THE MAGAZINE OF VICTORIA'S PEAK RECREATIONAL FISHING BODY SUMMER 2015

fishing lines

Representing Victorian Recreational Fishers

In this issue...

RESEARCH

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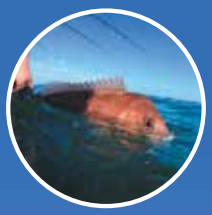
Help released snapper survive

Fish shallow water to avoid barotrauma

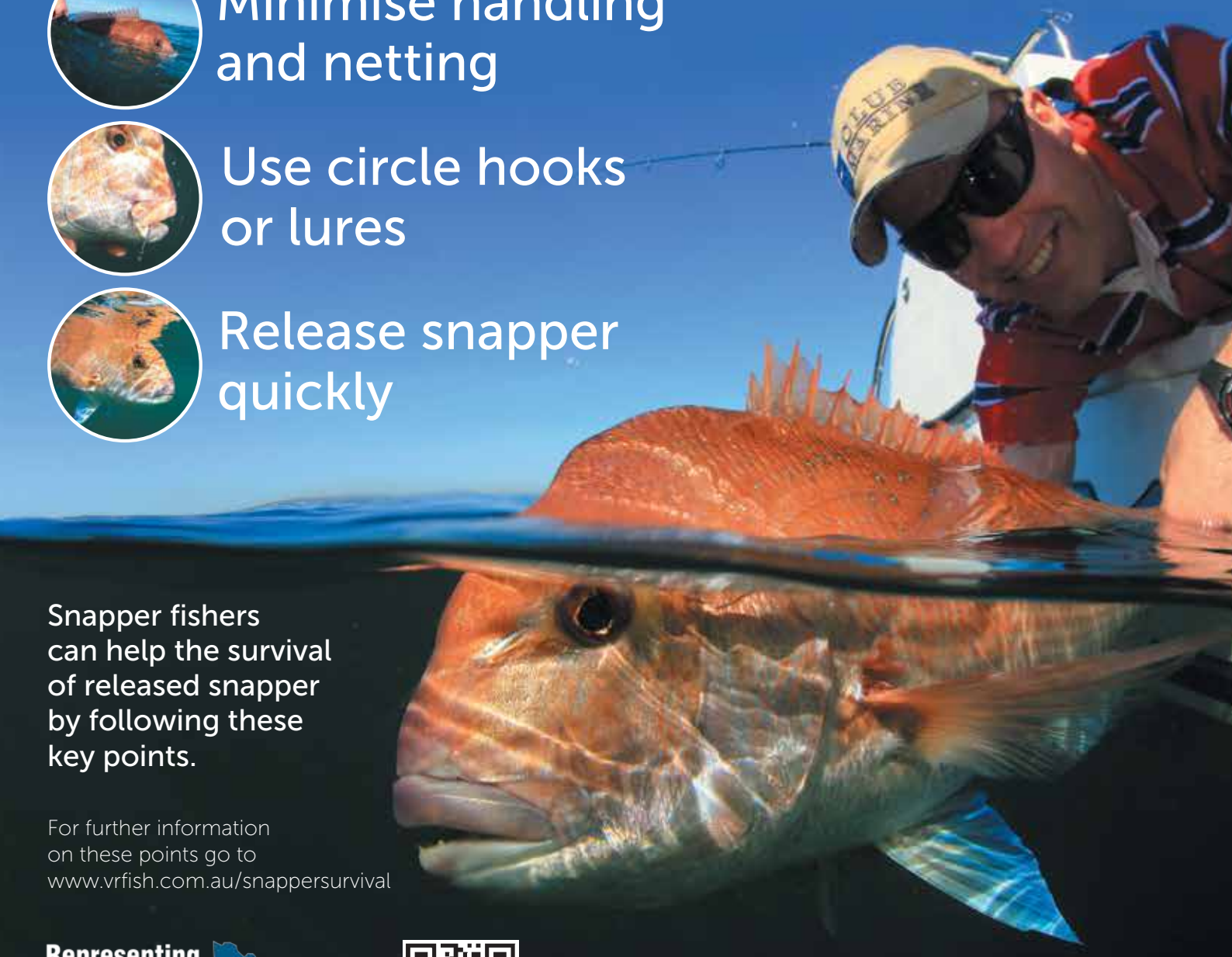
Leave snapper in the water for release



Minimise handling and netting

Use circle hooks or lures

Release snapper quickly



Snapper fishers can help the survival of released snapper by following these key points.

For further information on these points go to www.vrfish.com.au/snappersurvival

Representing Victorian Recreational Fishers

VRFISH

This project was funded by the Victorian Government using Recreational Fishing Licence fees

Your fishing licence fees at work

State Government Victoria

SUMMER 2015

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Researchers are becoming increasingly aware that recreational fishers have an incredible wealth of knowledge gained through years of closely monitoring the patterns of fish movement, catch rates and changes in the environment. ***This knowledge is now being harnessed through the use of "citizen science"...***

Message from the Chair

All of us who enjoy our recreational fishing have in some way benefited from research without necessarily realising it. This edition of *Fishing Lines* highlights the tremendously valuable contribution research makes to the improvement of our fisheries and the benefits that accrue to recreational fishers.

The articles in this edition showcase the work done by researchers, scientists and "grass roots" recreational fishers to improve our opportunities to enjoy fishing now and for future generations. Whilst we have learnt much about fishing over the years, there is still so much we don't know about our recreational species, the habitats they live in and their remarkable lifecycles.

There are very good reasons why research into recreational fishing is important:

- to increase our knowledge and understanding of the activity we enjoy
- to provide the evidence to support and inform the decisions we need to make to ensure we can continue to fish in the future
- to advance the development of new ideas which can then lead to improvement and innovation in recreational fishing
- to not only understand what is going on today, but to also appreciate how our fisheries have changed over time
- to understand the resilience of our fisheries, and the actions we need to take to ensure their future health.

Collaboration between recreational fishers, researchers, fisheries managers and the community is a very powerful combination. Researchers are becoming increasingly aware that recreational fishers have an incredible wealth of knowledge gained through years of closely monitoring the patterns of fish movement, catch rates and changes in the environment. This knowledge is now being harnessed through the use of "citizen science" to assist in the improved management of our fisheries. The technology we all have at our fingertips, the smart-phone, can provide researchers with near real-time information even before the day's fishing is completed. Information that previously took months and years to collect is now becoming readily available and in a timely manner.

Through research, we are also becoming aware of the social benefits of recreational fishing. Fishing is an important part of the shared activities of Australian families and provides opportunities to relax and enjoy mutual experiences and time together.

I invite you to read the articles presented in this edition and encourage you to think about your fishing and what you would like to know more about. VRFish looks forward to hearing your ideas about the important research matters we should be working towards to improve our understanding of recreational fishing and ensure significant improvements in the future.

Tight lines.

Russell Conway
Chair
VRFish

Message from the General Manager

Welcome to the new edition of *Fishing Lines*. It has been a hectic few months since our last edition. The Andrews Government has been kicking goals and it is great to see a number of election promises already delivered – whether they be giving fishers a fair go at Lake Toolondo, opening trout cod fisheries at Lake Kerferd and Lake Sambell, stocking mulloway into Lake Tyers or removing red tape on boaters at Blue Rock Lake.

This edition is more than telling the story about the importance of science and research in managing recreational fishing. When we hear the word science or research we often think biological or ecological. There is much more to it of course with social and economic considerations also critically important, especially for recreational fisheries. For all of the science that has been done on the super trawler, the Commonwealth small pelagic fishery and more recently the Geelong Star – none of it has addressed the social and economic concerns of recreational fishers and the flow on impacts to coastal communities.

Citizen science and fishery dependent science remains the most cost effective means of collecting data. Recreational fishers' licence fees fund a significant proportion of research in Victoria. Key species taken by anglers such as snapper, whiting, calamari, flathead, mako sharks, black bream, Murray cod and trout have all benefited from major investment in research by recreational fishers.

There is no doubt that Victoria has some of the best fisheries scientists in the country. What is great is that fisheries and habitat scientists engage early on with VRFish and fishers on future priorities for research. This is the best way to develop good projects that are valued by the end user groups.

We must not forget about the D in RD&E, which stands for development. Likewise we should not forget about the E or extension of research which results in actual practice change. Without the adoption of research, it is clear funds have not been well spent and you end up with a report collecting dust on the shelf.

There is no doubt that we need new 'big picture' thinking about how research is funded and provided across the nation. Are there opportunities to be realised by working more closely with universities? This is a great way to collaborate and grow the pool of knowledge.

There are some great research elements in the *Target One Million* policy that VRFish has advocated for – including more up to date catch and effort information for key recreational species and an expansion of the internationally recognised *Angler Diary Program.* We look forward to working with the Department to help ensure these policies are delivered successfully.

Citizen science and fishery dependent science remains the most cost effective means of collecting data. ***Recreational fishers' licence fees fund a significant proportion of research in Victoria.***

As you can see from this edition there is some terrific research underway that will help support sustainable, responsible and vibrant recreational fisheries in the years ahead. I would like to take this opportunity to thank the Board for their efforts and guidance, not to mention our State Council members for their tireless volunteering to improve recreational fishing and represent grassroots anglers and divers.

Finally, to our staff Michelle Wenner and Alison Wheeler I also say thank you for your hard work and support.

Until next time, we hope you enjoy this edition. Please be sure to stay safe on or near the water.

Dallas D'Silva
General Manager
VRFish

***There are some great research elements in the* Target One Million *policy** that VRFish has advocated for – including more up to date catch and effort information for key recreational species and an expansion of the internationally recognised* Angler Diary Program.

Citizen Science and Game Fi

BY DR JULIAN PEPPERELL

The involvement of the general public in scientific research has been dubbed 'Citizen Science'. It happens in many branches of science, with contributions of birdwatchers to censuses of bird populations perhaps the best known example. And in the case of recreational fishing, you couldn't get a better example of citizen science than the *Gamefish Tagging Program* run by NSW Department of Primary Industries.

Photos: Julian Pepperell

This year marks the 42nd year of the program's operation, during which time over 430,000 fish have been tagged, every one of them by a recreational angler. That Program yields enormous benefits. Without all those recaptured fish, we would know very little about the movements and stock structure of many pelagic species while the tag cards themselves reveal information on relative abundance of fish in time and space that can be related to variable environmental cues such as water temperature, chlorophyll and El Nino patterns.

In addition to tagging, there are many other projects that typify the close cooperation that has developed between game fishing and science. Thinking back over my many years of researching gamefish, one thing I and other scientists have always been able to rely on is support and help from anglers. This help comes in a number of ways – from generously donation of their time, boats and fuel, to waiting patiently at weigh stations while scientists poke, prod and measure their catch.

Several decades ago, boffins like myself with our tape measures and plastic bags were tolerated at game fishing tournament weigh stations, but these days scientific sampling of fish at these events has become the accepted norm. Club officials are happy to have scientists attend and to inform the general public about the research being conducted. Studies facilitated by tournaments cover many aspects of gamefish biology including global genetics, age and growth, feeding ecology, physiology and parasitology. And archived preserved tissue samples routinely taken at such events will continue to be used in all kinds of future studies.

Out on the water, boat owners and skippers are usually only too happy to take scientists on board to deploy electronic and satellite tags on fish, to the extent that hundreds of these kinds of tags have been placed on billfish, sharks, tuna and even dolphinfish over the past decade or so. And not only do anglers provide their boats free of charge, many take time off work just to be part of these exciting studies. The most recent examples of this cooperation in Victorian waters are the post-release survival experiments on southern bluefin tuna and mako sharks conducted by Dr Sean Tracey and Ph.D student Rob French from the University of Tasmania.

Another particularly good example of citizen science in action is a current global genetics study of black marlin being undertaken by University of Queensland student, Sam Williams. By asking anglers in both eastern and western Australia to take small finclips from black marlin before they were released, Sam was overwhelmed with offers of help, and has now received over 200 finclips. DNA analysis of those finclips has revealed distinct population differences between the eastern Indian and western Pacific oceans – a major breakthrough in our understanding of such an important highly migratory pelagic species. This project

is now expanding to incorporate the full Indo-Pacific distribution of black marlin, again using finclips taken by recreational anglers wherever possible.

In the future, I can envisage routine help from anglers in much the same way as the tagging program now operates. FTA cards, normally used in medical and forensic science to collect DNA from humans by swabbing the inside of the cheek, have been trialled on sailfish in WA and shown that DNA can be collected from fish simply by dabbing the card on the side or back of a fish before release.

Several decades ago, boffins like myself with our tape measures and plastic bags were tolerated at game fishing tournament weigh stations, but these days ***scientific sampling of fish at these events has become the accepted norm.***

And an improvement on taking samples by fin clipping is now being planned whereby a plastic punch tool on the end of a pole can be used to take a small plug of muscle from fish, enabling not just DNA studies but also stable isotope analysis that can reveal what the fish has been eating in the recent past.

Citizen science in game fishing goes back a long way. In my 35 or more years of field research and tournament monitoring, the cooperation from the entire game fishing community has always been nothing short of outstanding. Thanks to everyone who has ever helped, and here's to many more years of successful and fruitful partnership between science and game fishing.

Above: Fin clips taken from released black marlin by citizen science anglers. Cooperation in this project across Australia has been fantastic.

Opposite page: Anglers look on as scientists measure and take samples from a striped marlin.

Below: A blue marlin about to be released with its popup satellite tag. Such projects could not succeed without the cooperation of gamefish anglers and boat owners.

Continued

Catching trop

BY YVETTE BARRY
Science writer for REDMAP

Last summer Paul Sorensen spotted a tropical-looking fish lingering in an abandoned shopping trolley under Frankston Pier, south-east of Melbourne. Paul took a photo of the 40cm blue- spotted and white-striped fish but didn't know what it was until he scrolled the internet. Turns out it was a blue-spotted coral trout (*Plectropomus laevis*) (*pictured left*): a species far away from its usual home in tropical Queensland waters.

"It then became our little Frankston Pier icon," Paul says. "It hung around the pier for four weeks."

The coral trout either hitched a ride south on the East Australian Current or was dumped from a salt water aquarium. Paul noted it had lesions on the tail fin and it did not survive long.

Although this coral trout was an unusual tropical visitor, marine biologist Gretta Pecl expects Victorian fishers will catch more and more warm-water fish if sea temperatures continue to rise. Gretta is an Associate Professor at the University of Tasmania's Institute for Marine and Antarctic Studies.

"The world's climate is changing," says Gretta, "and oceans are absorbing more than 80 per cent of the extra heat generated by global warming."

Gretta says Australia's east coast, in particular, is considered an ocean warming 'hotspot' where average sea surface temperatures increased 2.28 degrees Celsius over the last 100 years.

A few degrees plus or minus doesn't sound like much. But for marine life it can mean the difference between thriving and barely surviving. That's because each marine animal and plant species prefers its own unique range of water temperatures, salinity, depth and habitat (among other aspects). Such factors determine where a fish lives and how it responds to ocean warming.

"Some marine species are able to adapt to these new conditions," Gretta says. "Some cannot thrive in warmer waters and so the population may slowly die out. Others will follow their preferred water temperature southwards in order to survive."

Studies on whole ecosystems suggest more than 25 per cent of the world's species have already shifted their postcodes toward the poles in response to rising temperatures.

The shift in fish distribution is most obvious into Tasmanian waters. Fishers have been telling Gretta for years that species common in Victorian seas – like King George whiting, eastern rock lobster and snapper – are being caught more frequently and much further south than usual along Tasmania's east coast.

Tasmanian fisherman Johah Yick has been throwing in lines for 21 years. Yet he only caught his first yellowtail kingfish earlier this year - and as far south as Hobart. Kingfish (*Seriola lalandi*) is common in Victoria but the species is, historically, a rare visitor across the Tasman.

Australia's seas are warming and fish are moving their homes further south than usual.

redmap
SPOT. LOG. MAP.

Redmap citizen scientists have shared more than 1500 sightings and photos on Redmap.

ical fish in Victoria?

Last summer Jonah started spotting schools of 50-plus hoodlums* near Hobart. After tweaking his technique he finally snagged five kingfish. His tips? "Cast soft plastic lures to the surface of a feeding school, as well as on weighted or un-weighted squid strips." (*Kingfish tend to fight dirty at the end of the line, hence their nicknames hoodlum and bandit).

"This was pretty exciting for me as it was one of those fish I had always wanted to 'tick off' in Tasmanian waters," Jonah says.

It's common for fish to be carried down to Victoria and Tasmania on the East Australian Current in the summer, only to die out or retreat in the cooler months. But this pattern is changing with the combination of warmer year-round temperatures and a strengthening East Australian Current. The EAC now reaches 350km further south along eastern Tasmania compared to the 1940s.

Does this mean Victoria's usual catches will venture south more permanently to be replaced by warmer-water fish from New South Wales and Queensland?

It's a question Gretta and her team are asking Australians like Paul and Jonah, with their unusual marine observations, to help answer.

REDMAP.ORG.AU invites the public to become citizen scientists and record sightings of new or uncommon marine life that turn up in their local seas.

Both Paul and Jonah logged their uncommon sightings on the Redmap app. Their photos were verified by one of Redmap's 80 marine scientists who confirmed the species identification and display the sighting online. Your secret fishing spots are safe, though, as sighting location maps are only shown at a resolution of 50km!

Community observations help scientists to reveal patterns in the movement of fish into new regions. Given Australia's 60,000 kilometres of coastline, and the usual research funding constraints, scientists welcome this citizen science data.

"Thousands of fishers are on the water all the time and often see changes in Australia's oceans before scientists do,' Gretta says. 'Redmap taps into the local knowledge of fishers. Their observations allow Redmap to better understand changes in the distributions of marine life.'

Redmap is also interested in marine animals that science knows little about. This includes turtles, whales, jellyfish, rays and sharks, to name a few.

Redmap member Robbie Waller uploaded a photo of a green turtle (*Chelonia mydas*) near Phillip Island. Robbie noted the large turtle had limpets and green algae attached to its head and shell.

"I'd be happy to put up with both if I can make it to the same age!" Robbie told Redmap.

Green turtles are found all around Australia but Redmap is interested in all sightings as turtle distribution and movement patterns are currently not well known.

Redmap citizen scientists have shared more than 1500 sightings and photos on Redmap. Over time, the community observations will be an early indication of those fish or regions that are most impacted by ocean warming. Traditional research can then be focused on marine animals more likely to be shifting their homes south.

Studying Australia's fish distributions, and how fish are likely to respond to warming seas, helps to prepare recreational and commercial fishers for possible changes in the fish they catch in their local seas in the near-future.

How you can help REDMAP?

The Range Extension Database and Mapping project invites fishers and divers to log marine life not usually found in their local seas. Download the Redmap app or visit *www.redmap.org.au* to share your photos of uncommon fish. Each sighting is verified by a marine scientist and displayed on the website. Follow us on facebook.com/RedmapAustralia. *Redmap is hosted by the Institute for Marine and Antarctic Studies (IMAS) at the University of Tasmania.*

Top 3 most logged marine life on Redmap in Victoria since 2012:

1. Western blue groper
(Achoerodus gouldii)

2. White-ear
(Parma microlepis)

3. Whitebarred boxfish
(Anoplocapros lenticularis)

Unusual sightings...

A. Paul Sorensen noticed a *blue-spotted coral trout* hanging out at the Frankston Pier for weeks. This species usually lives in tropical seas in Queensland and northern Australia. (*Photo: Paul Sorensen*)

B. Avid fisher Jonah Yick catches his first *yellowtail kingfish* as far south as Hobart. Kingfish are not as common in Tasmanian waters but fishers are catching more of them further south than usual (it's the second-most reported species out of their usual range on Redmap in Tasmania). (*Photo Jonah Yick*)

C. Robbie Waller spotted this *green turtle* near Phillip Island. Redmap is interested in all turtle sightings so we can better understand their distribution around Australia. (*Photo: Robbie Waller*)

D. Another unusual sighting on Redmap: a *giant squid* near Orbost. Note how large this squid is compared to the fishing rod! Giant squid (*Architeuthis*), which may reach up to 15 metres in total length, dwell in the deep sea and are rarely seen around the world. This Redmap sighting is also exciting and important as little is known of this squid's distribution. (*Photo: Craig Mills*).

Port Phillip Bay sand flathead

BY ROSS WINSTANLEY

Years to reach legal size:

FEMALES 4 years

MALES 12 years

There's probably not been a more important investment of Recreational Fishing Licence (RFL) funds in marine fisheries research than the study by a Fisheries Victoria research team into the condition of the Port Phillip Bay sand flathead stock.

The 2009 stock assessment had identified an alarming decline in flathead numbers and speculated on possible causes, including the 1997-2010 drought and the "explosion" in numbers of the exotic northern Pacific sea stars in the Bay.

In response, anglers virtually commissioned a team led by Alastair Hirst and Paul Hamer whose report *The decline of sand flathead stocks in Port Phillip Bay: magnitude, causes and future prospects* sheds new light on factors affecting flathead numbers and the prospects of a recovery.

Importantly, this study teases apart those environmental factors that drive annual recruitment and over which we have no control from fishing impacts and possible fisheries management responses. Anglers account for more than 95% of the annual catch from the Bay so, if there's a problem with a fisheries management solution, it's up to us to recognise and meet it head on.

Background

This study combined information including commercial and recreational fisheries, annual trawl survey and sand flathead recruitment monitoring data. Until 1960, the commercial fishery landed 150-300 tonnes of flathead annually from the Bay; most of the catch would have been sand flathead, with some Yank and rock flathead. Since then, with the growth in the supply of quality offshore trawl fish, the commercial flathead catch from the Bay has fallen to around two tonnes a year. Over this whole period, sand flathead have been the "bread and butter" catch by anglers, estimated at 322 tonnes in 2000/01.

Sand flathead can live for up to 23 years, with females growing to larger sizes than males. Males reach sexual maturity at 2-4 years, at lengths averaging 22 cm; females mature at 3-5 years and around 25 cm. Larvae occur in the water column between October and April, peaking in November, before settling on the bottom, mainly from December till February. Eggs are released and fertilised in the water column where larvae occur for periods estimated at 30-40 days. With most, if not all, recruitment originating in the Bay this larval stage is critical in determining successful recruitment to the stock.

During the early years of the 1997-2010 drought, crabs, other small crustaceans and marine worms were prominent in sand flathead diets but from 2000, pelagic fish - notably anchovies - and bottom fish became more important.

Trends in the bay stock

Fisheries Victoria's annual trawl surveys ran from 1990 till 2011, providing data that enabled trends in sand flathead numbers to be linked with annual spawning success and seasonal environmental factors. Trawl data showed that the recent decline in sand flathead numbers coincided with the first records and subsequent rapid population growth of northern Pacific seastars in the late 1990s. This observation prompted the questions about whether the seastars were implicated in the decline in sand flathead numbers.

In 1990 when the trawl surveys began, the sand flathead stock was estimated to be 3000 tonnes. The stock appeared to be in slow decline until 2000 after which estimates to 2010 showed a rapid decline of 87%. This was reflected in falling commercial and recreational fisheries catch rates. Detailed studies indicated that the 2008-2010 Channel Deepening Program played no part in this overall decline in sand flathead numbers. The final year of the trawl survey indicate that the stock increased from 400 to 464 tonnes in 2011. Commercial and recreational catch rates reflected the same upward trend. As with other biomass peaks from 1990 to 2000, this modest increase matched strong year classes entering the population at the larval stage.

In 1990 when the trawl surveys began, the sand flathead stock was estimated to be 3000 tonnes. The stock appeared to be in slow decline until 2000 ***after which estimates to 2010 showed a rapid decline of 87%.***

Comparison of sand flathead growth rate estimates show that they have slowed since the 1970s, particularly during the first four years of life. Females now take four years and males up to 12 years to reach legal size in the Bay. With females growing faster and to larger sizes than males it's not surprising that twice as many females exceed the legal size. The largest sand flathead taken in 21 years of trawl surveys was 41 cm long and the oldest were 23 years, although few survive beyond 16 years. Elsewhere in coastal waters and embayments in southern Australia, female sand flathead grow to 50 cm and males grow to 40 cm, both also living for up to 23 years.

The study found no link between the extended drought or the rise of northern Pacific seastar numbers and sand flathead growth rates.

What's behind the recent stock decline?

At the same time as the 20-year 87% decline in sand flathead biomass, the study found there was a substantial drop in annual recruitment or spawning success in the Bay. The most recent large recruitment event was in 1993; since then the best there's been are modest events in 1997, 2000, 2004 and 2013. The importance of strong year classes in maintaining the stock is illustrated by the fact that the strong 1989 year class was still detectable in catches 16 years later. The challenge now is how to "encourage" greater spawning success from a depleted stock with a fishery that targets the largest mature females. There is one bright spot - the 2013 recruitment pulse is the highest measured since 1997 when the flathead biomass was six times greater than at present. This emphasises the point that, even from a small base, stock recovery should be possible given favourable environmental conditions.

Clearly, the 1997-2010 drought was the most extraordinary environmental event that coincided with the years of biomass decline and poor recruitment. Its impacts on the Bay made it an obvious

There is a clear positive relationship between Yarra River flows and sand flathead recruitment at flow rates up to 3,000 ML per day

area to look for an explanation. As the timing of hatching and larval duration suggested that conditions in November and December are likely to be critical to survival, this period was studied in detail for possible environment-recruitment relationships in the Bay. The Yarra River accounts for 70% of all catchment flows into the Bay. Unsurprisingly, its flows decreased through the drought along with nutrient inputs from the Werribee sewage treatment plant. Nitrogen in particular is essential to stimulate phytoplankton productivity that provides food for zooplankton which in turn feed fish larvae.

The study looked for relationships between annual recruitment and daily November-December averages of four variables - stock size, temperature, wind speed and Yarra River flows. The one variable that accounted for a significant degree of recruitment variation was river flow during this critical spawning season. There is a clear positive relationship between Yarra River flows and sand flathead recruitment at flow rates up to 3000 ML per day.

Continued...

Figure 1. Trend in sand flathead biomass in the Bay, 1990–2011

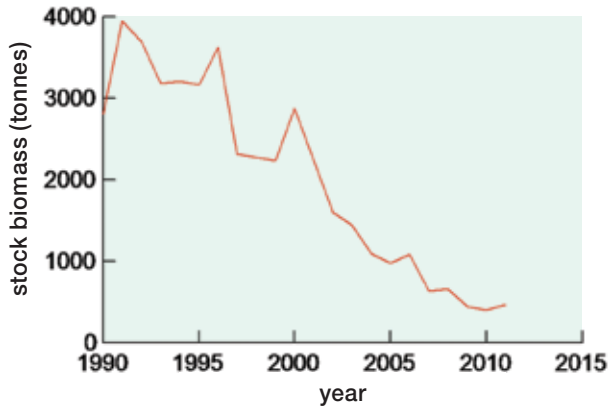
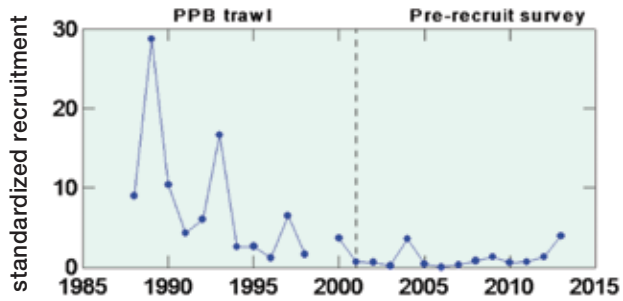


Figure 2. Combined measures of annual recruitment of sand flathead in the Bay from annual trawl and pre-recruit surveys over the period 1988–2013.



Prospects for stock recovery

The researchers found no evidence of overfishing or indications that fishing pressure contributed to the rapid stock decline observed since 2000. They noted that, even as an almost recreational-only species, sand flathead are often taken as bycatch. When numbers become low, anglers are more inclined to switch to Yank flathead and other species rather than intensify effort directed at sand flathead. Nevertheless, they pointed to the need for a review of fisheries management arrangements, given the potential for fishing to impede recovery from the current low stock size.

Now is the time for anglers, along with Fisheries Victoria, to press ahead with such a review. It's our fishery and it's been our investment of RFL funds that put us in a position to make informed decisions and to act. The results of this study give us two strong points of encouragement towards a recovery. First, substantial spawning success and a real boost to recruitment is possible from a small stock size. Second, 2013 saw the most successful spawning event in 16 years; this should boost the adult stock over the next few years, adding to the early signs of recovery observed since 2010 and a platform for further improvement.

It's our fishery and it's been our investment of RFL funds that put us in a position to make informed decisions and to act. ***The results of this study give us two strong points of encouragement towards a recovery.***

When and how far such further improvement might occur will depend on seasonal spawning conditions - largely beyond our control - and angling pressure on legal-sized breeding female sand flathead. Managing angling pressure is the immediate focus; we asked our best fisheries scientists for advice and they've given us a clear direction. They point out that changing the daily bag limit for sand flathead in the Bay is the only obvious management tool available. While the current bag limit is 20/day, 85-90% of angler trips surveyed from 2009 to 2013 caught five or fewer flathead. Modelling indicates that halving the bag limit could reduce the total catch by 4% while a bag limit of 5/day could reduce the annual catch by 16%. That's the sort of measure we need if we're serious about helping the sand flathead stock to rebuild. While the expected increases in stock size each year are in the order of 2-4%, the compounding effect over the next 10 years could be significant.

Underscoring the need for an urgent and decisive fisheries management response, the researchers point out that the longer term prospects for favourable larval recruitment conditions are not encouraging. Since the damaging long-term drought broke in 2010, the immediate outlook for favourable larval recruitment conditions has improved with the return to the "normal" range of Yarra River springtime flows. How long these conditions will occur is uncertain as global warming is expected to produce drier conditions on average. In south-eastern Australia, reduced rainfall and increased temperatures and evaporation rates are expected to reduce run-off by 20-36% by 2060.

Of course, anglers should be encouraged to take every possible measure to return sand flathead to the water unharmed and to minimise gut-hooking. Tasmanian studies have shown that, properly handled, 100% of lip-hooked sand flathead can survive and that more than 99% caught on circle hooks can survive after release.

Other bay flathead species

The research and recommendations described here refer to sand flathead; there are two other flathead species taken in the Bay - Yank or blue-spotted flathead and rock flathead. At the same time sand flathead numbers were declining, the Yank flathead stock remained steady and was estimated to be 180 tonnes in the final year of the annual trawl survey, 2011. Yank flathead caught by anglers are consistently larger - by an average 7 cm - than sand flathead. While their stock size is not known, rock flathead are also commonly taken at larger sizes, particularly by anglers using soft plastics. As most rock flathead are taken by commercial fishermen using nets, over the next few years as netting is phased out, rock flathead numbers can be expected to increase.

A final message

Fisheries Victoria's research team has delivered a thorough report that squarely addresses anglers' concerns about Port Phillip Bay sand flathead and gives the clearest possible pointers on management actions and continued monitoring. It looks like an excellent investment of RFL funds and warrants an equally thorough evaluation by anglers and fisheries managers.

The executive summary of the report *The decline of sand flathead stocks in Port Phillip Bay: magnitude, causes and future* **can be seen at http://agriculture.vic.gov.au/fisheries/science-in-fisheries or email: richard.rogala@ecodev.vic.gov.au for a copy of the full report.**

Modelling indicates that halving the bag limit could reduce the total catch by 4% while a bag limit of 5/day would reduce the annual catch by 16%

Q&A with Allison Webb

DIRECTOR, FISHERIES MANAGEMENT AND SCIENCE, FISHERIES VICTORIA

I am fortunate to have had approximately 20 years of working with the fisheries and aquaculture sectors in Canada - most of it working for the federal Department of Fisheries and Oceans out of their office in Vancouver BC.

In my previous roles I was able to work with a wide variety of stakeholders and interests including recreational and commercial fishers, Aboriginal peoples, ENGOs, aquaculturalists, other industries and various levels of governments which exposed me to a wide variety of perspectives.

I am particularly grateful for the opportunity that I had to work in our international division where I was responsible for international fisheries negotiations in the Asia Pacific Region as well as on bilateral treaties such as salmon and halibut with the United States.

What aspects of your new role do you most like?

I am really enjoying the opportunity to work in another jurisdiction and in that regard, loving meeting with stakeholders across the state and getting to know my team at Fisheries Victoria. I have been really impressed with the passion and commitment of the stakeholders that I've met to date to protect the fisheries resources and promote sustainable recreational fishing opportunities in Victoria.

What do you think are the key challenges facing recreational fisheries research and science?

I am really interested in ensuring that we can improve our data collection on species that we manage for the benefit for recreational anglers. In this area, I am pleased to see the Target One Million commitment to complete a recreational catch survey which should facilitate this, however, I am also interested in working on developing more cost effective ways that we can continue this work on an ongoing basis.

Climate change adaptation is also another area which I think it important for research - particularly in Victoria and Australia where productivity is relatively low and the impacts from changes in habitat could be significant.

What opportunities exist for recreational fishers to get involved in and support research, from a voluntary, citizen-science type of approach to research?

I think that the recreational sector has been really proactive in managing the resource and promoting research. The way that the Recreational Fishing Licence money has been used to go back into the sector is an excellent approach to continuing to support this work. In terms of other activities, I am interested in seeing if recreational fishers can work with Fisheries Victoria to pilot and test some new technologies for catch monitoring that can support stock assessment work as well as continue to support on-going projects like the Angler Diary Program, perch search etc. I am also open to hearing from anglers about strategic areas of research that are important to them as I think that research priorities should not just be driven from Fisheries Victoria, but also respond to those from the users of the resource.

Are there any lessons or learnings from your previous roles that could be applied to the Victoria context?

Surprisingly so many of the issues in Victoria are similar to those in Canada which means that much of my previous experience is relevant here although it's always important to consider the local context. One thing that I think that we've done well in fisheries in British Columbia where I'm from, is to bring all sectors and Aboriginal people together to collaboratively manage the resources and I would like to see more of those conversations taking place in Victoria. This dialogue has not always been easy, particularly when the views are often divergent, but over time we have made a lot of gains through improved relationships across sectors.

I am also interested in considering some of the approaches to licencing that are used in Canada which I think might be beneficial in Victoria.

Where would you like to see Victorian recreational fisheries head in the future?

I would love to see a longer term (10 year) strategic plan to support the growth of recreational fisheries in Victoria. This would have a science element, but also link together other areas of our work at Fisheries Victoria including stocking, policy, education and enforcement and management. I think that including socio-economic data on the contribution of the sector to regional Victoria would also be very useful.

The case for seagrass restoration in Port Phillip Bay

Figure 2 . Snail eye view of life in a long eelgrass (Zostera nigricaulis) seagrass meadow.

BY ALASTAIR HIRST
School of Life and Environmental Science, Deakin University

Port Phillip Bay is a highly productive system, supporting one of Australia's most prized recreational fisheries. Long-term stewardship of this resource relies upon, not only effective management of the resource, but upon the continued health and productivity of the bay's habitats and ecosystems. Seagrass is a key habitat in the bays and estuaries of coastal Victoria and provides essential habitat for some of Victoria's most sought-after recreational fishing species. Fisheries production for King George whiting (KGW) is closely linked to seagrass area and the majority of KGW catches come from regions adjoining major seagrass habitats in Port Phillip Bay including Corio Bay, the Geelong Arm and Swan Bay. Seagrass habitats also provide important nurseries for juvenile Australian salmon, flathead, snapper, garfish and mullet.

In recent years there has been renewed interest in restoring degraded or lost fish habitats to enhance fisheries production. Repairing where fish live is consistently rated as one of most important ways to improve recreational fishing in Victoria. However, repairing and restoring habitats requires both a longer-term perspective and commitment. The now accepted approach used to tackle such long-term issues is to bring together expertise, funding and passion from a range of key stakeholders using a model pioneered by the *Port Phillip Bay Oyster Reef Restoration Program.* This program is a consortium made up of government and non-government organisations, supported by the Albert Park Yachting and Angling Club.

There is an opportunity to develop a similar approach as part of a long-term seagrass restoration program in Port Phillip Bay. Recent research in Port Phillip Bay has identified factors affecting seagrass growth, reproduction and recovery that can be used to develop a restoration program. Our initial focus will be on developing techniques to help restore the loss of seagrass on the Bellarine Bank (see below). As part of this process we have been given some funding from the Recreational Fishing Licence Trust fund to consult with stakeholders and generate support and interest for a seagrass restoration program in Victoria. Over the next couple of months we will be talking with as many stakeholders as possible including local angling clubs, catchment management authorities (CMAs), non-government organisations and government. The culmination of this process will be a workshop for all stakeholders and interested parties. More importantly, this project will provide anglers with an opportunity to play a stronger role in the long-term stewardship of Port Phillip Bay and increase fishing opportunities for future generations.

Seagrasses in Port Phillip Bay

Seagrasses are most closely related to land plants and share many of their attributes. As a consequence, seagrasses are typically restricted to shallow coastal waters where this is ample light to support growth, and sandy/muddy bottoms where seagrass roots can acquire sufficient nutrients without being up-rooted and washed away by waves and currents. In contrast to seaweeds, they get most of their nutrients from the sediments they grow in and have extensive root systems that help stabilise coastal sediments and reduce erosion. In Port Phillip Bay, the largest expanses of seagrass are located in shallow (<4 metres) waters protected from prevailing westerly winds (and hence waves) such as Swan Bay, Corio Bay and parts of the southern shore of the Geelong Arm and western shore of the Bellarine Peninsula (*Fig. 1*). By comparison, there is little seagrass found on the eastern shore of Port Phillip Bay – the coastline most exposed to prevailing winds and waves.

Meadow forming seagrasses in the bay are dominated by two species, long eelgrass *(Zostera nigricaulis)* and short eelgrass *(Zostera muelleri)*, with a third species, *Amphibolis antartica*, restricted to the more exposed bay entrance (*Fig. 1*). Short eelgrass tends to occur in intertidal and very shallow subtidal habitats in Port Phillip Bay, whereas long eelgrass is almost exclusively subtidal (i.e.

always submerged regardless of the tides) growing to a maximum depth of 8 m within the bay. Long eelgrass meadows (*Fig. 2*) provide the majority of important seagrass fisheries habitat within the bay because their three-dimensional structure provides refuge from predators for juvenile fish and seagrass plants support algae (epiphytes) and invertebrates that in turn, provide food for fish.

Growth and reproduction in seagrass beds occurs in three ways. Seagrass bed expansion is achieved primarily through the physical elongation of rhizomes in the sediment (similar to grass root runners) from which new seagrass shoots arise (*Fig. 3A*). Seagrass also reproduce via seeds that result from the fertilisation of pollen and eggs produced by seagrass plants. These seeds are the source of new (genetically distinct) seedlings. The third strategy, is specific, to long eelgrass and involves the production of seagrass fragments called 'aerial roots' that contain both root and leaves (*Fig. 3B*). These fragments detach and float away in currents and contribute to the establishment of new seagrass colonies in other areas. These three mechanisms are important in the growth, maintenance and recovery of seagrass beds from disturbances.

Historical trends in seagrass abundance in Port Phillip Bay

Seagrass area has not always remained constant in Port Phillip Bay and has changed considerably in some regions. Researchers from Fisheries Victoria reconstructed historical trends using aerial photography and found that reductions in seagrass area over the last 70 years matched dryer periods in Victoria's climate. For example, seagrass area was lowest following the Second World War in the 1940s and the recent millennium drought (1997–2009). This has led researchers to suggest that climatic variability may be important in controlling total seagrass area in Port Phillip Bay.

During the recent drought from 1997–2009, the greatest seagrass losses occurred on the Bellarine Bank on the southern coast of the Geelong Arm (*Fig. 4*). Over 90% of seagrass meadows along this coast have disappeared since 2000 and historically this region has supported high catches of KGW. The cause of these losses has been attributed to changes in sediment movement (by winds and waves) and/or changes to nutrient inputs that occurred during the drought. It is predicted that if Victoria's climate dries there is likely to be less seagrass in the bay and greater future losses.

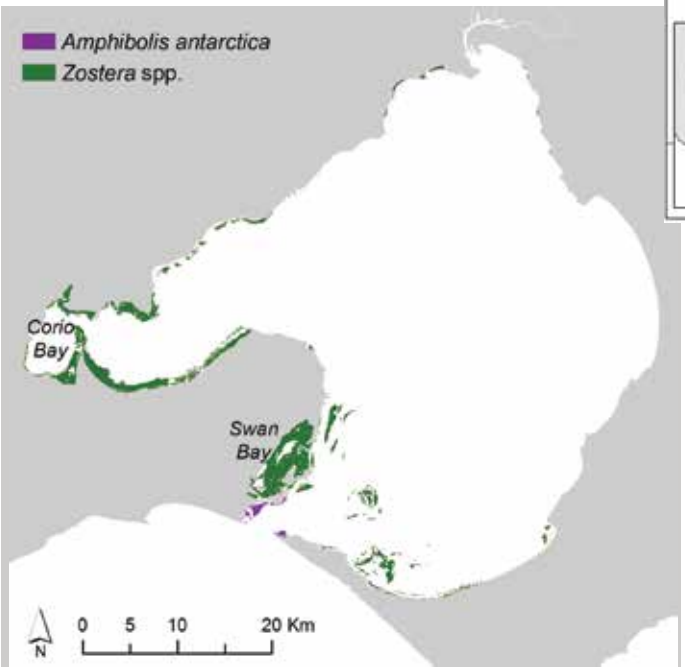


Figure 1. Map of seagrass habitats in Port Phillip Bay.

Figure 3. A) Seagrass shoots growing from rhizome, and B) aerial roots.

How resilient is seagrass in Port Phillip Bay?

Concerns about the loss of seagrass and the future health of seagrass ecosystems in the bay prompted the Victorian Government to fund a four-year research project examining seagrass resilience in Port Phillip Bay. This research was undertaken by a consortium of researchers from universities and government and focussed on the role nutrients and physical processes play in influencing seagrass dynamics, how seagrasses reproduce and how they recover from disturbance. The most interesting conclusion from this research was that not all seagrass in Port Phillip Bay is alike and that seagrass beds in different parts of the bay have differing levels of resilience to a range of impacts.

The research discovered that seagrass meadows in Port Phillip Bay can be divided into 'persistent' and 'ephemeral' seagrass beds. Persistent seagrass beds are relatively stable over time, whereas ephemeral beds are much more variable and have shown major increases and declines over the last half century. Persistent beds tend to be found in locations protected from high wave exposure in areas dominated by fine, muddy sediments (e.g. Corio Bay and Swan Bay), whereas ephemeral seagrass beds are found in more exposed parts of the bay dominated by sandy sediments (e.g. Bellarine Bank and the Mornington Peninsula). Seagrass growing in ephemeral beds is often much shorter and sometimes sparser because seagrass leaves are degraded by higher wave action.

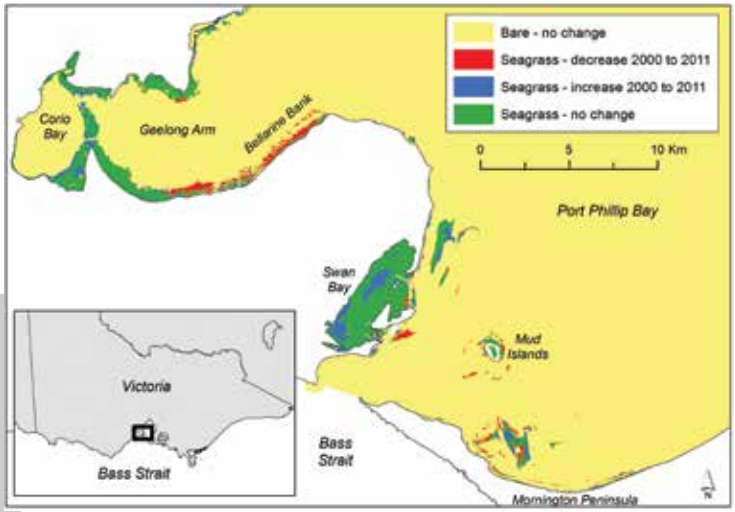


Figure 4. Change in seagrass area between 2000 and 2011 in south-western Port Phillip Bay.

Persistent seagrass beds tend to be dependent on nutrients recycled within the sediments and use nitrogen created within the sediments by nitrogen-fixing bacteria that convert nitrogen in the atmosphere into a form that can be used by seagrass. In contrast, ephemeral seagrass beds are more dependent on nutrients coming from external sources such as the catchment (river inputs) and the Western Treatment Plant (treated sewerage), and are much more vulnerable to disturbances such as storms or burial under moving sand bars. These external nutrients sources are much more variable and are likely to be heavily influenced by climatic variability, particularly the drying of Victoria's climate and long-term reductions in rainfall.

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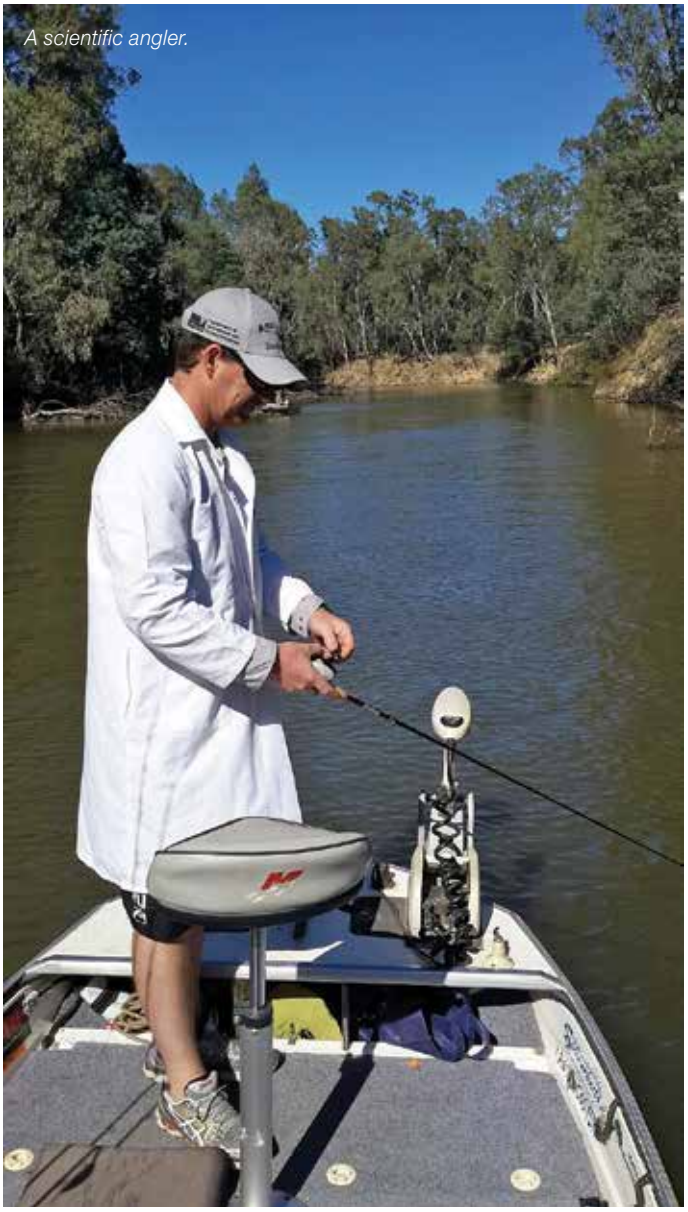
Scientific angling to support Murray cod research

– outcomes of events on Goulburn and Ovens Rivers 2015

BY DR BRETT INGRAM
Fisheries Victoria



A scientific angler.

*This is an innovative project that will allow researchers to better monitor Murray cod populations over time by **using Murray cod catch information collected by both recreational anglers and electrofishing surveys.***

During March 2015, Fisheries Victoria held two Murray cod fishing events at which anglers assisted in the capture and tagging of Murray cod to support a national, 3 year project *"Building a Stronger, more Resilient and Sustainable Murray cod Fishery"*, which is funded by the Fisheries Research and Development Corporation and state fisheries agencies across the Murray-Darling Basin.

This is an innovative project that will allow researchers to better monitor Murray cod populations over time by using Murray cod catch information collected by both recreational anglers and electrofishing surveys.

The two angling events occurred on the Goulburn and Ovens Rivers. Teams of anglers fished over two days at each event. These fishing events are part of a series of six fishing events held across the Murray - Darling Basin annually for the next three years. Murray cod that were caught were measured, tagged for identification purposes and released (left).

The project team from Fisheries Victoria kindly thank the overwhelming support of the 25 anglers that took part in the events.

A summary of the first year's results is provided below.

Event results

General observations

Anglers caught 25 Murray cod. A small number of golden perch and a trout cod were also caught by anglers. Most Murray cod were caught by spinnerbaits (13 fish), followed by bibbed (hard-bodied) lures (6 fish) and lipless crankbaits (4 fish), though these figures may reflect the popularity of these lures (or the angler's confidence in using the lures), rather than catching efficiency. Even though anglers caught more Murray cod on the Saturday than the Sunday, catch rate (hours/fish/team) was similar between the days. Most Murray cod were caught during the morning fishing session, which also corresponded with the highest number of teams fishing, with the peak in catch occurring between 9:00 and 10:00 am (Figure 2). On-going catch data, as recorded during these events, may provide further information on time of day when Murray cod are likely to be caught.

Electro-fishing caught more Murray cod, across a greater size range (237 fish, 4.5-88cm), than did angling (25 fish, 29.5-100 cm) (Table 1, Figure 1). This is not surprising considering that the latter used a method (mainly lure-fishing) that targeted larger fish, and relied on fish wanting to "take the bait". However, it is worth noting that angling caught more larger fish than did electro-fishing (Figure 1). For fish >40 cm, anglers caught 21 compared to 13 caught by electro-fishing.

Some Murray cod were observed but not captured by the electro-fishing crews, and of the Murray cod that were caught, generally only fish >10 cm were tagged. ARI has previous caught and tagged Murray cod in the Ovens River as part of another project. Some of these fish were caught during the present study, but were not considered as recaptured fish in the sampling period of this study.

Angled Murray cod with streamer tags inserted through dorsal fin.

Goulburn River event (14-15 March)

Nine teams (19 anglers) participated in the event. Over the two days of fishing 10 Murray cod (29.5 to 38 cm in length) were caught and tagged by seven anglers, 8 fish were caught on the Saturday.

Using information on the number of hours that anglers fish, there was a Murray cod caught every 2.4-9.6 hrs (mean 6.7hrs) by teams.

The electro-fishing survey conducted in the week after the event caught 78 Murray cod and tagged 31 of these. One Murray cod, caught by anglers at Toolamba Bridge B, was captured.

Ovens River event (28-29 March)

Seven teams (14 anglers) participated in the Ovens River event. Fifteen Murray cod (32 - 100 cm in length) were caught and tagged, 11 of these were caught on the Saturday. Half the anglers caught Murray cod. The largest Murray cod caught over both events were taken from the Ovens River at Lavis' A (95 cm) and Boorhamen Nth B (100 cm).

Using information on the number of hours that anglers fished, there was a Murray cod caught every 1.8-9.0 hrs (mean 5.6 hrs) by teams.

The electro-fishing survey caught 159 Murray cod and tagged 77. Just one of the Murray cod caught by anglers at Lavis' A was recaptured.

What's next

The Goulburn and Ovens River scientific angling events will be run again in 2016 and 2017 to build on the baseline data collected in 2015.

In addition, Fisheries Victoria has received funding from the Recreational Fishing Grants Program to extend the scientific angling program to the Loddon River. VRFish will by seeking up to 16 keen Murray cod fishers to take part in Loddon event.

Outcomes of the project

It is too early to draw any conclusions from the results of the initial events. However, when the project is completed, data collected from Victoria will be combined with data from similar events in other states for analysis. It is expected that this national project will build on our understanding of Murray cod populations and improve their monitoring and management. In particular the information gathered will help provide more robust estimates of population size and structure across larger areas, and help monitor outcomes of strategies to sustainably manage the fishery, such as changes to regulations (e.g. slot limits) and stock enhancement.

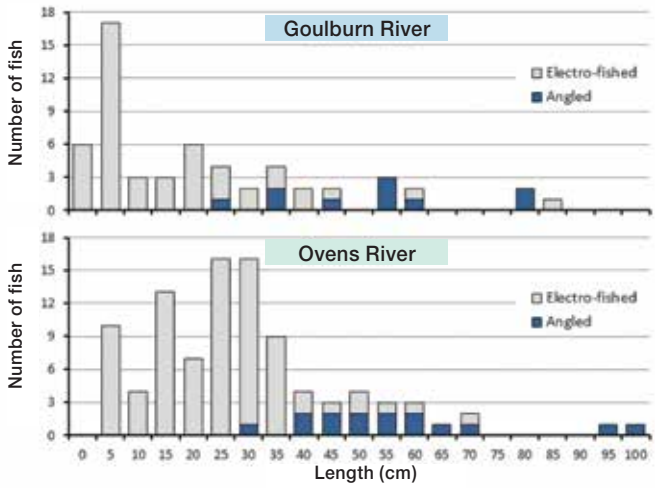


Figure 1. Length frequency distribution of Murray cod caught during angling and electro-fishing events in the Goulburn River and Ovens River.

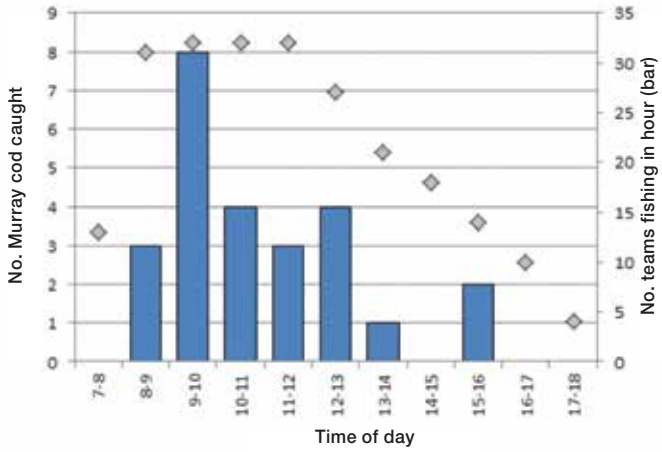


Figure 2. Number of Murray cod caught at different times of the day

Table 1. Summary of Murray cod caught, tagged and recaptured during angling events and subsequent electro-fishing surveys.

1 Excludes Murray cod that were observed but not caught.
2 Generally Murray cod < 10 cm were not tagged.
3 Values exclude recaptures of Murray cod that had been tagged prior to this project.

Event	Fishing method	Murray cod captured[1]	Murray cod tagged[2]	Recapture of angler-tagged fish	Recapture of electro-tagged fish[3]
Goulburn River	Angling	10	10	0	
	Electro-fishing	78	31	1	4
Ovens River	Angling	15	15	0	
	Electro-fishing	159	77	1	13
OVERALL	Angling	25	25	0	
	Electro-fishing	237	108	2	17

My life as a diary angler

BY ROSS WINSTANLEY

Over the past 15 years or so there's been a major paradigm shift in Victoria's approach to fisheries research. Fortunately, our Queenscliff researchers and some dedicated anglers have been working together ahead of the changes that today see Fisheries Victoria's *Angler Diary* and *Research Angler* programs underpinning the essential roles of monitoring and assessment of our bay and inlet fisheries.

I've been lucky enough to be at the point where fisheries management and research needs converge with the willingness of keen anglers to commit to long term delivery of detailed catch and fishing effort information collected in a consistent way. Right from the start in 1994, I've been a participant in workshops that have assessed our snapper, whiting, black bream and other key species and on the Port Phillip and Western Port Bays, Gippsland Lakes, Mallacoota and other inlet fisheries. My involvement began in my fisheries management role and, after leaving Fisheries Victoria in 2001, has continued as a member of these programs.

By way of background, since 1978 Fisheries Victoria has collected commercial fishermen's information in such fine detail that enabled a quite forensic approach to tracking changes in the bay and inlets fish stocks. However, as the effective shut-down of most of these commercial fisheries fast approaches, fisheries researchers are becoming increasingly dependent on recreational fishers as their source of essential data for stock assessments. Traditional methods of continuously monitoring recreational fishing, used face-to-face methods such as on-water or boat ramp surveys. These approaches are very expensive to run and can't be sustained as the main means of monitoring the growing pressures being applied by recreational fishing. As a response, Fisheries Victoria has pioneered the Angler Diary approach which has been taken up in various forms around the country and has received national recognition.

Why have I been such a keen member of the program?

I see so many benefits from being a diary angler. First and most importantly I love fishing and catching fish but I like to know that there's a valid purpose to fishing beyond the point where I've met my household needs for fish. I have always recorded basic details of my fishing trips and living in Geelong since 1996 I have taken advantage of the opportunity to fish frequently in Corio Bay. Because I fish so often and as - in most years - this bay is so productive, I have the potential to catch a lot of fish including more legal-sized fish than I want to keep. Knowing the value of the data I'm recording helps me to justify releasing the numbers of size and undersize fish caught in my 2-3 hr dawn sessions. Having previously tagged and released a lot of fish and been directly involved in the national "*Released Fish Survival Program*" reassures me of the high survival rates of fish I release.

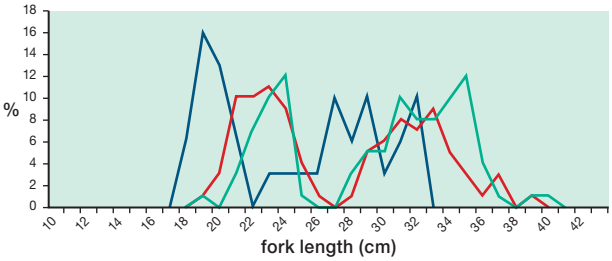
Second, I'm not a typical angler as I'm quite happy to commit to fishing much of each season in the same locations, using the same gear and methods for the same mix of species, year after year. Bait fishing with basically whiting gear, I target a mix of pinkies, whiting and flathead in depths of 3-6 m in Corio Bay.

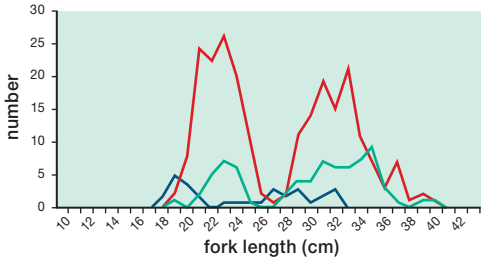
While all my fishing records go to the Queenscliff researchers for use in stock assessments, snapper research, etc, I also play around with the data myself. I started my career in research before moving happily into the fisheries management and policy areas but there's still a frustrated researcher inside me! Quiet times during winter give me the opportunity to chart the way undersized pinkies grow, month after month, through the warmer months and how members of an abundant year class that I first catch around 15-18 cm in one year are still identifiable as they move into the legal-sized pinky fishery two years later. Similarly, I can track the progress of undersized whiting as they grow beyond 27 cm.

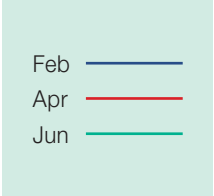
Observing how the Corio Bay spoil grounds function as "nursery" habitats for snapper and whiting until they reach about 35 cm reinforces the view I share with many others about how important it is to protect them. These undulating shallow grounds have long since been allowed to return to a natural condition typical of similar soft-bottom habitats covered with a mix of seagrass, algae and open bottom.

As one of more than 300 Victorian diary anglers I get to be part of the assessment workshops where our data inputs as volunteers are incorporated with commercial fisheries, recruitment survey, fish ageing and habitat data to describe the status and trends of the fisheries and the stocks. That's where I can see the real value of this program and appreciate how Queenscliff scientists have led the national development of approaches to assessing stocks and monitoring fisheries where commercial fishing has been removed.

While diary anglers operate on an entirely volunteer basis, running the program is expensive. It's proving to be a great investment of members' time and of Recreational Fishing Licence fund that pays for it. That's just as well as this program will be vital to ensuring that our bay and inlet fisheries continue to be sustainable.







Translocating River Blackfish in the Tarwin River Catchment

BY RENAE AYRES
Arthur Rylah Institute

Ask a recreational fisher which fish species they most prefer to catch in rivers and common responses are Trout, Murray Cod, Estuary Perch . . . but what about the humble River Blackfish?

In the Tarwin River Catchment in the past, River Blackfish were a very popular recreational fishing species. River Blackfish were found throughout fresh water areas of the entire Tarwin River Catchment and the region was one of the main fishing destinations for River Blackfish in Victoria. These days, the abundance of the River Blackfish in the Tarwin River Catchment has declined and its distribution is restricted. Leongatha Angling Club Inc. hold an annual River Blackfish fishing competition on opening weekend and report that their catches have waned over recent decades.

Healthy habitat is a key to improving fish populations (and your fishing opportunities!). Over the past 25 years, the West Gippsland Catchment Management Authority (WGCMA) together with local landholders and community members, have undertaken extensive waterway rehabilitation activities in the Tarwin River Catchment, including weed removal, native revegetation, fencing and bank stabilisation works. These works have rehabilitated habitat for River Blackfish and other fish species at a number of sites. However, the non-migratory nature, localised breeding strategy and small home range of River Blackfish may be limiting the natural recolonisation of these rehabilitated areas.

New research is commencing to investigate ways to help return the local River Blackfish population to its former glory. WGCMA, the Arthur Rylah Institute for Environmental Research (ARI) and local recreational fishers are working together on a pilot research project to trial the translocation of River Blackfish into rehabilitated habitat sites in the Tarwin River and investigate whether they establish new home ranges within the rehabilitated sites.

In October/November 2015, 30 adult River Blackfish (greater than 20 cm long) will be collected from source locations in the Tarwin River and moved to rehabilitated and non-rehabilitated reaches located downstream within the historical distribution of this species. The translocated River Blackfish will be implanted with acoustic tags (similar to microchips for your pets) so that we can monitor their movements. We hypothesise that the River Blackfish translocated into the rehabilitated habitat will stay within their new home range, whereas the River Blackfish translocated into the non-rehabilitated reach may move to find better habitat and possibly return to the source location.

A series of acoustic receivers placed within the rehabilitated and non-rehabilitated sites, as well as between these sites and source sites, will log the details of tagged River Blackfish if they swim past. Data from the receivers will be downloaded regularly over the next 6 months to check whether the tagged River Blackfish are moving within or out of translocation sites and in which direction.

The project is in the early stages and final results will not be known until mid-2016. We kindly ask that recreational fishers safely release any tagged River Blackfish caught in the Tarwin River until after the project finishes. Learnings and outcomes from this trial translocation may be applied in the future to help re-establish local River Blackfish into rehabilitated habitat within their natural range in Victorian waterways.

Many thanks thus far to Leongatha Angling Club for supporting the project and for suggesting locations to source River Blackfish.

This project is funded by the Victorian Government using Recreational Fishing Licence Fees. It is managed by WGCMA and ARI has been contracted by WGCMA to conduct the research. For further information, please contact Matt Bowler at WGCMA (phone: 1300 094 262) or Justin O'Connor at ARI (phone: (03) 9450 8600, email: justin.o'connor@delwp.vic.gov.au).

River Blackfish

Rehabilitated habitat in a tributary of Tarwin River west branch; weeds have been removed, native trees replanted and fences erected.

Fish continue to benefit from habitat enhancements in the Goulburn Catchment

BY JOANNE KEARNS Arthur Rylah Institute

The Goulburn Broken Catchment is one of the most preferred river fishing regions in Victoria[1]. It supports a diverse range of fish, including recreational species such as trout, Murray Cod and Golden Perch, and other important native species such as Blackfish, Macquarie Perch and Barred Galaxias.

Like many waterways in south-eastern Australia, the Goulburn Broken Catchment has a history of extensive clearing of riparian vegetation and removal of large quantities of instream woody habitat (snags).

This has resulted in increased flow velocities, bed degradation, channel enlargement and loss of critical habitat for aquatic animals. Such changes have been implicated as a major contributing factor in the decline of many fish populations.

Between 2000 and 2008, the Goulburn Broken Catchment Management Authority (CMA) conducted habitat enhancement works at several sites in the Goulburn, Delatite, Rubicon and Acheron Rivers, aimed primarily to benefit Brown Trout and Rainbow Trout. These on-ground works were funded largely by Victorian Recreational Fishing Licence Fees and involved installing lunkers (artificial habitats constructed of wood and rock to replicate undercut banks), constructing deflecting rock groynes, boulder seeding (large boulders placed in the river), stabilising banks and re-instating snags. Fish surveys conducted by Fisheries Victoria confirmed that fish were using these new habitats shortly after construction.

Brown Trout (top) and Two-spined Blackfish (bottom) collected from habitat enhancement sites in the Rubicon River.

Years have passed and questions are now being asked as to whether these habitat enhancements continue to provide benefits for fish? Such information is essential to inform future habitat improvement programs as well as to justify past investments.

In early 2015, the Goulburn Broken CMA initiated a research project to investigate the current status of the habitat enhancement works and their effectiveness in providing benefits for fish populations. The research project was jointly funded by Goulburn Broken CMA and the Victorian Government, using Victorian Recreational Fishing Licence Fees. Scientists from the Arthur Rylah Institute for Environmental Research (ARI) assessed habitat condition and fish occupancy in the Goulburn, Delatite, Rubicon and Acheron Rivers at the habitat enhancement sites, as well as at several control sites (sites where no habitat enhancement was undertaken), and reference sites (sites with natural structural habitats including wood, rock and undercut banks) for comparison.

ARI's research found that the habitat enhancement works undertaken from 2000 to 2008 continue to provide vital attributes important for fish, including structural complexity, hydraulic diversity and localised bed scour (depth). Habitat structures were intact at most habitat enhancement sites, and only a few sites suffered from sedimentation (particularly in downstream, low flow areas) and structural failure (some lunkers).

ARI's research found that the habitat enhancement ***works undertaken from 2000 to 2008 continue to provide vital attributes important for fish,*** *including structural complexity, hydraulic diversity and localised bed scour (depth).*

In the mid-Goulburn River, more than 400 fish were recorded from 15 habitat enhancement sites. Brown Trout occupied habitat installed at the habitat enhancement sites and their abundance at these sites was significantly higher than at the control and reference sites. The habitat enhancement sites with rock groynes, or rock groynes together with snags, contained more Brown Trout than sites with just boulder seeding or snags.

Surveys in the Delatite River also indicated that habitat enhancement works continue to provide benefits to the local fish community. Over 450 fish were recorded from seven habitat enhancement sites, which consisted largely of boulder seeding and rock groynes. Two-spined Blackfish were more abundant and there was a greater biomass (kilograms of fish per site) in the habitat enhancement sites compared with control and reference sites. Few Brown Trout and Rainbow Trout were captured at any of the Delatite River sites located in the lower-mid river reaches. This is likely a reflection of other factors that affect trout distribution, such as adequate water temperatures, rather than a failure of the habitat enhancement works.

Fourteen habitat enhancement sites were surveyed in the Rubicon River and 464 fish were recorded. The on-ground works completed in the Rubicon River mainly consisted of installing lunkers. Like the Goulburn

Examples of habitat enhancement works (a) rock groynes with rock banking; (b) snags; (c) boulder seeding; and (d) lunkers. Arrows indicate structures.

and Delatite Rivers, habitat enhancement sites in the Rubicon River had greater numbers of fish than the control and reference sites. Large numbers of Two-spined Blackfish were found at habitat enhancement sites in the lower reaches of the Rubicon River. Brown Trout occurred in greater abundance and biomass at habitat enhancement sites in the upper reaches of the Rubicon River compared with control sites.

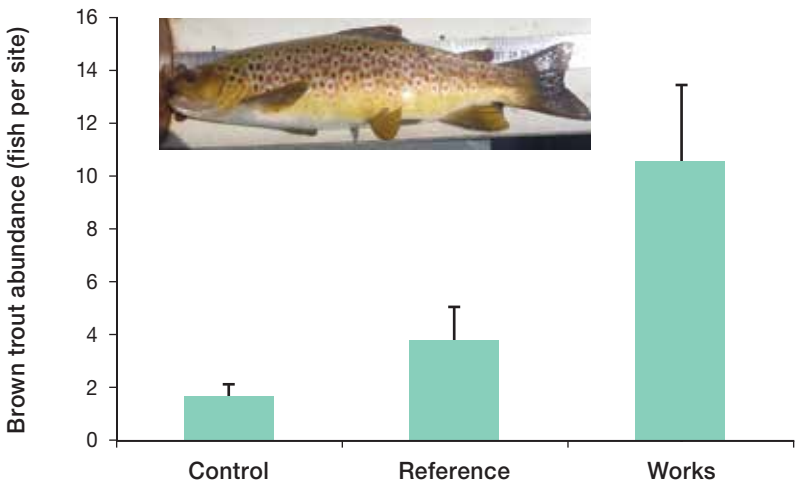
In the Acheron River, just two habitat enhancement sites were surveyed; thus, the effectiveness of those structures in providing benefits to fish populations was inconclusive.

Overall, this research demonstrates that habitat enhancement in the Goulburn, Delatite, Rubicon and Acheron Rivers continues to benefit local fish communities, particularly Brown Trout and Two-spined Blackfish. It adds to the growing body of global evidence that habitat rehabilitation can benefit fish populations. Lunkers, rock groynes, snags and boulder seeding, positioned and retained within sites of adequate water velocities and on outer bends (erosional zones) can provide long term benefits to fish populations. Of course, several other factors, such as site access, project objectives, the types of habitat works and their installation costs, must also be considered when selecting sites and planning future habitat enhancement projects.

Overall, this research demonstrates that habitat enhancement in the Goulburn, Delatite, Rubicon and Acheron Rivers ***continues to benefit local fish communities,*** *particularly Brown Trout and Two-spined Blackfish.*

For further information, please contact Zeb Tonkin at ARI (phone: (03) 9450 8600; email: zeb.tonkin@delwp.vic.gov.au) or Christine Glassford at Goulburn Broken CMA (phone: (03) 5797 4400; email: christineg@gbcma.vic.gov.au).

[1] DPI Fisheries Victoria: Improving Inland Recreational Fishing Survey July 2012



Brown Trout abundance (number of fish per site) in control, reference and habitat enhancement sites in the Goulburn River. Brown Trout were significantly more abundant in the habitat enhancement sites compared with control or reference sites.

Mulloway anglers:
the new citizen scientists

BY LAUREN VEALE
Nature Glenelg Trust

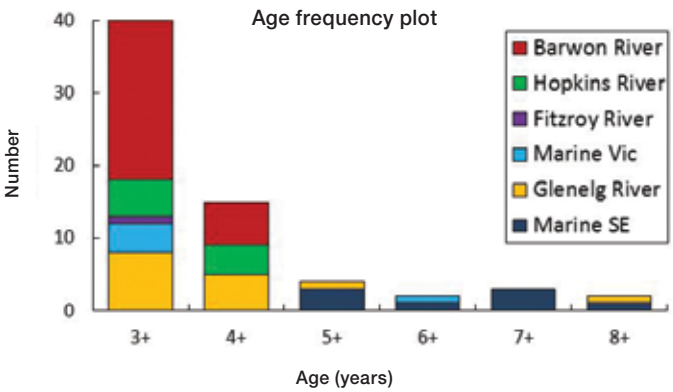
At a very early age, I was introduced to the world of fishing (thanks mum and dad) and vividly remember catching my very first fish (redfin) at Lake Bolac. In recent years, I have spent many holidays by the beautiful banks of the Glenelg River in the hope of catching one of those elusive mulloway the locals all talk about. Through this quest, I developed a passion for our aquatic environment, steering me towards a career in fisheries science.

After obtaining formal qualifications, I quickly realised that no matter how much knowledge you gain through looking down a microscope or dissecting fish in the laboratory, the fundamental knowledge of a recreational fish species often rests between the ears of an angler. The term 'citizen scientist' is a relatively new term but old in practice. It relies on the collection of data from the natural world by members of the public. It promotes an understanding of science and empowers people to look after their own backyard.

With an increased number of anglers targeting mulloway across Victoria, now is the perfect time to learn more about this elusive but highly sought after species. Despite their occurrence across much of the state, few studies have focused on mulloway in Victoria. At Nature Glenelg Trust, we are undertaking research to learn more about the population structure and connectivity of mulloway stocks.

The research program, funded by Recreational Fishing License Fees, largely relies on the active involvement of recreational fishers. In comparison to other states, the commercial catch of mulloway in Victoria is minimal which limits the availability of collecting biological samples for research. However, with many anglers dedicating their life to catching mulloway, citizen science may hold the key to advancing our understanding of this species.

Any angler can become a citizen scientist by donating their filleted fish frames to the research or by filling out an Angler Diary. With each filleted fish frame, we record the total length, sex



and reproductive condition of each mulloway and extract the ear bones or 'jewels' from their skull and use these to determine the age the fish.

Preliminary age data collected through citizen science indicate the majority of mulloway currently caught by anglers in Victorian estuaries are juveniles aged between 3-4 years, highlighting the importance of these estuaries during early life stages. Since the project began in August 2014, over 50 anglers have been involved in the research and so far, we have received over 150 donated fish frames. For a full description of the preliminary research findings, download the Research Angler Newsletter from the Nature Glenelg Trust website (www.natureglenelg.org.au).

Mulloway display very different life history traits across temperate Australia. For example, mulloway along the east coast mature at 3-4 years and live for around 24 years, whereas those in South East South Australia (SA) do not mature until 6-7 years and live for as long as 41 years of age. These differences reflect recent research, which defines four genetically distinct subpopulations or breeding groups of mulloway in Australia: Western Australia (1), western South Australia or 'Yalata' (2), South East South Australia including the Coorong (3); and southern Queensland and New South Wales (4).

Unfortunately, fish do not conform to state boundaries and it is unknown whether Victorian mulloway constitute their own breeding group or whether they form part of adjacent subpopulations. The current research project is well underway to collecting the necessary genetic information to clarify these stock boundaries and determine the degree of dependency of Victorian stocks on recruitment from interstate waters- information that is critical to species management.

We encourage any angler with a passion for catching mulloway to get involved in the project by becoming a citizen scientist. You can join our Facebook Page: www.facebook.com/groups/mullowaycitizenscience for more information about the project and a list of drop-off points where you can donate your frames. Alternatively, contact Lauren Veale at the Trust directly by email (lauren.veale@natureglenelg.org.au) or phone (0439 034 390).

Are native fish tuning in to the wrong channel? Throw the screen into the creek!

PETER ROSE
North Central Catchment Management Authority

Golden perch with a PIT tag (photo from North Central CMA). Twenty percent of tagged golden perch were found to enter irrigation channels; none were recorded to return to the stream.

The *Gunbower and lower Loddon Native Fish Recovery Plan* (the Plan) is an ambitious, long term plan being implemented by the North Central Catchment Management Authority (CMA) that aims to increase native fish populations and improve river health in over 200km of streams and wetlands in the Torrumbarry Irrigation Area.

The Plan takes a different philosophical approach to most river restoration plans – instead of trying to restore streams to their natural state, it recognises the opportunities to increase native fish populations within an existing vibrant and productive agricultural setting. Because the system contains two anabranches of the Murray River, water can be used for environmental flows to reconnect or maintain habitats, stabilise stream hydrographs to prevent nest abandonment or stimulate spawning migrations of key species, and then be returned to the Murray River further downstream. That is, every drop can be used twice!

A critical aspect of the Plan is addressing the loss of fish into irrigation channels. When adult, juvenile, or larval fish passively move from natural streams into irrigation channels (generally via a regulator with a flume gate that does not allow for return passage to the stream) they are effectively lost from the breeding population. Irrigation channels usually offer little habitat complexity to support large fish populations, and many are drained over the winter period, leaving fish to die or become stranded in isolated refuge pools and subjected to intense competition or predation pressures. While this issue has been well recognised in other parts of the world such as Europe and the USA, scientists have only recently investigated the magnitude of the problem in streams of the Murray-Darling Basin.

Initial work by the Victorian Arthur Rylah Institute for Environmental Research highlighted the extent of the problem in the Murray Valley and Torrumbarry Irrigation areas. In electrofishing surveys of 59 irrigation channel sites, over 10,000 fish from 10 native species were collected. Of particular concern for recreational anglers, these included numerous Murray cod, generally entering channels as juveniles, and golden perch, which appeared to be entering channels predominantly as adults. Larval fish surveys also indicated that drifting larvae and eggs of Murray cod, silver perch and golden perch from rivers and streams also entered into the channels. In a tagging project undertaken in Gunbower Creek, 20% of tagged young-of-year and adult golden perch were found to enter an irrigation channel, with none recorded to return. A population viability modelling study also assessed the impact of larval Murray cod loss into irrigation channels. The results indicated the impact could be severe, especially when combined with the impact of recreational fishing.

When adult, juvenile, or larval fish passively move from natural streams into irrigation channels ... ***they are effectively lost from the breeding population.***

Fish loss to irrigation channels is a global issue, but there are well established solutions. In the USA and Europe, screens are used to limit fish movement into channels, hydroelectric power stations and pump houses. In some cases, legislation requires it, which has resulted in innovation of many designs for different situations. Screens can take a variety of forms including vertical screens, rotating drum screens, travelling belt screens or pump screens. The appropriateness of a particular design depends largely on the target species, the expected volume of flow, the shape (and nature) of the diversion system and maintenance requirements. The use of innovative screens can be a win-win situation for irrigators and native fisheries, as they can minimise the entrainment of woody debris and sediment which can cause problems for pumping, while protecting native fish.

Monitoring and research undertaken by the North Central CMA over the past 10 years has demonstrated that, although diverse, the native fish population is low in abundance. With implementation of the Plan, there is high potential for native fish recovery, providing a great opportunity to test pilot applications of irrigation screen designs. Further work is needed to quantify the losses of native fish to the four major irrigation offtakes within the area (Channels No. 1, 2 (Macorna), 3 and 4). Following this, pilot designs will be implemented at one or two irrigation offtakes and evaluated for effectiveness in preventing fish losses to the irrigation channels. By keeping native fish in the streams and part of the breeding population, irrigation screens can help achieve a sustainable native fishery for the Lower Loddon and Gunbower system.

More information about the Native Fish Recovery Plan can be found at: http://www.nccma.vic.gov.au/Biodiversity/Conservation_and_Habitat/Native_Fish_Recovery_Plan/index.aspx

Potential for Victoria's yellowtail kingfish fishery

Your fishing licence fees at work

BY COREY GREEN
Fisheries Victoria

Yellowtail kingfish are a highly sought after recreational species mainly due to their fighting ability and eating qualities. Commonly caught off NSW around reefs and Fish Aggregation Devices (FADs), it was not uncommon for Victorian based anglers to travel to places like Eden and Narooma to target them. Historically (prior to 1990) yellowtail kingfish were caught by recreational anglers at various locations across Victoria including Mallacoota, Wilsons Promontory, Port Phillip Heads and Portland.

While the number of fish taken was not as high as those from other states (particularly NSW), fish were sometimes very large (up to 40kg). From the mid 1990s through the early 2000s both the number and size of fish taken has decreased and general interest in targeting kingfish declined. Many fishers believed the cause of decline was related to changing environmental conditions, food availability and the NSW kingfish trap fishery, but the actual cause is unknown.

Since around 2010, targeting yellowtail kingfish has increased in Victoria and a wide size range of fish are reportedly taken. During early February 2015, around 100 vessels were actively targeting kingfish at Port Phillip Heads on a single day. On some occasions fishing effort was so high that the Port of Melbourne issued alerts to anglers to avoid particular regions of Port Phillip heads as they posed a hazard to shipping traffic.

In Victoria, fundamental stock structure information is limited on this re-emerging fishery. However, with increasing fishing pressure it is important to understand the biology and structure of the stock.

Funded by Victorian recreational fishing licence fees, the objectives of this two-year project are to:

- Determine whether yellowtail kingfish caught in Victorian waters are from a single or multiple stocks.
- Define population characteristics (age and growth, size structure, spawning characteristics) of Victorian yellowtail kingfish.
- Determine the future potential of this fishery using historical recreational catch information.
- Trial the use of satellite tags as one method to understand movement characteristics (spatial, depth, temperature preference) of yellowtail kingfish.
- Trial otolith chemistry analyses as a method for investigating yellowtail kingfish temperature preference.

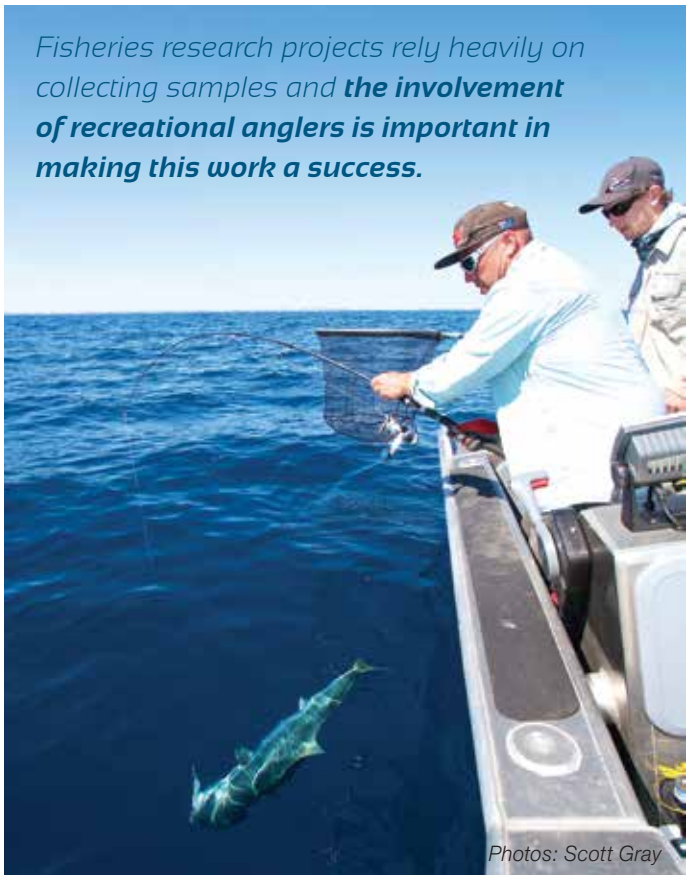
Information such as spatial and temporal stock structure (i.e. where and when do we see them), spawning age and growth data are basic knowledge requirements used to assess the status of the current population. This information will help us understand the productivity of the fishery and improve our management strategies that aim to enhance its potential.

Similarly, investigating movement and temperature preference will help us understand the distribution of this species. We will determine if satellite tags are suitable for tracking yellowtail kingfish. Such tags have been extremely valuable in tracking Southern Bluefin tuna. This trial will determine if satellite tags will hold in kingfish and whether behavioural characteristics allow effective transfer of data from the fish to satellites. Stable isotope analysis of their otoliths (earbones) has been successfully used to determine the temperature preference of many species; however, this technique has not yet been trialled on yellowtail kingfish. Such information will allow Fisheries Victoria to determine where kingfish are likely to live during different times of the year.

Fisheries research projects rely heavily on collecting samples and the involvement of recreational anglers is important in making this work a success. As such we are asking the recreational fishing community from all over Victoria to donate yellowtail kingfish frames. From frames we can collect much of the above information. If you are keen to help out and donate some frames please contact Dr. Corey Green at Fisheries Victoria for more information.

If previous years kingfish run is anything to go by, we are looking forward to a great year ahead.

Fisheries research projects rely heavily on collecting samples and ***the involvement of recreational anglers is important in making this work a success.***



Photos: Scott Gray

Electrofishing ...a great research tool!

BY RENAE AYRES Arthur Rylah Institute

Fish research tools: why do we use them?

We use a range of study tools to understand fish populations; how they function, how they respond to impacts, and how they respond to our efforts to help improve them. One of these study tools is 'electrofishing'.

Electrofishing is used by fish biologists to collect fish and gather information about fish populations, such as species distributions, abundances, diversity, size class distributions (showing recruitment or breeding success) and the presence of introduced or invasive species. It is used to assess and monitor recreational and threatened fish, as well as fish responses to, for example, habitat improvements, environmental flows, fish 'ladders', drought and bushfire impacts. Electrofishing provides vital fish data to inform fisheries and waterway management throughout Victoria and worldwide.

Electrofishing?! What is it?

Electrofishing involves the use of electricity to momentarily stun fish so that they can be caught, identified and measured for length and weight. In some instances, fish are also tagged with unique identification labels, transmitters to track fish or fin-clips are collected for genetic analysis. Fish recover quickly when removed from the electric field and are released back into their environment unharmed.

How does electrofishing work?

There are three main types of electrofishing units: backpack, bank-mounted and boat-mounted. All have a **power source** (battery or generator) to provide the electrical current, a **control box** to regulate the delivery of electricity to suit the specific survey, **positive and negative electrodes** which are suspended in the water and pass the electrical current through the water, and **safety switches** which immediately shut down power.

Each type of electrofishing unit differs in its application. **Backpack** electrofishing units are designed for use in wade-able habitat (e.g. smaller streams and wetlands) with low to moderate salinities. Backpack electrofishing units are literally carried on your back, so they can be used wherever you can walk through the stream and in more remote areas. **Bank-mounted** electrofishing units have a much higher power output and are operated via a generator mounted in a vehicle. They are also used in wade-able habitat and can be applied in moderate to high salinities, however you need to have the supporting vehicle nearby. **Boat-mounted** electrofishing is used to sample fish from larger sites that are navigable by boat, such as rivers and lakes, and in water depths greater than 0.5 metre.

Until recently, boat-electrofishing was limited to fresh water, however German electrofishing manufacturer Hans Grassl and the Arthur Rylah Institute for Environmental Research (ARI) have developed a prototype boat-mounted electrofishing unit that has the capacity to operate in saline environments such as estuaries.

The Grassl boat-mounted electrofishing unit is a great innovation which will help fill a significant gap in worldwide fish research by enabling more thorough studies of estuaries. You can watch a video about this world-first unit at: https://www.youtube.com/watch?v=PaXCutLOuJg.

Fish responses

Fish react variously to electrofishing. Within the electric field, voltage is greatest near the unit's positive electrode and decreases with distance. The size of the fish, its distance from the positive electrode, and its' orientation to the electric field all influence the voltage that a fish is exposed to. At very low levels of voltage exposure, fish exhibit little or no reaction and may just swim away. Higher levels of voltage exposure can inhibit swimming, trigger forced - swimming towards the positive electrode, and/or temporary stunning. As stunning only lasts for a few seconds, the fish need to be quickly netted and placed into an insulated, holding tank of clean water for recovery, allowing a number of fish to be measured after the electrofishing operation is finished.

The effectiveness of electrofishing is influenced by many environmental, biological and technical factors, such as water depth, salinity and turbidity; the size, biology, behaviour and density of fish; the working environment, weather, gear type, staff experience, etc.

Is electrofishing better than netting?

Of all the various tools available to sample fish, electrofishing is the most commonly used. Its main advantages over conventional netting methods are that:

- Electrofishing allows capture of a range of fish species and sizes
- Electrofishing can be used in a variety of habitats, whereas netting becomes tangled amongst reeds, logs and other instream habitats
- Electrofishing is more efficient: it takes less time and less effort
- Electrofishing is more scientifically 'rigorous': it allows a greater standardisation of catch per unit effort
- If properly used, adverse effects on fish are minimised
- Unlike netting, electrofishing does not rely on the movement of fish to be effective.

Who uses electrofishing?

The practice of electrofishing is specialised and highly regulated; it can only be undertaken by qualified personnel. There are strict requirements to ensure safe operation. All electrofishing operators must comply with the Australian Code of Electrofishing Practice which includes extensive theory and practical training and exams, first aid qualifications, medical examinations and qualifications for each type of electrofishing unit. In Victoria, electrofishing is used by researchers within government agencies, universities and private consultancies.

For more information about electrofishing and other fish sampling tools, please contact fish biologists at the Arthur Rylah Institute for Environment Research (phone: (03) 9450 8600, email: research.ari@depi.vic.gov.au).

Barkers Creek Reservoir trout fishery Recovery Project

BY GREG HELLSTEN

Barkers Creek Reservoir, also known as Harcourt Reservoir, is located north-east of Harcourt, Victoria. Built in 1869, Barkers Creek Reservoir is a 58 ha (2,900 ML; 14 m deep) domestic water storage. Because it supplies domestic and irrigation water, boating and swimming is prohibited and angler access is limited to the bank.

Its history of usage has been one of a family friendly location with toilet facilities and parking, remnant exotic trees in a heritage garden picnic area, redundant mooring point for hire boats, heritage gates and valve operation platform, and is an ideal destination for day fishing trips for anglers from Melbourne and regions using the upgraded highway.

The Reservoir has been renowned for its prolific mayfly and caddis hatches and for decades attracted fishers and fishing clubs from all over Victoria. Barkers Creek Reservoir is the closest large stillwater trout fishery to Bendigo and its growing population. It is also the home water of Bendigo and Districts Fly Fishing Inc (BDFF) and has been the scene for many of the club's events including an annual "Clean Up Australia" event.

In recent times the fishery has declined markedly as indicated by poor returns to occasional and regular fishers. Since late 2013 BDFF have been trying to identify reasons why Barkers Creek Reservoir has not been producing adequate returns for angler effort since drought recovery stocking commenced in 2010/2011 and a special stocking of large fish in November 2014.

The project to restore the Barkers Creek trout fishery developed from discussions with local fishers who have fished the Reservoir for many years. This included "brain storming" sessions aimed at identifying all possible reasons for decline of the fishery, question and answer sessions with Fisheries Victoria's John Douglas in February 2014 and discussions since then with Arthur Rylah Institute (ARI) scientist Renae Ayres.

The reasons for the decline of the fishery are currently subject to speculation and the interpretation of anecdotal offerings. Therefore, a scientific approach is needed to identify issues and determine what is required to turn around this important fishery.

Initially BDFF were focusing on a study on the effect of carp which appear to have proliferated in the water since 2010. Following unsuccessful attempts to locate a suitable biologist to participate in the project, discussions with ARI scientist Renae Ayres proved to be fruitful. Review by ARI and Fisheries Victoria of the possible research topics promoted by Barkers Creek Reservoir fishers has led to the recognition that there is a need for a preliminary analysis of the Reservoir fishery to basically determine what fish are surviving and build a stocking strategy accordingly.

***The Reservoir has been renowned for its prolific mayfly and caddis hatches** and for decades attracted fishers and fishing clubs from all over Victoria.*

BDFF, with the support of many stakeholders, successfully applied to the Department of Economic Development, Jobs, Transport and Resources, Victoria, for project funding under the 2014/2015 Large Grants Program to cover the cost of engaging ARI to perform the project management of the fisheries research, assessment and completion of the project deliverables.

The specific objectives of the preliminary analysis are to:

- Conduct a fisheries assessment of Barkers Creek Reservoir, following methods previously applied by Fisheries Victoria, to determine the current status of the trout fishery.

- Analyse available stocking, fisheries assessment and angling catch data to develop a time-series that describes changes in the Barkers Creek Reservoir trout fishery over time.
- Assess available data to inform and identify stocking strategies that will re-establish high quality trout fisheries at Barkers Creek Reservoir.
- Recommend a 5 year stocking strategy with provision for flexibility and contingency to adapt to environmental changes and angler catch effort data.

In May 2016 the survey will be conducted by taking a sample of fish using boat mounted electrofishing and mesh netting. The fish will be identified, counted, checked for a fin clip, weighed and measured for fork length. A condition factor (K) will be calculated for the trout which will allow the comparative health of the each fish to be assessed.

Its rebuilding as a reliable fishery is necessary to provide opportunities for new fishers to catch fish ***which is essential for recruiting and retaining fishers...***

Otoliths, commonly referred to as "fish ear bones", will be collected from up to twenty trout and will be used to determine the age of each fish. Otoliths, are hard, calcium carbonate structures which grow inside the soft, transparent inner ear canals behind the brain of the fish. These measures will facilitate the assessment of the survival and condition of stocked fish and will allow comparison of data from previous fisheries assessments. A selection of fish species from different size classes will be collected, euthanized and preserved (subject to animal ethics approval) for future research on the diet of trout and predator/prey relationships in Barkers Creek Reservoir using gut and/or stable isotope analysis.

Barkers Creek Reservoir is a small water which is seen as a microcosm of the climatic and environmental and biological issues affecting many impoundments in Victoria. We expect that the results may be extrapolated to other waters which have not been adequately productive in recent times. It is envisaged that further investigations may follow the preliminary analysis, including the study of the effects of predation and carp foraging habit, water quality as relates to macro invertebrate population, food supply, and vegetation quality.

Barkers Creek Reservoir is very accessible by road and there are multiple access points from roads and car parks to the water's edge. Its rebuilding as a reliable fishery is necessary to provide opportunities for new fishers to catch fish which is essential for recruiting and retaining fishers, including the growing regional population of culturally and language diverse fishers of all abilities. It is expected to resume its function as a destination for angling club activities, including come and try days, skills development sessions, environmental studies, and habitat improvement exercises.

An ongoing benefit of the project will be the involvement of fishers in developing their fishery; by direct involvement with catch data collection and developing a database of angler effort to aid the management of fisheries in Victoria, hands-on involvement with projects, and self-regulation with respect to practices promoting sustainability of the Barkers Creek Reservoir trout fishery.

BDFF have developed a Research Angler Logbook for recording of catch data from Barkers Creek Reservoir, and request that anglers who want to be involved register their interest by email to bendigodistrictflyfishers@gmail or at www.bdffc.weebly.com.

Preliminary assessment of the stocking success of *estuary perch* in Victorian lakes

BY TY MATTHEWS
Deakin Universtiy

Fisheries Victoria is developing new estuary perch (*Percalates colonorum*) fisheries by stocking 10 inland waters in Victoria, beginning in Lake Bolac in 2012. Recreational fishers involved in the Great Perch Search have played an instrumental role in providing brood stock for this program.

Deakin University, in cooperation with Fisheries Victoria and a commercial eel fisher, completed a preliminary assessment of the stocking success of estuary perch in six of the 10 stocked waters in April 2015. Six lakes were surveyed using fyke nets and included lakes Bolac, Struan, Albert Park, Beaufort, Hamilton and Devilbend Reservoir.

To gauge stocking success, two target measures were set prior to the survey: 1) that the survey would capture fish that represented all cohorts of estuary perch that had been stocked into the six lakes since 2012; and 2) that growth rates and condition of stocked estuary perch would be comparable to those of wild, riverine populations. A small subsample of fish from each lake was also retained so that the age (otolith analyses) and diets of both estuary perch and redfin (a potential competitor) could also be ascertained.

The netting survey revealed that all of the stocked cohorts of estuary perch were still represented in all six lakes. Numbers of captured fish ranged from 18 in Lake Beaufort to 165 in Lake Hamilton and they ranged in size from 5– 27cm in length and 3.1 – 486 grams. Three predominant size classes of estuary perch were captured: 5 – 11 cm, 12 – 22 cm and 22 – 28 cm, respectively.

Another encouraging result was that the growth rates and condition of captured estuary perch were either similar to, or greater than, those of wild riverine populations. Several fish from the earliest stocking event (i.e. Lake Bolac, 2012) have now reached legal minimum size (> 27cm) and several fish from Lake Struan were just below legal size. Fish also exhibited better than average condition in four of the six lakes, with slightly below average condition occurring in estuary perch captured in Lake Hamilton and Devilbend Reservoir. Both criteria established to gauge the success of the stocking program have been met in all lakes. Our preliminary surveys strongly suggest that stocking of estuary perch in all lakes has been successful, but more work needs to be conducted in the future to confirm growth and condition as fish grow larger and determine the success of stocking estuary perch in other waters.

Typically, the estuary perch appeared to be targeting prey similar to those of wild, riverine fish. The major items included shrimp, scuds (amphipods), midge pupae, water boatmen and small bait fish. The prevalence of small bait fish increased in the larger sizes classes sampled (those greater than 12 cm). There was little evidence of dietary overlap amongst the three common size classes of estuary perch, except in Lake Struan.

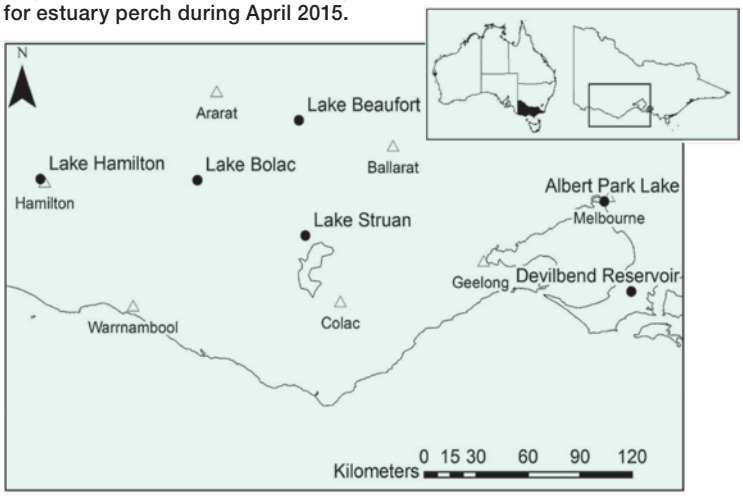
Diets of estuary perch were also compared with redfin in Lake Hamilton (low captures of redfin prevented comparisons in the other five lakes) and while there does appear to be some overlap in the diet between small estuary perch and moderately-sized redfin, further work is required to confirm these patterns. These results imply that it may be useful for recreational anglers to use lures that mimic small fishes such as gudgeon and galaxiid minnows, which were more common in the larger size classes of fish. Shrimp imitations may also be effective, but may result in greater captures of smaller fish.

This is useful information for Fisheries Victoria because it permits transparent decisions that can be used to guide future management associated with developing these new fisheries. Deakin University is hoping to repeat these surveys in November 2015 to further validate these findings. With continued good management, patience and possibly a bit of good luck, we expect to see these new recreational estuary perch fisheries lead to vibrant and rewarding angling experiences and subsequent flow-on benefits for regional communities in Victoria. The challenge is now set for recreational anglers to see whether they can tempt these estuary perch to either strike a lure or take a bait!

Acknowledgements:

Deakin University particularly thanks Fisheries Victoria and Bill Allan for this opportunity, which provided honours research projects for Ben Walker and Merric Northey. Preliminary results were presented to the Great Perch Search fishers in Nelson, September 2015. The project was supervised by Dr Paul Jones, Dr Ty Matthews, Dr Dion Iervasi and Associate Professor Laurie Laurenson (Deakin University, Warrnambool Campus).

Map of the six lakes that were sampled for estuary perch during April 2015.



The Nature Conservancy Australia Great Southern Seascapes Program

The Nature Conservancy (TNC) is a leading conservation organisation working around the world to protect ecologically important lands and waters for nature and people.

Globally we work in more than 35 countries with a staff of nearly 4,000 including 600 scientists and engage in over 200 marine restoration projects. We began working in Australia in 2002 and since then we're proud to have collaborated with a wide array of partners to support conservation efforts across more than 127 million hectares of Australia's lands and waters.

Building on our global marine restoration experience, TNC Australia launched the Great Southern Seascapes Program in 2014, which aims to spark a revolution in marine conservation and the blue economy by scaling-up restoration of coastal habitats in bays and estuaries across Southern Australia. This will be underpinned by developing best practice restoration models, influencing policy, growing funding and inspiring and educating people.

TNC takes a collaborative, partner-driven approach to our projects and is looking forward to continuing to work closely with the recreational fishing community. Our restoration partnership in Port Phillip Bay is a great example of how we operate, with TNC, Fisheries Victoria, Albert Park Yachting and Angling Club and The University of Melbourne all working together on a three year science trial to work out how to bring back the lost shellfish reefs of the bay.

Shellfish reefs were once a dominant feature of seascapes across southern Australian bays and estuaries, but by the mid to late 20th century they had virtually disappeared. In fact, 85% of shellfish reefs have been lost worldwide, making it the most threatened habitat on earth.[1] Native oyster reefs and mussel beds are nature's water filters and provide homes and food for a range of sea life including many important fish species – so that's why we are so motivated to bring them back.

Our marine program work has quickly expanded to other southern states, with shellfish reef restoration partnerships formed in South Australia and Western Australia with the support of both states peak recreational fishing bodies.

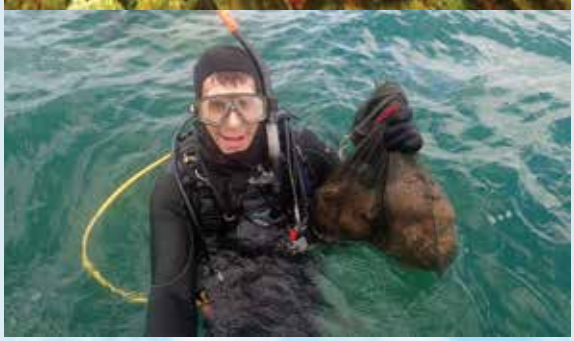
Another project we have initiated in Victoria is Mapping Ocean Wealth, which also builds on TNC's global work in this space. The objectives of the project are to develop context ready, local valuations of coastal ecosystem services (e.g. blue carbon, coastal protection, recreation/tourism, fisheries) for marine habitats (e.g. saltmarsh, mangrove, seagrass) and spatially represent this through an online mapping porthole. This information will assist in building robust business cases for marine restoration and better inform coastal development decisions.

It's still early days in our practical in-water restoration works but ***as our projects progress there will be many opportunities for fisher involvement.*** *We all depend on healthy marine habitats so it will take heavy lifting by everyone to help make sure there is plenty of fish in the future.*

To find out more, please visit www.natureaustralia.org.au

1. Beck, M.W et al. Shellfish Reefs at Risk: A Global Analysis of Problems and Solutions. The Nature Conservancy, Arlington VA. 52 pp.

85%
of shellfish reefs have been lost worldwide



Fishing in Victoria – something for everyone

Victorian fishers are a blessed lot – the fisheries across the State provide ample opportunities to ply your skill and feed your family.

Over 721,000 Victorians share a passion for recreational fishing, and there are fishing clubs scattered all over the State catering to fishers whether they be hooked on feeding 'old man' cod or like to chase the big reds as they come into our bays to spawn.

There are many reasons a large segment of VRFish members belong to fishing clubs:

- Fishing clubs give fishers access to a fantastic group of people who love to talk about fishing as much as they do.
- They give a sense of contributing to the local community.
- Club membership provides an opportunity to participate in social and competitive events.
- They give the ability to improve fishing by learning from more experienced fishers or to share your own knowledge.
- Club membership also provides a means to contribute to the political landscape of fishing, and have your say in issues that affect you and your favourite fisheries.

Contact one of our member clubs below for more information:

Albert Park Yachting & Angling Clubs Association
Contact: Patrick Hutchinson
Phone: 03 9329 8200
Email: info@apyac.org.au
Web: apyac.org.au

Association of Geelong & District Angling Clubs
Contact: John Hotchin
Phone: 03 52486817
Email: jhotchin@bigpond.net.au
Web: fishinggeelong.com

Australian Anglers Association (VIC)
Contact: Tim Hose
Phone: 0428 521 449
Web: aaavic.org

Australian National Sportfishing Association (VIC)
Contact: Darren Wloch
Phone: 0414 383 477
Email: dwloch@borcor.com.au
Web: ansavic.com.au

Ballarat & District Anglers Association
Contact: Geoff Cramer
Phone: 0418 320 139
Email: gcaramer@chw.net.au

Beaumaris Motor Yacht Squadron
Contact: Brian Wright
Phone: 0421 764 370
Email: bwgardening@optusnet.com.au
Web: bmys.com.au

Boating Victoria
Contact: Wallace Nicholson
Phone: 03 9585 1330
Email: boating@yachtingvictoria.com.au
Web: boatingvictoria.com.au

Council of Victorian Fly Fishing Clubs
Contact: Doug Braham
Phone: 03 5174 4606
Email: ddbraham@bigpond.com

Fishcare Victoria
Contact: Dave Cleeland
Phone: 0400 882 851
Email: dcleeland@fishcarevictoria.org.au
Web: fishcare.org.au

Game Fishing Association of Victoria
Contact: Geoff Fisher
Phone: 0412 005 850
Email: secretary@gfav.com.au
Web: gfav.com.au

Gippsland Angling Clubs Association
Contact: Robert Caune
Phone: 03 5155 1505
Email: robert@net-tech.com.au

Goulburn Valley Association of Angling Clubs
Contact: Wally Cubbin
Phone: 0428 942 744
Email: wcubbin@bigpond.net.au

Howqua Angling Clubs Fish Protection Association
Contact: Steven Relf
Phone: 0417 553 249
Email: srelf@optusnet.com.au

Metropolitan Anglers Association
Contact: William Richards
Phone: 03 9337 5113
Email: fishomaa@hotmail.com

Midland & North Central Angling Association
Contact: Greg Hellsten
Phone: 0401 984 323
Email: gregh.ogp@hotmail.com

Mid Northern Association of Angling Clubs
Contact: Alan Digby
Phone: 03 5492 2822
Email: alasue@hotmail.com

Native Fish Australia
Contact: Tim Curmi
Phone: 0417 419 765
Email: timbo42b@yahoo.com.au
Web: nativefish.asn.au

North East Angling Association
Contact: Stafford Simpson
Phone: 0419 564 319
Email: vk2ast@tpg.com.au

Scuba Divers Federation of Victoria
Contact: Priya Cardinaletti
Phone: 0414 310 727
Email: priya@sdfv.org.au
Web: sdfv.org.au

South Gippsland Angling Clubs Association
Contact: Allister Dowling
Phone: 0429 001 984
Email: Jodie_dowling@bigpond.com

South West District
Association of Angling Clubs
Contact: Gary Cronin
Phone: 0417 125 127
Email: gbear@hotmail.com

Southern Freedivers
Contact: Clint Engel
Phone: 0409 613 804
Email: info@brimbosports.com
Web: southernfreedivers.org.au

Torquay Angling Club
Contact: Paul Rebbechi
Phone: 0423 209 563
Email: prebbech@gmail.com
Web: www.torquayfish.com.au

Victorian Fishing Charters Association
Contact: John Willis
Phone: 0407 053 484
Email: john@beachmarine.com.au

Victorian Piscatorial Council
Contact: Peter Milley
Phone: 0419 537 082
Email: pmilley@bigpond.net.au

Wimmera Anglers Association
Contact: Barry Williams
Phone: 0402 352 006
Email: barry3422@bigpond.net.au

Recreational Fishing Code of Conduct

Representing Victorian Recreational Fishers

VRFish has developed this Code of Conduct for recreational boat, shore, river, stream and jetty fishers in Victoria.

Recreational fishers have a responsibility to look after fisheries resources for the benefit of the environment and future generations of fishers. Recreational fishers should also show respect for other users of the aquatic environment. This Code of Conduct provides guidelines to minimise conflicts on the water, and should be adopted by all recreational fishers.

1 Awareness of and compliance with fishing regulations

2 Always seek permission when entering private property

3 Respect the rights of other anglers and users

4 Use established access roads and tracks

5 Protect the environment

6 Attend to your fishing gear and value your catch

7 Carefully return undersized, protected or unwanted catch back to the water

8 Education - pass on your knowledge

9 Fish species and other organisms must not be relocated/ transferred into other water bodies

10 Respect indigenous sites and values

For a full version of the Code of Conduct, please go to:
www.vrfish.com.au/Corporate_Documents

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