering aftertaste.”**

Keith Browne is the co-owner of South Coast Sea Urchins, based at Merimbula on the NSW South Coast, where he and business partner Andrew Curtis have spent more than a decade developing wild-harvested Australian sea urchin roe into a viable business. Recently awarded a gold medal in *delicious* magazine’s produce awards, which spotlight new and native ingredients, produced with passion, knowledge and regard for the environment, things are starting to pay off.

Initially they supplied urchin roe mostly for the kina market. Kina is a lower-value product loved by the Maori population. But after a decade of product development, 45 per cent of their production is now higher-quality, higher-valued uni grade roe, favoured by the Japanese.

“The uni market is more about precision, getting the same size and same colour,” Keith Browne says.

The domestic market absorbs all of their production, with uni becoming a feature on the menus of many leading Australian restaurants.

South Coast Sea Urchins harvests two species of urchin – *Centrostephanus rodgersii* or Long-spined Sea Urchin and *Heliocidaris erythrogramma* or Purple Sea Urchin – at different times of the year. Keith Browne says



Photo: John Minehan

Left Diving for urchins has given Keith Browne a greater understanding of their impact on marine vegetation. Below Urchins harvested for South Coast Sea Urchins.



Photo: South Coast Sea Urchins

the former is stronger in flavour and beloved of well-seasoned eaters of urchin roe, while *Heliocidaris erythrogramma*, which he harvests from Victoria, has a more subtle flavour and is in demand from high-end restaurants.

## Harvest strategies

As an abalone diver, long before he thought of harvesting urchins, Keith Browne started to notice that abalone and rock lobsters were disappearing from the reefs he dived on and urchins were appearing in their place.

Sea urchins are voracious feeders and when in numbers can strip underwater reefs of most of their vegetation, leaving bare rock or barrens. The Long-spined Sea Urchin is particularly known for its devastation of underwater vegetation, but Keith Browne says both species can be damaging. “We learnt that by thinning urchins, the environment started to change; (it) started to revert back to what it was originally,” he says.

Fortuitously for South Coast Sea Urchins, healthier underwater environments produce better-quality urchin roe – a finding that has been confirmed by FRDC research. Keith Browne also contributed to the project, designed to develop and manage the sea urchin fisheries of NSW and eastern Victoria. The research found that roe quality improved when the concentration of urchins in barrens was reduced and when ‘transplanting’ them to fringe areas.

Multiple FRDC research projects have investigated sea urchins in NSW and Tasmania

to understand how they interact with other species such as abalone and rock lobsters and how they impact on marine vegetation. As these relationships have become better understood, projects have also examined the viability of harvesting sea urchin fisheries and establishing sea urchin fisheries.

South Coast Sea Urchins maintains detailed maps of the coastal areas it fishes on the NSW South Coast and in Victoria’s Port Phillip Bay. Keith Browne assigns divers to ‘manage’ and harvest specific areas so that the divers become attuned to how the environment changes in their area and the kinds of urchins, and roe, that environment produces.

He says that when divers first start working for him, they tend to harvest as many urchins as they can. But as they learn more about urchins and roe and how the available feed and environment influence roe quality, the divers refine how they fish, taking smaller quantities of higher-quality urchin. In turn they make more money.

He says the divers monitor their fishing areas every year, thinning urchins to maintain the vegetation, which adds value to the remaining urchins in the form of higher-quality roe down the track. “There is a lot of thinking that goes on behind the scenes, because if you don’t do that, the quality suffers badly and then the customers don’t want the product,” Keith Browne says. **F**



# Reopening the fishways

New efforts to overcome river barriers are helping to restore crucial life cycle travel for migrating fish species

By Bianca Nogrady

Photos: Catchment Solutions

Many fish, crustaceans and marine mammals are great travellers. From birth to spawning, they can travel thousands of kilometres through oceans and along rivers to a destination that is essential for reproduction, for food in various life phases and for the survival and abundance of their species.

But for many species in Australia (and around the world), these journeys are hampered by human infrastructure: roads, bridges, dams, earthworks causeways, bunds and flood barrages.

This loss of connectivity is having a devastating impact on the total biomass of fish, crustaceans and marine mammals. It inhibits their ability to migrate in order to complete various life stages because their ability to become mature or spawn is dependent on being able to access specific environmental conditions. This in turn means dwindling stocks, as well as the degradation of marine and freshwater habitats.

In Australia, fish and crustaceans that migrate between the sea and freshwater tend to be catadromous – they are born in saltwater, the juvenile fish swim up estuaries to rivers or other freshwater to grow to adult size, and finally migrate back to the estuary or ocean to spawn. These include species important to commercial and recreational fishers, such as Barramundi, Mangrove Jack, Jungle Perch, most species of mullet, as well as many prawns and crabs.

This contrasts with Northern Hemisphere species such as salmon, which migrate upstream as adults to spawn.

“If you have barriers in the way, then those juveniles, who are generally the weakest swimmers of those species, can’t get to those nursery grounds,” says Trent Power, an aquatic ecologist with Catchment Solutions.

“Or where they once might have been able to get there for 20 to 30 days a year during adequate flow, now they might only be able to get

there for one or two days a year when these barriers are drowned out and movement becomes unrestricted.”

Barriers to migration have already been implicated in the decline in Jungle Perch numbers ([frdc.com.au/stories/Pages/16\\_Jungle-Perch-go-wild.aspx](http://frdc.com.au/stories/Pages/16_Jungle-Perch-go-wild.aspx)) over the past 30 years. These fish used to be found from Cape York to northern NSW, but have now dwindled to small areas in northern Queensland.

Loss of connectivity also makes a population much more vulnerable by splitting it into smaller groups. “The more fragmented a population is, the less diversity and the less resilience it has against change,” Trent Power says.

Loss of connectivity plagues coastlines, estuaries, river and species biodiversity and abundance right around Australia, says natural resource research scientist Colin Creighton, who has led many estuary restoration ecology projects, including the *Revitalising Australia's Estuaries*

**Before (left) and after (below right)**

The removal of a barrier at the Gooseponds in Mackay has included rock ramps to slow water flow and

strategically placed boulders and riparian vegetation to improve bank stability.



report for the FRDC. He is also currently a director of Greening Australia.

He says the estuaries of the south-eastern Australian coastline have largely disappeared, while the salt marshes of Tasmania are similarly under threat.

### Simple steps

The simplest solution is to do away with the barriers. “Engineering-wise it’s pretty easy: let the tide back in, it will kill the freshwater weeds and everything will work fine,” Colin Creighton says.

This approach has already proved spectacularly successful in the wetlands of Mungulla Station in northern Queensland. The traditional owners of the land, the Nywaigi people, removed a bund that had been put in decades ago to turn the wetlands into ponded pastures. Within two years, the wetlands were transformed from a weed-choked, oxygen-starved wasteland into a flourishing ecology; the saltwater tide restoring native vegetation, fish and

birdlife. “We see this project as a great model of how we can get these lower floodplains to be more productive for all,” Colin Creighton says.

But if a blockage has to remain in place, such as for irrigation or town water supply, then this is where fishways or fish ladders come in.

“The simplest way of defining a fish ladder or a fishway is that they’re a set of stairs for fish,” says Tim Marsden, head of Australian Fish Passage Services. “Instead of going up one big step over the weir or dam, we create a series of smaller steps that they can negotiate, just as we do when we go up a set of stairs.”

Fish ladders have been used in the Northern Hemisphere for many years to help migrating salmon make their way upstream to spawning grounds. But those fish are adult and have the ability to jump; something that Australian species lack. This means fish ladder designs must be tailored specifically to Australian fish.

“Instead of going up one big step over the weir or dam, we create a series of smaller steps that they can negotiate, just as we do when we go up a set of stairs.”

Tim Marsden, Australian Fish Passage Services

### Ladder options

There are five main types of fish ladders. Which one is used depends on factors such as the height and width of the barrier, the size of the river, the materials available and the fish species and sizes that use it.

At the smallest and simplest end of the scale are fishways that are effectively a ramp studded with rocks and boulders that create a series of small steps for the fish to work their way up. A design such as this is in use near the Mackay Botanic Gardens off the Pioneer River; a project that was supported by the FRDC and the Biodiversity Fund.

But a fish ladder like that will only work for structures of less than 1.5 metres, such as those on the lower floodplains estuaries. Taller structures require a more sophisticated solution. This might take the form of a cone or a vertical slot fishway. These are essentially stepped fishways, providing a controlled flow of water with obstacles such as concrete cones or small walls that create slow-flow areas for the fish to rest.

For even higher barriers things start to get even more technical with solutions such as fish locks and fish lifts. Fish locks work much the same as boat locks; the fish are attracted into a holding area at the base of the lock, then this periodically closes and the water level inside the lock is increased until it matches the level at the top of the lock and the fish are released above the obstruction. Fish lifts are like elevators in buildings; the fish are enticed into a space, then trapped, raised above the level of the barrier and released. While the engineering might sound relatively simple, designing and building an effective fishway is a complex, multidisciplinary project that needs engineers, fish biologists and hydrologists to make sure that the fishway works for as many species and sizes as possible and under as broad a range of flow conditions as possible.

“We’re passing everything from 20-millimetre gudgeons through to 1.2-metre-long Murray →

**Before (below left) and after (below right)**

Building a rock ramp fishway at Blackrock Creek, Mackay, helps to reduce flow velocity and provides resting places for juvenile fishing travelling upstream.



Cod or half-metre-long Barramundi,” Tim Marsden says. “In North Queensland I’m currently trying to pass fish as small as 10 millimetres.”

**Flow rates matter**

The fishway must be designed so that the flow rate of water isn’t too strong for these comparatively weaker swimmers. It must take into account the risk of exposure to predators such as herons. And it must be suited to the local climatic conditions, which can range from monsoonal flood pulses to steady winter rain.

Trent Power says new barriers and fishways should be designed to maintain adequate passage over the whole flow cycle, while the aim with retrofitted fishways is to provide this for as much of the flow cycle as possible.

“Up in northern Queensland, we get really high intensity flows at certain times of year over the wet season, but they quickly abate and then you’re left with a really low baseload that might persist for two to three months after that initial big flood pulse,” he says. “That’s generally when the barriers are most restrictive to fish movement and it’s during these flows that you want your fishway to operate at its optimal capacity.”

Fish ladders and fishways will never be as effective as a completely open watercourse, but how effective can they be?

“The smaller the structure is, the more efficient

(fishways) tend to be, if they’re built correctly. The wider the river and the higher the structure, the less and less efficient they will become,” Tim Marsden says. “The large numbers of fish that are migrating in these very big rivers, you simply can’t accommodate them through a fishway because the fishway has to be the size of the dam and there’s never enough money to make it that way.”

The big challenge for those working with fishways is the lack of monitoring that happens after a new fishway is installed.

Tim Marsden says this makes it difficult to learn from each fishway to improve future constructions.

“You have to do a very thorough assessment to know how efficient they are and there’s never enough money for monitoring,” he says.

**Unexpected results**

He gives the example of a fishway that was built to enable the migration of Golden and Silver Perch in the Murray-Darling Basin. These fish are usually about 10 centimetres long. Then one day the water flow through the fishway was turned down to a mere trickle and suddenly millions of 20-millimetre gudgeons began travelling through the fishway.

“We didn’t even know these things migrated, but because we created the conditions that were suitable for them to move, we

learned that they in fact do undertake migrations in large numbers,” he says.

Similarly, when he began working in northern Queensland, the assumption was that fish only migrated during the peak of the wet season – from December to March – and only big fish migrated. But a new fishway installed on the Fitzroy River barrage at Rockhampton is allowing 20-millimetre mullets to move upstream in September/October/November.

“They don’t care about the wet season,” Tim Marsden says. “They’ve got completely different migration patterns that people didn’t recognise previously because they didn’t look. But when we sample fishways, we learn and the next iteration of fishways can benefit with that learning.”

He says that without proper monitoring, it will be difficult to assess the impact of the new fishway on the barrage. “But the fact thousands of baby mullet passed the barrage for the first time in 40 years will be a significant change that people should see over the next few years.”

**Complex decisions**

While the new fishway is an improvement on the previous design, it still has limitations; it only works for certain levels of river height and flow.

To further improve connectivity, Joanne Coulter, a recreational fisher and resident in the Rockhampton area, is advocating construction of channels to connect a series of floodplain wetlands and bypass the barrage altogether.

Her proposed bypass would link a small creek above the barrage with a series of large floodplain lagoons to the south of Rockhampton and thence to tidal creeks below the barrage.

As well as allowing fish to migrate up and down, she argues that a fishway bypass would help the prawn populations in the downstream mangroves, which are negatively affected by the large flushes of fresh water released when the barrage is opened.

Some investigations have already been undertaken into this proposal, which has been criticized as “simplistic”, and alternately hailed as “visionary” by different members of the scientific community.

Discussions in the local community are ongoing, but the debate over the proposal highlights the challenges and complexity of reconnecting flows, and negotiating infrastructure investment against both positive and negative environmental impacts. **F**



# ‘Fish hotels’ help river residents to reconnect

Efforts to re-establish river snags are bringing residents of both the waterway and the local community back to the reaches of the lower Darling

By Catherine Norwood



For more than two years, members of the Barkindji Maraura Elders Environment Team (BMEET) have been working with the Murray-Darling Freshwater Research Centre (MDFRC) and La Trobe University to restore fish habitat in the lower Darling River near Wentworth, on the NSW-Victoria border.

They have been building and installing ‘fish hotels’, re-creating river snags to improve biodiversity in the waterway. Large stretches of the river were cleared of snags in the mid-to-late 1800s to provide passage for paddle-steamers and many areas have remained relatively barren of both fallen woody debris and fish ever since.

“We want to encourage more fish into stretches of the river where there are currently very few,” says MDFRC ecologist Paul Brown.

Many Australian fish species are found in association with ‘snags’ – large woody debris in rivers. Generally, snags provide a velocity refuge in flowing water that allows fish to save energy. They provide shade and physical protection, or hiding places, for both predators and prey.

Invertebrates such as shrimp eat the slimy matrix of algae, bacteria, diatoms and fungi that grows on the woody surface of snags. Herbivores such as Bony Herring graze on filamentous algae that grow on the wood, while small fish species such as gudgeons and rainbowfish prey upon

“Essentially, snags are the supermarkets of the river system. You can get all your provisions there and if you hang around long enough you’ll see everyone in town.”

Paul Brown, MDFRC ecologist

small shrimp and other invertebrates. Ambush predators such as Murray Cod and Golden Perch can also often be found lurking around snags.

“Essentially, snags are the supermarkets of the river system,” says Paul Brown. “You can get all your provisions there and if you hang around long enough you’ll see everyone in town.”

The project has been funded over two years by the NSW Recreational Fishing Trust, in conjunction with the MDFRC, and has focused on a “low-tech” solution that could be easily implemented.

BMEET manager Dameion Kennedy says it has provided employment for members of the local Barkindji community and has also been an important opportunity for trainee rangers to connect with their country.

The Barkindji people are based on the floodplains of the Murray and Darling rivers, which

meet at Wentworth, but Dameion Kennedy says it is often difficult to gain access to the river and adjacent floodplains as the land is privately owned.

However, in the case of the BMEET project, local landholders Ormond and Kelso McLeod were happy to cooperate with the rangers, who installed the fish hotels along a five-kilometre stretch of their property, where it fronts the Darling River. Dameion Kennedy says this also provided an opportunity to identify middens, scar trees and other signs of Indigenous life along the riverbanks and to share the associated cultural traditions with the younger members of their team.

The fish hotels were pre-assembled at BMEET’s Dareton workshop, using Mallee timber donated by another local landholder. Two different structure designs are being trialled, both less than two metres high.

Nine of the fish hotels were installed in 2015, with a further 20 installed in 2016.

However, it may not be long before the signage also alerts boaters to the most likely fishing spots.

Paul Brown says sampling around the structures indicates they have successfully begun increasing biodiversity.

Sampling in 2015 found the constructed snags had attracted a similar mix of species as those found around naturally occurring snags, although larger fish were still absent. Further sampling will be undertaken later in 2017. **F**



# Acidic oceans challenge oyster survival

Climate change predictions have intensified Australian efforts to improve the resilience of oysters to increasing ocean acidification

By Annabel Boyer

Between 2005 and 2009 billions of oyster larvae raised in sea-based hatcheries off the north-west coast of the US died when an influx of highly acidic ocean water compromised their ability to grow shells.

During this period, upwellings of cold, carbon-dioxide-rich water from the deep ocean moved onto the continental shelf, inducing the kind of ocean acidification condition scientists believe could be commonplace in the not-too-distant future.

To date, this has been a localised phenomenon in the US, but it has already cost the oyster industry there millions of dollars and thousands of jobs. It has also served as a worldwide alert about the very real impacts of increased global carbon dioxide emissions, climate change and ocean acidification.

## Less carbonate

Ocean acidification occurs as seawater absorbs carbon dioxide from the atmosphere, producing a chemical reaction that increases the acidity of the water and reduces the dissolved carbonate ions in the water.

When fewer carbonate ions are available for use in forming shells, it is difficult for molluscs and other calcifiers, such as crustaceans and corals, to form and maintain their shells or exoskeletons.

Since the beginning of the Industrial Revolution, the acidity of surface ocean waters has increased by 0.1 units, or 26 per cent. It is estimated that by the turn of the next century the world's oceans could be nearly 150 per cent more acidic than they were in 1750.

## Australian challenges

Ocean acidity is already a recognised issue for Australian oyster growers. Acid sulphate soils are common in many of the catchments on the south-east coast where oysters are grown, and these can flush acid into an estuary when disturbed or drained, increasing water acidity.

Increased climate variability on the south-east coast – a designated ‘climate hotspot’ – is also expected to exacerbate fluctuations in temperature and salinity levels, along with more variable and extreme rainfall.

Researchers at the Port Stephens Fisheries Institute (PSFI) have focused on the variables of temperature, salinity and pH for many years,

but have ramped up their efforts during the past decade, in light of climate change projections.

PSFI director Wayne O'Connor says ocean acidification is an old problem with a new focus for NSW oyster growers. “A whole variety of people have been looking in at the same room through different windows. Now one of those windows is climate change,” he says.

“From our perspective this interest is adding to our understanding of the physiology of the oyster and the variables we are interested in and that can only be a good thing.”

## Implications for growers

At the University of Sydney, Laura Parker has been studying the implications of ocean acidification for oysters in NSW, in collaboration with the PSFI. “I wanted to do work that would help industry understand how they might be affected by these changes,” she says.

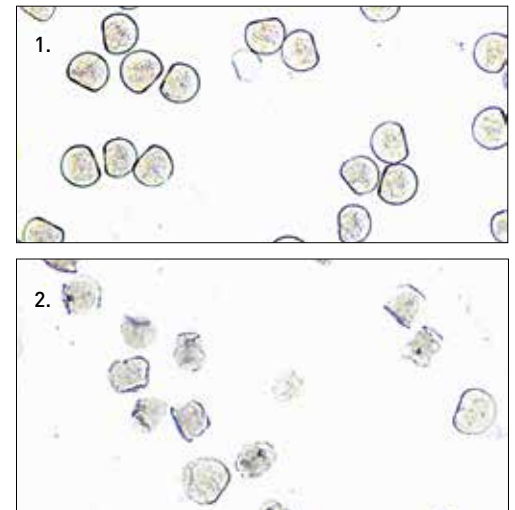
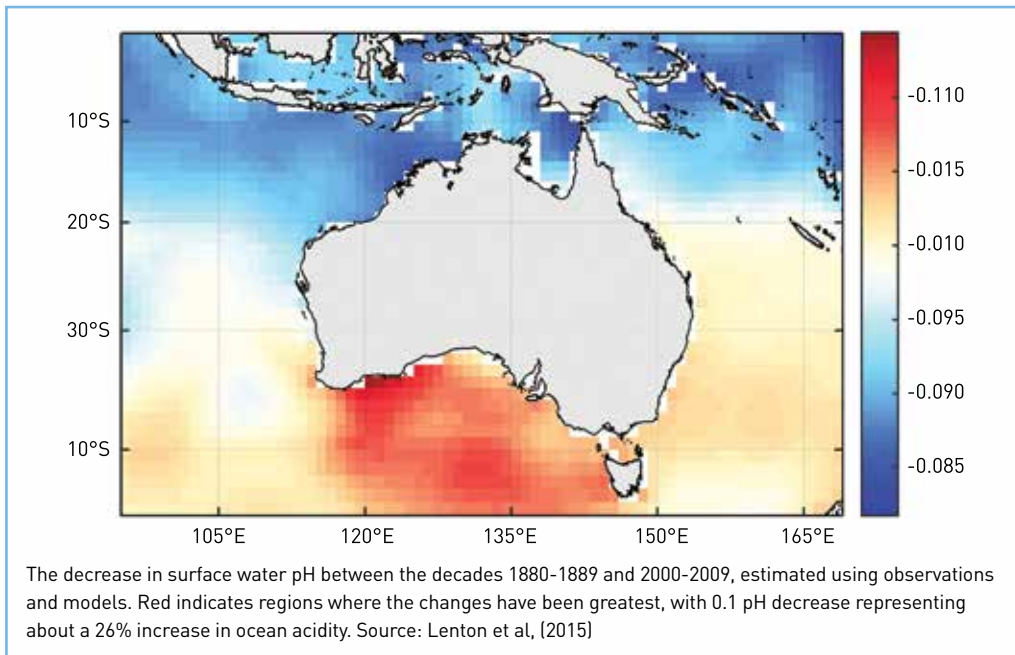
“Oysters are ecosystem engineers which provide habitat and shelter for other organisms in their environment and improve water quality by filtering the surrounding seawater. In addition to this, oysters are an important source of protein in Australia and around the world and form large aquaculture industries.”

The research began with an investigation of the ability of mollusc larvae such as oysters to cope with changes in ocean acidification, temperature and salinity. Researchers exposed Sydney Rock Oysters (*Saccostrea glomerata*) and Pacific Oysters (*Crassostrea gigas*) in their larval stages to varying temperatures and acidity – both of which are predicted to increase – and



Sydney Rock Oysters grown and harvested at Pambula on the NSW south coast.  
Photo: Annabel Boyer





1. Healthy Sydney Rock Oyster larvae grown in 'normal' sea water. 2. Sydney Rock Oyster larvae struggling to survive, grown under elevated carbon dioxide conditions, as predicted for the end of the century (1000 µatm). Photos: Laura Parker, University of Sydney

found that the oyster larvae were badly affected. Oyster larvae grown under these conditions exhibited irregular shell growth and the more extreme the conditions they were exposed to, the more extreme were the adverse effects.

Having established that oysters would be affected by ocean acidification, the next question was whether some strains of oysters might have resilience.

Laura Parker says the research was greatly helped by work that had already been done at the PSFI to breed different strains of Sydney Rock Oysters for speedy maturity and resilience to the QX parasite, an area of FRDC investment.

### Improved resilience

"We got access to particular lines of oysters and we found that these lines were far more resilient to changes than other oysters," she says.

Once the researchers had established that it was possible to produce oysters with resilience to more acidic ocean conditions, they began to investigate whether this resilience existed in wild oyster populations. They collected oysters of breeding age from the wild, when they were not in a state of reproduction, and gradually began to expose them to higher acidity and temperature, while feeding them well.

By growing adult oysters under these conditions, they hoped to create an environment in which the oysters would pass on beneficial characteristics to their offspring to deal with the ocean conditions of the future. This phenomenon, whereby a parent passes on characteristics to deal with an environmental condition being

experienced, is called parental carry-over effect.

Oysters with an inbuilt resilience to higher acidity and temperature resulted from this research and are now being bred. "This is an important result as it provides evidence to suggest that the wild oyster population may have the capacity to acclimate or adapt to ocean acidification over this century," says Laura Parker.

"It has also allowed us to incorporate oysters that are resilient to ocean acidification into the NSW Department of Primary Industries' oyster breeding program, helping to 'future-proof' the NSW oyster industry."

One of the advantages of the new oyster lines is that they are able to put on shell at a much faster rate. This is an important advantage for baby oysters at the time when they are most vulnerable. Laura Parker is now investigating the mechanism whereby the oyster larvae grow their shells faster.

The PSFI team is also researching the likely climate change impacts on Native Oysters (*Ostrea angasi*), scallops and Yellowtail Kingfish (*Seriola lalandi*).

### Research efforts improve resilience

In an area where the questions are endless, but resources are thin, the Global Ocean Acidification Observing Network (GOA-ON) is an international organisation which aims to share data and build capacity to document the effects of ocean acidification on the world's marine ecosystems.

Australian researcher Bronte Tilbrook is co-chair of GOA-ON, which involves 65 countries and provides consistency and quality control in data collection that will allow

ocean acidification trends and changes to be identified on local through to global scales.

Much of the Australian data published through GOA-ON is collected through the national Integrated Marine Observing System (IMOS).

Bronte Tilbrook and colleagues at CSIRO's Oceans and Atmosphere Cooperative Research Centre have used observations and models to develop maps of how conditions have changed in Australian waters since the 1870s.

"The maps are providing the first indication of variations in waters sweeping through much of Australia's coastal seas from offshore," he says. "We are working to drill down to local environments to understand the variability in, say, shellfish producing regions. By identifying the current levels and rates of change in ocean acidification we start to understand the future shifts and pressure points in ecosystems and how to develop strategies to offset the problem."

An example of this, he says, is the response to the oyster production crisis in north-west US in 2005. The industry worked with researchers to identify ocean acidification as the culprit. Ways to work around the problem were developed and the hatcheries returned to full production by about 2009. The region has now installed monitoring devices along the coast as a warning system, and other countries, including New Zealand, are developing similar monitoring programs.

GOA-ON is at the epicentre of developing strategies to define how to observe and identify the responses of ecosystems and organisms to changes in ocean acidification. **F**



# Leaders aim to strengthen national seafood identity

Diverse perspectives find common ground among the aspirations of a new generation of seafood sector leaders

By Catherine Norwood

Generating greater recognition of fishing and seafood as a quintessential part of Australian culture – that’s one of the aims of projects undertaken by participants of the 2016 National Seafood Industry Leadership Program (NSILP).

The communications officer for the Western Australian Fishing Industry Council, John Duffy, was one of the 16 participants in last year’s program.

He says he was surprised by the strength of the shared desire to more strongly connect the seafood sector as an intrinsic part of Australia’s national identity, heritage and economy.

While there are already so many ways that Australian society identifies with seafood, he says the group recognised it was important the next generation of industry leaders continued efforts to maintain and enhance these connections.

Participants in the 2016 program included representatives from research bodies,

government, small business, professional fishers, big seafood companies, peak fishing industry bodies, a peak recreational body, industry consultants, a world-class fisheries certification agency and the Indigenous sector.

The NSILP runs across eight months and John Duffy says it gave him huge exposure, within a short time frame, to a broad cross-section of the industry. “I learned a great deal, both professionally and personally, from all involved – participants, facilitators and presenters,” he says.

Another participant, Paul Jordan, a second-generation commercial fisher from King Island, also says the program was valuable in broadening his perspective of the sector. “Having grown up in a fishing family I really hadn’t thought much further afield than issues that face us as commercial fishers,” he says.

“But the more I listened to everyone’s thoughts and ideas, the more I started to realise that fishers, seafood wholesalers,

retailers, marine scientists, aquaculturists and even recreational fishers – this one surprised me the most – want the same thing and face similar issues.”

The 2016 NSILP concluded in November with an intensive week of meetings with politicians including Deputy Prime Minister Barnaby Joyce, Senator Anne Ruston, other members of Parliament and their senior advisers.

The meetings were followed by a formal graduation ceremony and dinner, with participants providing an overview of the projects they worked on in teams during the year.

Group projects included:

- creation of a street art ‘seafood trail’ to promote the seafood industry at the Australian Wooden Boat Festival in February 2017;
- a “#thiscouldbeyou” social media campaign to raise the understanding of career opportunities available in the seafood industry;
- a widespread media blitz to generate understanding of the contribution of the fishing industry to the broader community; and
- a photographic exhibition and campaign for International Women’s Day 2017, celebrating the contribution of women to the seafood industry.

Jill Briggs, NSILP program manager from Rural Training Initiatives, says continuing investment in developing leadership capability in the fishing and seafood sector was the best way to improve the resilience of Australian industries. The program provides skills sessions and practical activities that enhance participants’ knowledge and confidence to lead their industry into the future. **F**

**2016 NSILP graduates**  
**(back, from left)**  
 Matt Watson, Zak Olsen, Dan Kimberley, Dale Maschette, John Duffy, Asher Flynn, Felipe Henriquez, Markus Nolle, Emma Wilkie, Mike Gilby, Dom Pirrello  
**(front, from left)**  
 Paul Jordan, Josh Pearce, Laura Smith, Brenton Cardona, Heidi Hansen



Photo: FRDC



Photo: Evan Collis

## Seafood trail art poster

Promotional posters wrapped around lampposts in Fremantle provided Matt Watson (left) and Asher Flynn and other members of their NSILP team with the idea to create a street art seafood trail, which premiered at the Australian Wooden Boat Festival. Held in Hobart from 10-13 February, 2017, the festival provided exposure to thousands of people with an interest in boats, boating and all things marine.

Matt Watson says the project displays information promoting the diversity of the seafood industry on lamppost wraps, which created a community trail winding throughout the festival site at Salamanca Bay. Those who undertook the tour – mostly families – won prizes by following the trail and answering questions using information on the posters.

He says the Wooden Boat Festival was essentially the pilot for an industry promotional strategy he hopes will be adopted at other relevant events, including a variety of seafood festivals held across Australia during the year. He says the same poster designs could be used, or local event organisers might choose to develop their own bespoke posters within the industry tour framework. **F**

## Celebrating women in the seafood industry

International Women's Day, Wednesday, 8 March, 2017



### Annie Jarrett

Chief executive officer,  
Northern Prawn  
Fishery Industry

#### How did you get involved with the seafood industry?

I was working in tourist resorts in the Whitsunday Islands when some of the Northern Prawn Fishery trawl boats came through on their way to the Gulf of Carpentaria for the start of the 1980 fishing season. One of the skippers asked me if I wanted to go to the Gulf and offered me a job as a cook/deckhand. It seemed like a fun and adventurous thing to do, so I said yes and the next day we were heading north!

#### What led you to choosing this as a career?

I didn't really choose this career – it chose

me! I totally fell in love with the Northern Prawn Fishery and the industry in general when I went fishing in the Gulf in 1980.

#### Do you have any particular goals?

My personal goal is to have the Northern Prawn Fishery operating as Australia's first successful, fully delegated, third-party-audited, co-managed fishery, whereby government delegates the majority of NPF fishery management functions to our industry body, in the next three to five years.

#### What are you most passionate about in relation to your industry?

I'm equally passionate about ensuring that we harvest our fisheries in an environmentally responsible manner and that our fisheries generate profits. Fishing is hard work. It takes a lot of commitment and financial investment, and fishers are often away from home for long periods

of time. I strongly believe that our fisher folk deserve good economic returns for their efforts, providing their fishing practices are sustainable.

#### What are the opportunities for women in our industry?

Opportunities for women are limitless these days. When I first started the few women involved were mainly in seafood processing. Now we are involved in every aspect of the industry, from deckhands and skippers and aquaculture production, to scientists and fishery managers. Many women own and operate seafood businesses – from boats to retail outlets. There are a lot of women like myself in leadership roles. And we have our first female federal fisheries minister! It's been great to see the growing involvement of women in the seafood industry over the years – I'm really proud to be part of that journey. **F**



# Fisheries growth and new research priorities

Knowledge, partnerships and research capacity continue to play important roles in sustainable fishing and aquaculture sectors. FRDC reports to Parliament and its stakeholders about its activities over the past financial year.

**T**here was strong financial growth in the Australian fishing industry in 2015-16, with the gross value of production increasing to \$2.71 billion.

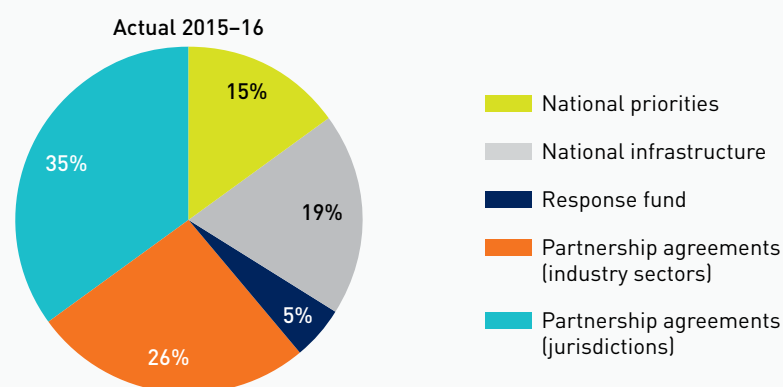
The increase was driven by solid production for a number of sectors, the value of the Australian dollar, lower fuel prices and expanding markets arising from new free-trade agreements. However, some inshore fisheries continue to operate in a difficult social environment.

Access to marine resources continued to be a major issue, which has led to conflict and changes in policy and management of a number of fisheries around Australia. This trend is likely to continue in the short term with new marine park boundaries due to be released in the latter half of 2016. In addition, management of oil and gas exploration, in particular seismic testing across Australia and its interaction with the fishing and aquaculture industry, remained a contentious and topical issue.

During the year, FRDC's 'New and emerging aquaculture opportunities sub-program' began to see results, with two new fish farming sites in NSW and Western Australia coming on line. These sites will see significant growth in production volumes and capacity. Other aquaculture sectors, namely prawns, abalone and Barramundi, also started work during the year on increasing capacity and production in 2016-17.

The FRDC has maintained strong partnerships with seafood industry councils, recreational fishing bodies, peak bodies, fisheries managers, science providers and the Australian Government Department of Agriculture and Water Resources (DAWR) during the year. Work has also been undertaken to improve engagement with Indigenous communities across the country.

RD&E budget expenditure 2015—2016



## RD&E Plan

The FRDC inaugurated its new RD&E Plan 2015-20 during the year, which signifies a quantum change in how FRDC invests in RD&E and new directions in research priorities. There will be a focus on the fewer key priorities identified by our stakeholders. 'Lead, collaborate and partner' are the core principles that will drive how the plan is implemented. Nationally, FRDC will work with lead bodies to deliver three national research priorities:

1. Ensuring that Australian fishing and aquaculture products are sustainable and acknowledged to be so;
2. Improving productivity and profitability of fishing and aquaculture; and
3. Developing new and emerging aquaculture growth opportunities.

The FRDC will encourage its regional and sector partners to collaborate wherever possible. Importantly, FRDC is committed to continuing its support for people development, the Indigenous Reference Group, Recfish Research and key services including the Australian Fish Names Standard and SafeFish.

Two new industry partnership agreements (IPAs) were signed with the Australian Council of Prawn Fisheries and the Australian Abalone Growers Association.

The year also saw the implementation of a new business model with the opening of its first regional office in Adelaide in April 2016. New staff were employed to oversee the delivery of key services including delivery of the *Status of Australian Fish Stocks Reports* and regional research advisory committees, formerly known as Fisheries Research Advisory Bodies.

## Community perceptions

Community perceptions of the sustainability of Australia's fisheries remains an ongoing challenge and a key area of focus for the FRDC. Since 2011, the FRDC has commissioned a biennial survey to gauge community perceptions about the achievements and ongoing investment being made by fishing and aquaculture in achieving long-term sustainability.

Respondents to the most recent survey (13–19 August, 2015) indicated that the community's perception of the fishing industry increased slightly.

However the rating of the commercial fishing sector fell to the lowest level in the five years of perception surveys, with fewer than one in four supporting it.

Overseeing the management and development of the *SAFS Reports* is one of the FRDC's strategies to communicate reliable scientific knowledge to business and the community.

The FRDC also provided advice and assisted with market research to a DAWR project aimed at improving public understanding of the seafood industry and fisheries management.

## Marketing

Minister of Finance Senator Mathias Cormann approved a change to the FRDC's outcome statement on 15 March, 2016, to incorporate changes to the *Primary Industries Research and Development Act 1989* (PIRD Act), allowing RDCs to fund marketing activities, as well as placing a greater emphasis on extension and adoption activities.

### 'Rural R&D for Profit' program

An FRDC-sponsored project was successful in round two of the 'Rural research & development for profit' program. On 6 June, 2016, Senator Anne Ruston announced \$236,275 to investigate the use and commercialisation of an automated oyster opening system.

### Aquatic biosecurity

Two major disease outbreaks occurred during the year – Pacific Oyster Mortality Syndrome (POMS) in Tasmania, and a disease with similarities to *Penaeus Monodon* Mortality Syndrome which affected Black Tiger Prawns in Queensland's Bundaberg region. These led to a reprioritisation of funding and a heightened level of awareness and biosecurity around aquaculture facilities.

**Table 1: Financial indicators of R&D investment**

Expenditure	2011–12	2012–13	2013–14	2014–15	2015–16
	\$m	\$m	\$m	\$m	\$m
<b>Total expenditure</b>	<b>29.68</b>	<b>25.69</b>	<b>27.56</b>	<b>28.16</b>	<b>28.33</b>
Total of R&D projects	25.98	22.14	22.87	24.85	24.58
R&D Program 1 (Environment)	11.80	8.25	10.20	10.44	8.68
R&D Program 2 (Industry)	9.47	9.57	8.33	10.09	11.54
R&D Program 3 (Communities)	0.47	0.74	0.75	0.83	0.86
R&D Program 4 (People)	2.12	1.80	1.94	1.49	1.54
R&D Program 5 (Adoption)	2.12	1.78	1.65	2.00	1.95
Management and accountability	3.70	3.55	4.69 <sup>(1)</sup>	3.31	3.76
<b>Total income</b>	<b>25.42</b>	<b>25.98</b>	<b>26.89</b>	<b>31.75</b>	<b>30.12</b>
Industry contributions	7.70	7.98	8.46	8.57	8.29
Total government contributions	16.63	17.23	17.93	18.71	20.05
Project funds from other parties	0.46	0.48	0.17	4.27	1.48
Other revenue	0.63	0.29	0.33	0.20	0.30
Maximum matchable (government) contribution <sup>(2)</sup>	5.56	5.83	5.99	6.25	6.78
Actual government matching	5.51	5.57	5.96	6.22	6.48

1. In 2013-14, FRDC had a \$1.2 million write down of assets which increased the cost of management and accountability.

2. Government funding and maximum matchable contribution (the maximum amount to which the Australian Government will match industry contributions)

## Research evaluation

The FRDC has developed a flexible approach to how it funds projects to align with its current RD&E Plan (2015-20) and the principles of 'lead, collaborate and partner'. Reflecting this new approach, the value or benefit of research is assessed (and presented in the annual report) against two sets of categories: national priorities or infrastructure, collaboration or partnerships (sector or jurisdiction); or FRDC's five foundation programs (Environment, Industry, Communities, People, Adoption). This change ensures that projects are now assessed not only on the output value from input but also against the outcome or benefits of FRDC research.

This demonstrates the fact that a single project can cross a number of fields and identifies where a project sits within the FRDC's investment framework.

## Parliamentary inquiries

The FRDC provided input into the following inquiries:

- Productivity Commission inquiry into regulation of the Australian marine fisheries and aquaculture sectors;
- Inquiry into opportunities for expanding the aquaculture industry in northern Australia;
- Inquiry into large-capacity fishing vessels operating in Australia's marine jurisdiction; and
- *National Research Infrastructure Capability Issues Paper*. **F**

A complete copy of the FRDC's Annual Report 2015-16 is available from the FRDC's website at [www.frdc.com.au](http://www.frdc.com.au).



# Formula for fisheries success

A big picture approach drawing on economic, market and scientific data has helped Roger Edwards lead fisheries to sustainable growth

By **Melissa Marino**

**N**ine years ago, Roger Edwards tried to leave the seafood sector. He had been running an economics, business and marketing consultancy for close to 20 years, working with fisheries as diverse as Southern Rock Lobster, Blue Swimmer Crab, oysters and prawns. But the passion had waned.

A decade-long campaign to secure protection and compensation for displaced fishers had been successfully concluded with new South Australian legislation, and the time seemed right to move on. So Roger Edwards and his partners wound up their fisheries consultancy, Corvel Marketing and Management, to concentrate on grain marketing.

But the decision proved premature. A year had not passed before the lure of the fishing sector drew him back to help a group of South Australian pipi fishers at a parliamentary inquiry into their quota allocation. The political realm was familiar to him after years of negotiating with governments on behalf of various fisheries. But it was the pipi fishery itself that proved the major drawcard for its unique qualities, considerable growth potential and location.

“As luck would have it, I have always visited and enjoyed the coast south of Adelaide where the fishery is,” Roger Edwards says. “And the fishers were a good bunch of people so I agreed to chair their association (the Goolwa Pipi Harvesters Association).”

Since then, he has used a combination of political nous, marketing experience, economic know-how and diplomacy to help transform Goolwa pipi production from a low-value largely bait business to an economic powerhouse.

Today Goolwa is Australia’s biggest pipi fishery, grossing more than \$4 million annually, with 85 per cent of the 550-tonne quota sold to some of the nation’s best restaurants.

## Wide horizons

A big picture approach is a hallmark of the way Roger Edwards works. He believes the combination of scientific research, economics and market analysis results in the best decisions for sustainable growth.

One thing he insisted on when he first agreed to chair the Goolwa Pipi Harvesters Association was the development of a robust policy based on sound information. “A policy or plan for development must be based on sound science, social or economic grounds, rather than opinions, otherwise you’re just making ill-informed guesses,” he says. “Building in economics and market conditions is probably what I have brought to the process.”

His appreciation of research stems from his own Master’s in agricultural science and an early career as agricultural business extension officer with the South Australian Department of Agriculture in the 1980s. His research hypothesis then – that rotations on farms should be analysed on the unique conditions of each paddock – was counter to conventional wisdom at the time, but proved to be correct.

His move from agriculture to a job with the Southern Rock Lobster industry with virtually no experience in the fisheries sector was something of a leap of faith. But he has been “consumed” by the vast complexities and opportunities, he says, and it is here that he has made the biggest waves, helping to protect, build and grow fisheries.

The people skills developed in the fisheries sector have helped his continuing involvement in the grains sector and likewise, he says, his work in fisheries has been strengthened and informed by his experience in agriculture. Many of the economic principles he learned as an agricultural economics student and consultant can be

applied in the fisheries sector, he says. It was his experience with farmers, for example, that gave him the idea for a unique twist for setting the pipi fishery quota, implementing a “gross margin calculator” which is widely used in the grains and livestock sectors to analyse profitability.

Using this mathematical tool, adapted for the fishery with advice from Julian Morison from EconSearch, the fishery’s quota is set by an annual scientific review, which determines what can be caught sustainably, along with intelligence about the impact of supply on industry profitability. “As a result, four of the last five quota decisions have been set lower than the maximum scientific recommendation,” he says. “This has ensured we have delivered a massive fishery resource and maximum industry profits.”

## Road to success

Roger Edwards says the success of the fishery is the result of many forward-thinking contributors. These include the FRDC, the South Australian Government and regional development agencies for research into the fishery, markets and new products; the marketing team Blue Harvest; and not least the fishers themselves.

“This has happened as a function of the willingness of the fishers to work together and explore ways to build the value of the industry,” he says. “This group is motivated and innovative and prepared to have a crack at things if we put enough information together to measure the opportunities. And now all our pipis are lining up in the sand.”

The establishment, under his guidance, of the commercial Goolwa PipiCo has been an important factor. The company has united fishers who represent more than 60 per cent of South Australia’s pipi quota under a single brand and marketing strategy.



Roger Edwards digs into a dish of Goolwa pipis (pasta alle vongole) at Lucia's at the Adelaide Central Market.  
Photo: Jacqui Way



“Today Goolwa is Australia’s biggest pipi fishery, grossing more than \$4 million annually, with 85 per cent of the 550-tonne quota sold to some of the nation’s best restaurants.”

Meanwhile, the commercial structure of the company gives several key benefits to licence holders, he says. The risks and benefits from investment in research and product and market development are shared; prices and profits are pooled and returns divided equally per kilogram so everyone shares market highs and lows fairly.

The volume of pipis being provided to market can be targeted to customer needs, helping to maintain supply and price stability, and harvesting crews work to agreed schedules, which allows family needs, such as holidays, to come first. In 2014, the company opened its fisher-owned processing plant, which has developed new products such as smoked pipis, generating strong business growth.

When market research, for example, showed the potential markets for pipis supplied in a more user-friendly form, the company invested in long-life modified atmosphere packaging. This extended the pipis’ shelf-life from two days to 10, and demand from the hospitality and retail sectors boomed.

“We have gone from zero to about 100 to 130 tonnes in two-and-a-half years in modified atmosphere packaging,” Roger Edwards says. “And this shows that collaboration and sharing the risk and rewards can be a pathway to building value.”

“I think they could become the number one mollusc in Australia,” he says. “If people think oysters are good, they need to get on to pipis.” **F**

Roger Edwards was invited to present the story of the Goolwa PipiCo and its success at the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) 2017 Outlook Conference in March.

### Conference knowledge 2008-314.37

This report details the synthesised knowledge and key outcomes from the 7th World Recreational Fishing Conference 2014 (WRFC 7) in Campinas, Brazil. The overarching theme for the conference was "Change, transformation and adaptation in recreational fisheries". Topics discussed at the conference included: assessment of the economic importance of recreational fisheries; catch-and-release practices; marine protected areas (MPAs); innovative management and governance methods; and the social licence to operate.

This report also outlines the outcomes from sending eight representatives of the Future Leaders in Recreational Fishing Program (FLRFP) to the conference. FLRFP representatives attended each of the lectures and discussions at the conference. The group also met privately with several leaders in their field in order to build relationships that might in future assist the Australian recreational fishing sector. The group will share their experiences and knowledge gained from the WRFC 7 in a number of ways including reporting to their host organisations, writing articles in state and national publications and hosting workshops and events to communicate key concepts and knowledge gained.

**More information:** [Cheyne Jones, cheyne\\_jones@centuriesahead.com.au](mailto:cheyne_jones@centuriesahead.com.au)

### Economics Masterclass 2013-748

This report outlines the revisions and improvements to the 'Future Harvest Masterclass in Fisheries Economics'. There is an increasing demand for capacity building in fisheries economics. Recognition of this ongoing need resulted in FRDC project 2010/714 – 'Future Harvest Masterclass', which involved the development and delivery of a one-day intensive masterclass in fisheries economics. This course was aimed at improving the capacity of fisheries managers, biologists, industry representatives and members of advisory committees to integrate economic factors, processes and principles into assessment and decision-making processes. Following trials of the 'Future Harvest Masterclass' program, there was strong industry support for continued delivery of the course. It also involved developing the resources required to underpin an online version of the masterclass, the goal being to increase accessibility and allow for enhanced self-paced learning.

**More information:** [Sarah Jennings, UTAS, sarah.jennings@utas.edu.au](mailto:sarah.jennings@utas.edu.au)

### Clarifying access and allocation 2011-215

Fisheries resources are a common property resource and there is a need to share limited fisheries resources

among competing parties, including commercial, recreational and Indigenous fishers and no-take sectors. This is a task undertaken by the government on behalf of the community. In 2010, the Australian Fisheries Management Forum formed a working group aiming to develop a more comprehensive and consistent approach to this issue. This report reviews the principles and guidelines for fisheries resource access and allocation in Australia. A critical aspect of that management is the description and determination of the rights of those in the community who wish to access the fisheries – either for take or no-take purposes – and the basis of, and processes for, allocating use of fisheries resources among those who seek to do so for a range of different reasons and needs.

Due to these complexities, there is no 'one size fits all' model that can guide allocation decisions.

This report explores the objectives, principles and guidelines, allocation decision-making frameworks and impediments to addressing issues of access and allocation. These principles and guidelines are also explored in the context of several case studies from Australia and overseas.

**More information:** [Daryl McPhee, Bond University, 07 5595 0155, dmcphoe@bond.edu.au](mailto:dmcphoe@bond.edu.au)

### Disease responses 2009-315.28

This report outlines the development and outcomes of a two-day fish disease and biosecurity workshop held in Townsville in July 2015. Prompt and accurate disease detection and control is necessary to protect the biosecurity of the Australian fish farming industry and to prevent disease incursion or spread within and between states of Australia. The current workshop was developed in response to this need. The workshop delivered new knowledge and technical skills to 24 participants representing Australian fish farming and government veterinarian sectors. The workshop participants now have enhanced knowledge, technical skills and expertise, workshop resources and increased professional networks that, together, can be utilised during a response to a disease emergency.

**More information:** [Rachel Bowater, Department of Agriculture, Fisheries and Forestry, 07 3330 4546, rachel.bowater@daff.qld.gov.au](mailto:rachel.bowater@daff.qld.gov.au)

### Fisheries policy economics 2013-748.20

This report outlines the research outcomes of a project investigating roadblocks to the adoption of economics in fisheries policy. Despite increased interest in incorporating economic analyses and instruments into fisheries management frameworks, in order to maximise economic efficiency, increase profitability and establish ecologically conservative targets,

these methods are seldom applied in Australia. This project produced three peer-reviewed journal articles investigating the challenges and opportunities for economics in fisheries policy.

The first used several case studies to illustrate how bio-economic analyses and instruments can improve economic performance in Australian wild-capture commercial fisheries. The second article discussed how the introduction of economic instruments such as individual transferable quotas might fail to maximise the profitability of commercial fisheries. The third article examined the potential for stock enhancement to improve profitability with high-value invertebrates such as Australian abalone and rocklobster.

**More information:** [Tim Emery, UTAS, 03 6226 8284, timothy.emery@utas.edu.au](mailto:timothy.emery@utas.edu.au)

### Reassessing shellfish toxicity 2013-054

This project generated acute oral toxicity data for C3&4, a paralytic shellfish toxin (PST) commonly found in Tasmanian shellfish during blooms of toxic microalgae. PSTs are neurotoxins produced by certain marine microalgae that can accumulate in filter feeding shellfish such as mussels and oysters. A regulatory limit exists for PSTs in seafood in order to assess the potential risk to human health from consuming contaminated seafood. These limits are expressed relative to the potent neurotoxin and PST, saxitoxin, as a toxicity equivalence factor or relative toxicity.

Methods for determining the toxicity of PSTs have historically used mouse bioassays, a method now known to be inaccurate. This project sought to update the oral toxicity data for C3&4, given its relevance to the Tasmanian aquaculture and wild-capture fisheries industries, using more accurate analytical chemistry methods. The relative oral toxicity of C3&4, when compared to saxitoxin, was 36 times lower. The report recommended that this relative oral toxicity value be adopted into routine regulatory test methods to afford a more appropriate assessment of potential risk to shellfish consumers.

**More information:** [Tim Harwood, Cawthron Institute, +64 3548 2319, tim.harwood@cawthron.org.nz](mailto:tim.harwood@cawthron.org.nz)

### National harvest strategy 2010-061

This report outlines guidelines for a best-practice, national approach to fishery harvest strategies. A harvest strategy is a framework that specifies the pre-determined management actions in a fishery for defined species that are necessary to achieve the agreed ecological, economic and/or social management objectives.

The project conducted an audit of current harvest strategies being applied across Australian fisheries



management jurisdictions. The audit identified that while harvest strategies are used widely in Australian fisheries, their application is highly inconsistent. There was therefore a need to provide a national framework to support a consistent and more harmonised approach to harvest strategy development across Australian fisheries jurisdictions.

Through the establishment of a working group and a national stakeholder workshop, a broad cross-section of Australian fisheries management, policy, science and fishing industry expertise was consulted with in the development of these guidelines. The guidelines outline definitions, key elements, design principles and processes and considerations for specific fisheries.

**More information:** Sean Sloan, Primary Industries and Regions, SA, 08 8226 2318, [sean.sloan@sa.gov.au](mailto:sean.sloan@sa.gov.au)

### Gear changes aid profits 2011-010

Within prawn trawl fisheries, there have long been concerns for the impacts of high levels of bycatch (non-target species) and the potential impacts of long-term interactions of prawn trawls on the seabed and subsequent damage to benthic habitats. There is also a growing socio-economic impetus on prawn trawl fisheries to improve energy efficiency. This project sought to identify gear modifications suitable for use in NSW prawn trawl fisheries that would reduce bycatch, fuel consumption and habitat impacts, while also maintaining target catches. These are collectively termed 'low impact and fuel efficient' (LIFE) trawling systems.

Following industry consultation, a series of experiments were carried out using NSW estuarine prawn trawlers to determine the utility of various anterior gear modifications. Modifications included those to trawl configurations, otter boards, ground gear and materials. The results showed that the anterior section of prawn trawls can be modified to maintain target catches, while also dramatically reducing either unwanted bycatches (by up to 95 per cent for key species) or seabed contact (by up to 85 per cent compared to existing conventional gears). Modifications were also shown to reduce drag (thereby improving fuel efficiency) by up to 20 per cent.

**More information:** Matt Broadhurst, Department of Primary Industries, NSW, 02 6648 3905, [matt.broadhurst@dpi.nsw.gov.au](mailto:matt.broadhurst@dpi.nsw.gov.au)

### National action on POMS 2015-406

This report outlines a National Industry Response Plan (NIRP) for cases of Pacific Oyster Mortality Syndrome (POMS). POMS has devastated oyster industries throughout the world but, until fairly recently, Australian oyster growers had been spared. That changed in 2010, when the first incursion of POMS in Australia occurred at Botany Bay, NSW. Later that same year, it was

detected in Port Jackson, and then in the Hawkesbury River in 2012. In February 2016, POMS was detected in a major farming area on the east coast of Tasmania. It caused devastation to oyster farming operations directly impacted by the disease and also those further down the value chain.

The NIRP aimed to identify programs that would improve the industry's capacity to recover from the 2016 event and that would also contribute to building resilience for future growth and sustainability. This report outlines support actions required in the immediate future and in the medium and long term. The principle solution to the immediate POMS threat identified in the report is the sustainable development of a POMS-resistant oyster in Australia. This will assist not only in re-establishing currently affected oyster-growing areas, but also in ensuring the continued growth of the oyster industry in Australia.

**More information:** Jan Davis, Agribusiness Tasmania, [jandavistas@gmail.com](mailto:jandavistas@gmail.com)

### Improved spat production 2011-236

This report outlines efforts to increase the reliability of spat production for Silverlip Pearl Oysters (*Pinctada maxima*) in north-west Western Australia, using cost-effective measures. Since aquaculture efforts for *P. maxima* began in the 1980s, spat production methods have since developed in an ad hoc fashion, with little emphasis on targeted research to provide a platform for sustained improvement.

In 2006, an outbreak of oyster oedema disease devastated stocks of hatchery-produced spat and severely compromised adult oysters on pearl farms in the Exmouth Gulf. Since then, WA pearl farms have continued to struggle with spat production due to persistent mass mortalities.

This project sought to develop improved processes for spat culture in order to address this limitation to WA's commercial pearl industry. A review of current spat production methods and constraints identified research priorities, and trials of techniques and processes followed.

The methods and processes developed through this project have substantially increased spat production. The cost of production has declined proportionately and is anticipated to continue to fall as production increases and efficiencies are implemented.

**More information:** David Mills, Paspaley, 08 8982 5582, [dmills@paspaley.com.au](mailto:dmills@paspaley.com.au)

### Aquatic animal health R&D 2012-001

This report outlines the activities and achievements of the 'Aquatic Animal Health Subprogram' (AAHS) from 2012 to 2016. The AAHS was established in 2001

as a FRDC national sub-program aiming to provide leadership to aquatic animal health R&D and its adoption in Australia. Specifically, between 2012 and 2016, the AAHS aimed to increase the industry's capacity to manage aquatic animal disease in the commercial, recreational and traditional fishing sectors and thus help Australia's aquaculture and fisheries industries become more competitive, profitable and sustainable.

From 2012 to 2016, the AAHS managed 35 projects concerned with aquatic animal health. These included projects on improved diagnostic capability and/or disease management for a number of aquatic animal pathogens, development of emergency aquatic animal disease response arrangements and training to improve the disease emergency management capability of industry and government personnel.

The AAHS R&D plan was reviewed in-house on an annual basis, which included consultation with major stakeholders from industry and government. The subprogram newsletter, *Health Highlights*, has been a source of information dissemination to industry associations, research providers and regulators, both domestically and internationally.

**More information:** Mark Crane, CSIRO, 03 5227 5000, [mark.crane@csiro.au](mailto:mark.crane@csiro.au)

### Aquatic animal health 2012-002

This report outlines the outcomes from three years of annual Aquatic Animal Health Technical Forum workshops. A total of 80 participants met between 2013 and 2015 to gain experience in making oral presentations, to participate in training and to develop a network that can be used for obtaining information and advice on technical matters concerning aquatic animal health. Participants included staff from aquatic animal health diagnostic laboratories and university laboratories, as well as a number of aquaculture industry staff.

In the face of increasing frequencies of disease outbreak in Australia's aquaculture industry, there is a strong need to increase technical capacity within the field. In response to this need, the Aquatic Animal Health Technical Forum was established in 2010. It was seen as a way to increase capacity and provide professional development opportunities for scientists, technologists and industry staff. From an initial 18 members in 2010, the forum has expanded to 61 members. The 2013-15 workshops provided participants with the knowledge and tools to respond more effectively in the face of disease outbreaks. In this way, the potential negative impacts of disease outbreaks on industry productivity and profitability can be reduced. A funding model for the forum needs to be agreed upon by governments and industry and

implemented as soon as possible to ensure that the forum is maintained and past achievements can be built upon.

**More information:** [Lynette Williams, CSIRO, 03 5227 5000, lynette.williams@csiro.au](mailto:lynette.williams@csiro.au)

### Seafood consumer trends 2015-702

This report outlines the findings of the third 'Omnibus Consumer Research' project on consumers' attitudes and behaviours towards seafood. The purpose of this project was twofold: first, to identify changes in consumers' attitudes and behaviours over the past five years; and, second, to further explore key issues impacting on consumer trends. This study adds to knowledge on these areas and follows on from the 2009 and 2011 Seafood Omnibus studies.

In April 2015, an online survey was conducted of more than 2500 consumers. It identified several changes since the previous two Omnibus studies, including locations of peak seafood purchasing and consumption, product market penetration and awareness of health guidelines. This project also explored and benchmarked key issues relating to seafood marketing. The study found that one in three consumers have either no idea, or an incorrect idea, of what sustainability means in relation to seafood, and sustainability is not currently impacting on the purchase decisions of most Australian consumers. Country of origin labelling is strongly supported by close to 100 per cent of Australian consumers, with more than two-thirds of consumers indicating they would be prepared to pay a premium of up to 30 per cent for Australian seafood.

**More information:** [Meredith Lawley, University of the Sunshine Coast, 07 5430 1223, mlawley1@usc.edu.au](mailto:mlawley1@usc.edu.au)

### Multi-trophic aquaculture 2010-201

This project is the first contribution towards the development of seaweed aquaculture as a component of integrated multi-trophic aquaculture (IMTA) in southern Australia. IMTA involves strategic co-culture of organisms so that wastes from one species are used to grow another, providing environmental and economic benefits. Seaweeds can be used in IMTA systems to remove and utilise dissolved inorganic nutrients from fish aquaculture. There is also increasing demand for seaweed products, which may provide opportunities to exploit new markets. This project investigated several species of seaweed native to South Australia's fish farming region to determine potentially suitable species and farming systems for the development of IMTA in Australia. The project contributes the first practical information on offshore seaweed culture and implementation of IMTA in Australia. However,

additional research and development are required before IMTA using seaweeds can be applied on a large scale or commercially. This includes further investigation of seaweed biology, culture systems and suitable sites. Additionally, potential markets for products from farmed seaweeds need to be developed. Future culture trials should investigate product quantity and quality as well as seaweed growth and nutrient removal.

**More information:** [Kathryn Wiltshire, South Australian Research and Development Institute, kathryn.wiltshire@sa.gov.au](mailto:kathryn.wiltshire@sa.gov.au)

### Oyster hatchery hub 2015-706

Due to demand for Sydney Rock Oyster (SRO) seed exceeding supply, Select Oyster Company, an industry-owned company that manages the commercialisation of the SRO breeding program, initiated the development of the 'Sydney Rock Oyster Hatchery Hub' program. The hub was created to increase spat supply of selected lines of SRO to industry and improve knowledge transfer about hatchery production and the breeding program. As part of the project, a hatchery expert visited commercial hatcheries to assess operational protocols, identify solutions to specific issues across all areas of hatchery and nursery operations and offer ongoing support as solutions were implemented. A network for future support has also been established.

**More information:** [Emma Wilkie, Select Oyster Company, selectoysterco@gmail.com](mailto:selectoysterco@gmail.com)

### Whiting life history 2011-017

Conducted over four years, the study was designed to determine whether single (state) jurisdictional management of the King George Whiting fishery was appropriate in relation to the species' population structure. Innovative methods were used to determine population structure including otolith chemistry and advanced genetic analyses. The results support the current state (jurisdictional) based management of the fisheries; however, further work is recommended to clarify the relationship between the Victorian and South Australian King George Whiting populations.

**More information:** [Gregory Jenkins, gjenkins@unimelb.edu.au](mailto:gjenkins@unimelb.edu.au)

### Measuring fishing value 2012-214

Recreational fisheries have no reliable and acceptable methodology or mechanism to measure their economic value to Australians. The sector would also benefit from an improved understanding of end-user requirements for its economic data and the most appropriate means of obtaining that data. Catch-based valuation approaches are not appropriate to estimate the economic

value of the recreational fishing sector. Not only do such approaches not appropriately capture all the community benefits of the sector, recreational fishers don't sell their catch.

While estimates from commercial catches could be attached to the estimate, there are often disparities in the species caught. This project finds that expenditure-based valuation approaches are more appropriate to value the sector's economic contribution. Using this approach, the project estimates the sector's annual economic value to be \$2.56 billion in 2013. This valuation approach is based on fishers' estimated direct attributable annual expenditure as a proxy, and recognises the sector's recreational service values beyond catch. This valuation preference was confirmed by fisheries economics experts and ABARES at a forum held on 13 February, 2015, in Canberra.

The expenditure-based valuation approach was endorsed by the federal government in the 2005 Campbell Report. This is the approach recommended by this project for valuing the national recreational fishing sector. It is recommended that all fishers, policy-makers and other stakeholders immediately adopt this standard valuation method across the national recreational fishing sector.

**More information:** [Ewan Colquhoun, ewan@ridgepartners.com.au](mailto:ewan@ridgepartners.com.au)

### Aquaculture program 2014-246.20

It is important to take advantage of opportunities presented by market demand for quality seafood. This can be done by developing sustainable, productive and profitable new and emerging aquaculture industries in Australia that will complement growth in established sectors. The FRDC's RD&E Plan 2015-20 identified the development of new and emerging aquaculture growth opportunities as a national research priority. Aquaculture currently contributes 43% or \$1 billion to the value of Australian seafood production. This has increased 12% from 2002-03 to 2012-13.

This project was the early establishment phase of the FRDC's 'New and Emerging Aquaculture Opportunities' sub-program, to strategically coordinate research, development and extension around new aquaculture opportunities. Sub-program activities will help farmers to form new industries, overcome issues in emerging sectors and become more profitable. Stakeholders attending the November 2015 workshop identified current issues and gaps in knowledge and recommended that an audit of past research and industry adoption in new and emerging aquaculture be undertaken by June 2016.

**More information:** [Jenny Cobcroft, jennifer.cobcroft01@gmail.com](mailto:jennifer.cobcroft01@gmail.com)



## Movers and ...



**Nicole Hancox** is the new executive officer of the Abalone Industry Association of SA, taking over from **Michael Coates**.

**Tim Emery** has moved from the Institute of Marine and Antarctic Studies to work at the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES).

**Adam Main** has left the Tasmanian Salmonid Growers Association (TSGA).

**Mick Hortle** has taken over the position as TSGA's executive officer.

**Mark Porter** has left the position of CEO of Tasmanian aquaculture company Petuna. **David Wood** is acting CEO.

**Blake Ratner** is acting in the position of director-general at WorldFish.

**Andrew Campbell**, formerly at Charles Darwin University, has moved to the Australian Centre for International Agriculture Research as CEO.

**Colin Grant** has been appointed as chair of the National Carp Control Plan (NCCP) Policy Advisory Group and **Peter O'Brien** as NCCP's Science Advisory Group chair.

**Mark Boulter** has left the Sydney Fish Market to start his own consultancy.

**Dallas D'Silva** has been appointed director of policy and licensing at Fisheries Victoria, replacing **Mark Edwards**. **Michael Burgess** has taken up the position of general manager at VR Fish (previously held by **Dallas D'Silva**).

**Nathan Kimber** has been appointed executive officer of the South Australian Rock Lobster Advisory Council.

Annabel Boyer, 02 6285 0415, annabel.boyer@frdc.com.au

### FEEDBACK

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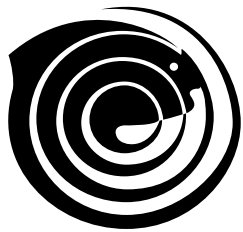
### QMSA MARKETING SYMPOSIUM BRISBANE 30 JUNE 2017

**From water to waiter** – this one-day marketing symposium will cover why what you do on the boat or farm is important to your marketing efforts. The symposium is being run by the Queensland Seafood Marketers Association (QSMA) alongside the Queensland Seafood Awards in Brisbane on Friday, 30 June, at Rydges Southbank in Brisbane. To whet your appetite we already know one keynote speaker will be direct from the US National Fisheries Institute. And QSMA is lining up a cast of speakers that will make you think seriously about what you do from the moment you catch a fish, right through to when you send it off to market.

**Interested?** If you would like to register please contact QSMA: [contact@queenslandseafoodmarketers.com.au](mailto:contact@queenslandseafoodmarketers.com.au)

## Calendar of events

DATE	EVENT	MORE INFORMATION
<b>2017</b>		
7 to 8 March	ABARES 2017 Outlook Conference, Canberra	
20 to 24 March	Giant Prawn 2017, Bangkok, Thailand	<a href="http://giantprawn.org">giantprawn.org</a>
19 to 21 March	North America Seafood Expo, Boston, US	<a href="http://seafoodexpo.com">seafoodexpo.com</a>
25 to 27 April	Seafood Expo Global, Brussels, Belgium	<a href="http://seafoodexpo.com/global/">seafoodexpo.com/global/</a>
27 to 28 April	FRDC Board Meeting, Hobart/Dover	02 6285 0400
4 to 7 June	SeaWeb Seafood Summit, Seattle, US	<a href="http://seafoodsummit.org">seafoodsummit.org</a>
14 to 15 June	FRDC Board Meeting, Darwin	02 6285 0400g
26 to 30 June	World Aquaculture 2017, Cape Town, South Africa	<a href="http://was.org">was.org</a>
2 to 6 July	Australian Marine Sciences Association (AMSA) Conference 2017, Darwin	<a href="http://amsa.asn.au">amsa.asn.au</a>
25 to 27 July	Asia Pacific Aquaculture 2017, Kuala Lumpur, Malaysia	<a href="http://was-apc.org/?p22">was-apc.org/?p22</a>
16 to 17 August	FRDC Board Meeting	02 6285 0400
23 to 25 September	Trans-Tasman Rock Lobster Congress	<a href="http://rocklobstercongress2017.com">rocklobstercongress2017.com</a>
27 to 29 September	Seafood Directions Australia	<a href="http://seafooddirectionsconference.com">seafooddirectionsconference.com</a>



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