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The Australian Animal Welfare Strategy (AAWS) – Practical implementation of Welfare Overarching Principles within the recreational fishing sector

An initiative of the Aquatic Animal Welfare Working Group of AAWS



Dr Paul Hardy-Smith

June, 2015

FRDC Project No 2012/508

**AUSTRALIAN
ANIMAL
WELFARE
STRATEGY**



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2014

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Researcher Contact Details				FRDC Contact Details	
Name:	Dr Paul Hardy-Smith	Name:	Dallas D'Silva	Address:	25 Geils Court
Address:	3/814 Glenferrie Road Hawthorn, Victoria, 3122	Address:	VRFish PO Box 538 Williamstown VIC 3016	Phone:	Deakin ACT 2600
Phone:	03 9818 5100	Phone:	03 9397 6318	Fax:	02 6285 0400
Fax:	03 9818 1200	Email:	info@vrfish.com.au	Email:	02 6285 0499
Email:	paul@panaquatic.com	Web:	www.vrfish.com.au	Web:	frdc@frdc.com.au
Web:	www.panaquatic.com				www.frdc.com.au

In submitting this report, the researcher has agreed to FRDC publishing this material in its edited form.

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Executive Summary

This project was conducted by Panaquatic Health Solutions Pty Ltd, consisting of veterinarians and scientists specialising in fish health, and VRFish, the Victorian recreational fishing peak body. It is the first project in Australia to evaluate high profile fishing competitions and charter boat operations purely from an animal welfare perspective.

The Australian Animal Welfare Strategy (AAWS) was an Australian Government initiative that aimed to protect and promote the welfare of all Australian animals, including aquatic animals. A key initiative of the Aquatic Animal Welfare Working Group of AAWS was the development of [Overarching Welfare Principles](#)¹ to assist the various aquatic sectors to develop animal welfare best practice in their sector. Principles 5, 6, 7 and 8 were applicable to all aspects of this project i.e.:

5. *During any handling of live fish:*
 - *care should be taken to avoid any damage to the fish*
 - *fish intended to remain alive should be returned to the water promptly*
6. *Any fish selected for harvest should be killed as rapidly as possible, by humane means suitable for the species*
7. *For fish harvested from the wild timely handling from capture to death is essential to minimise suffering*
8. *Capture methods should be designed to minimise the capture of unwanted fish*

In addition, principles 1, 2 and 4 were applicable to the holding of “live fish” at the Mulwala Cod Classic fishing competition i.e.

1. *For fish held in captivity, the key parameters (temperature, salinity, pH, dissolved oxygen, & metabolites) of the aquatic environment in which fish are maintained should be within the species’ natural range of tolerance.*
2. *For fish held in captivity, the holding unit in which they are normally housed should provide*
 - *safety from predators;*
 - *refuge from environmental extremes beyond their natural range of tolerance;*
 - *appropriate space;*
 - *appropriate space and/or water flow to avoid chronic degradation of water quality parameters referred to in point 1 above.*
3. *For fish held in captivity the feed supplied should meet known nutritional requirements, and be distributed in a manner and frequency which avoids starvation for periods longer than the species natural range of tolerance.*
4. *For fish held in captivity, any visibly damaged or sick fish should be assessed and either treated appropriately or promptly removed for killing by humane means suitable for the species.*

It is estimated that over 3.5 million Australians fish recreationally each year. They currently enjoy a strong social license to operate in our community. There is the potential for this to be eroded, particularly from a welfare perspective. Through projects such as this the potential is high for the recreational fishing community to positively strengthen its social license through improvements in fish welfare.

¹ A complete list of the Overarching Welfare Principles can be found in Appendix A of this report.

Urbanisation and modernisation are contributing to a change in attitudes towards animal welfare. Science has so far been unable to resolve the issue of whether fish can feel pain or suffer. To this end the Overarching Principles concentrate on minimising stress from capture to release or killing.

This project evaluated the following fishing competitions² and charter boat operations using the Overarching Welfare Principles as a guide:

1. The Snapper Tea Tree competition, in which over 1,500 competitors spend two days in November fishing in Port Phillip and Western Port Bays, Victoria with the aim of catching one or two snapper (*Pagrus auratus*) over 40cm in length. Eligible snapper are killed when caught;
2. The Mulwala Cod classic, where over 2,600 competitors fish during a two day period in December targeting Murray Cod (*Maccullochella peelii*) and Golden perch (*Macquaria ambigua*) on Lake Mulwala and adjacent sections of the Murray River, New South Wales. The competition is catch and release for these species, so fish must be kept alive during the period between capture and measuring at designated measuring stations;
3. A charter boat operation targeting estuarine fish species in Westernport, Victoria. Fish caught are usually kept for eating, but also sometimes released;
4. Two charter boat operations targeting off shore pelagic species (primarily Southern bluefin tuna - *Thunnus maccoyii* and albacore tuna - *Thunnus alalunga*) in south west Victoria. Some of the fish caught are kept for eating, and others are released;
5. A charter boat operation targeting barramundi (*Lates calcarifer*) in a remote part of the Northern Territory. Fish caught are usually released; and
6. A charter boat/resort operation targeting reef fish (particularly red emperor – *Lutjanus sebae*) in a remote part of the Great Barrier Reef, Queensland. Fish caught are usually kept to be eaten the same day.

For evaluating high profile fishing competitions, this project developed a model process that could be applied to any fishing competition in Australia. This model process involved initially contacting competition organisers and then working closely with them to:

- i. Evaluate the competition in the first year to objectively identify any fish welfare considerations where change may bring about beneficial outcomes in these areas based on the Overarching Welfare Principles;
- ii. Utilise research available in the scientific literature and elsewhere to develop educational material for competitors to help increase their understanding of the welfare issues identified;
- iii. Identify and then describe in detail practices that competitors can use to bring about greater benefits in fish welfare and explain why the practices not only benefit the fish, but them as well;
- iv. Develop a communication strategy to deliver the educational material to prospective competitors prior to the second year of competition. Deliver this strategy;
- v. Evaluate the competition in its second year to objectively identify whether there has been a change in fish welfare attitudes and practices by competitors competing in this second competition; and
- vi. Summarise the results of the second year's evaluation and discuss with competition organisers.

² Both fishing competitions had prize pools in excess of \$125,000 with a number of boat/motor/trailer packages to be won.

Snapper Tea Tree Competition

This model process was applied to the Snapper Tea Tree competition. Information gathered from attendance at the competition in the first year (2012) and by surveying over 235 competitors showed a positive response from a welfare perspective and in keeping with the Overarching Welfare Principles. Key findings from the first year baseline evaluation were as follows:

- The majority of competitors reported that they actively “killed” the fish that they caught. The most commonly used method was by putting fish directly into an ice water slurry (49%) with 34% killing the fish by a blow to the head (percussive stunning) or brain spike.
- 9% of competitors kept fish alive after capture. Of these approximately half used a live well and half used a tub, bucket or esky with water in it to hold their fish³.
- 66% of competitors “killed” the fish they caught within one minute, with another 20% taking 2-5 minutes. Eight (3%) competitors stated that they took longer than 10 minutes to “kill” their fish;
- Although not directly a welfare issue, the majority of competitors (87%) stated that they reduced the internal temperature of the fish after killing, either by placing it in an ice water slurry or in an esky with ice. Importantly, most of the competitors surveyed indicated that they would eat the snapper that they had caught and had weighed in at the competition although one competitor noted that he:

“would like to eat the fish but generally you can’t eat the fish that you weigh in for the Tea Tree as it has been sitting around for so long”

Using the Overarching Welfare Principles as a guide, a number of fish welfare considerations were identified by this survey for which the development and deliverance of educational material to competitors prior to the second year’s competition was considered of benefit. For example:

- i. Nearly half the competitors believed that placing a snapper into an ice water slurry was an effective method of killing. As far as the project team is aware, there has been no research conducted specifically on snapper that demonstrates this. Research on other temperate fish species indicates that the use of an ice slurry may actually prolong death;
- ii. The survey showed that over 35% of competitors were not killing fish quickly (i.e. within a minute). It is not a difficult task to kill a fish quickly that is caught by a recreational angler. Doing this has benefits for the fish and for the angler;
- iii. Competitors generally planned to eat the snapper they caught but there were misconceptions noted regarding how quality of the killed fish can be maintained.

Educational material and a communication strategy to deliver it was developed and delivered through a number of channels, including presentations, mail outs and web and social media. The second year’s competition (2013) was then held, and a total of 248 competitors were surveyed at this competition to evaluate the effectiveness of the communication strategy.

The results of the survey showed positive changes. These included:

1. An increase in the proportion of competitors humanely killing their fish with a spike or blow to the head - from 34.5% in 2012 to 43.1% in 2013;
2. An increase in the proportion of competitors who actively killed the fish within a minute of being caught – from 25.5% in 2012 to 35.9% in 2013;

³ The project team did not go out on boats to evaluate water quality on board vessels that were holding snapper in such containers.

3. A decrease in the proportion of competitors placing their fish immediately into an ice slurry with no other killing method being used – from 51% in 2012 to 43.1% in 2013;
4. An increase in the proportion of competitors who believed that the eating quality of the fish is affected by how the fish is stored after capture – from 82.6% in 2012 to 97% in 2013.

These are encouraging trends.

The Mulwala Cod Classic

A modified version of the process model was applied to the Mulwala Cod Classic fishing competition. A preliminary assessment was conducted in April, 2013 during the Mulwala Cod Nationals, which is a separate event but run by the same organisers as the Cod Classic.

Competitors were then surveyed during the Cod Classic held in December, 2013. The results of this survey included the following findings:

- Murray cod and Golden perch caught and then brought to a measuring stations were usually kept alive in water during the transport. However, 27% of Murray cod and 20% of golden perch were brought to the measuring stations in a net, generally within 5 minutes of capture. One Murray cod was recorded as being 9 minutes in the net;
- 16% of Murray cod were brought to the measuring stations in a wet towel or hessian sack, one of these being brought in the back of a car. All were recorded as being at the measuring station within 5 minutes of being captured;
- A number of Murray cod and Golden perch had been held for greater than one hour before being measured and released. All were kept in a live well on the competitor's boat;
- A large number of European (common) carp (*Cyprinus carpio*) were caught during the competition⁴. Many were brought to the measuring stations alive and then not actively killed.

Again using the Overarching Welfare Principles as a guide, there were a number of key welfare considerations identified by this survey. These included:

- i. The need to educate competitors on the harm air exposure can have on any fish that is to be released;
- ii. The need to ensure any carp that are caught are quickly killed.

These findings were discussed with the organisers of the event:

1. A difficulty with the issue of air exposure is that many competitors competing in the Mulwala Cod Classic use their own boats which don't have live wells. This is because competitors fishing recreationally either keep the fish they catch or release them immediately. The project team therefore investigated a number of alternative transport containers that could be developed at low cost and could be used by competitors to ensure that they kept any Murray cod or golden perch in well oxygenated water during transport from the point of capture to a measuring station.
2. With respect to carp, the project team and the organiser of the event discussed the possibility of having competitors be given a ticket into the specific prize for capturing carp (a

⁴ Competitors bringing carp to a measuring station were given a ticket which entered them into the draw for one of the boat/motor/trailer packages.

boat/motor/trailer package) only if the carp was brought in dead i.e. any carp caught were immediately killed when captured. As all carp caught are collected by a third party fertiliser company, the issues of product quality needed to be considered in adopting this possible change in competition rules.

Charter boat operations

The project team accompanied charter boat operations and then discussed welfare considerations with the charter boat operator at the end of the charter.

The project team identified that each charter operation was unique and it was difficult to develop a specific model process for assessment of charter boat operations. However, it was still possible to assess each operation using the Overarching Welfare Principles as a guide.

The charter boat operator was either revisited in the second year of the project or at the very least contacted to discuss whether there had been any change as a result of the first year's discussions.

With respect to the charter boat operations assessed, the project team identified the following welfare considerations:

1. The charter boat operation targeting estuarine fish species in Victoria generally had a good knowledge of fish welfare and incorporated welfare practices in keeping with the Overarching Welfare Principles when conducting charters. His understanding of welfare considerations (particularly impacts of barotrauma on fish) were greatly improved after attending one of the presentations given as part of this project and has subsequently used the brochure (developed as part of the educational material for the Snapper Tea Tree competition) on his charters;
2. Welfare considerations of concern were noted when accompanying charter operations targeting pelagic fish species off south west Victoria. These included how fish to be kept were being killed and how fish to be released were being handled prior to release.

With respect to these charter operations, according to the operators a key factor that influenced the success of the charters was the ability to catch large numbers of fish on each charter. According to the charter operators, this was why clients booked to go out with these specific charters. Anything that may reduce how many fish are caught on a charter could impact on the economic viability of their business, in their opinion.

The degree of understanding of fish welfare by clients going out on these charters was not assessed. However, if the understanding of these clients on what was the “normal” way fish were caught and released came predominately through attending these charters, then the process may be a self-sustaining cycle. While there is no doubt many of the clients do want to catch a lot of fish, the project identified that further education of the clients on fish welfare and particularly how quickly killing the fish and keeping any fish for consumption on ice would significantly improve product quality and may assist in the modification of charter operators attitudes and practices.

3. The charter boat operations targeting barramundi (*Lates calcarifer*) in a remote area of the Northern Territory were generally knowledgeable on fish welfare issues, and practices were generally in keeping with the Overarching Welfare Principles. A number of the younger guides were keen to learn more in the area of fish welfare, and it was noted that there is no formal training of guides on aspects of fish welfare. It was not possible to determine if the owner of this charter operation would be willing to implement such training into the operations.

4. The charter operations fishing on the Great Barrier Reef was in a unique position in that this operation generally was the only operation fishing the area recreationally. He was extremely interested in learning more about fish welfare issues and the effect handling and killing fish has on its eating qualities. Most of the fish caught are eaten by clients that same day. Generally, the attitudes to fish welfare by this charter operation were in keeping with the Overarching Welfare Principles. On-site training by the project team when attending this charter greatly assisted in the charter operator understanding humane killing methods for the fish he was catching.

In conclusion

This project has identified that there are many within the recreational fishing community that want to understand more about fish and about what they can do to respect the fish they catch and minimise the stress they may impose on it. There are also many who want to know how to maximise the eating qualities of what they catch from better handling of their catch.

This project, being the first to specifically assess fish welfare in both high profile fishing competitions and charter boat operations, has paved the way for other projects. Discussing fish welfare issues with the recreational fishing community was in general a highly positive experience, with the vast majority of those spoken to wanting to learn more about how to kill fish quickly and how to minimise the impact of their practices on fish they wished to release.

Continuing the work that has been started by this project has the potential to increase the understanding of the recreational fishing community on fish welfare and to ensure the day to day attitudes and practices of those fishing recreationally are in keeping with the Overarching Welfare Principles created by the Aquatic Animal Welfare Working Group of AAWS.

Importantly, as has been shown by this project, practices that benefit fish welfare also generally benefit the recreational angler. While some in the recreational fishing community fear the term “fish welfare” and consider it as having the potential to shut down their fisheries and curb their enjoyment of fishing, this project has worked to convince recreational anglers to embrace fish welfare and in so doing conduct themselves in a manner that will only increase the social acceptance of recreational fishing in our community.

Keywords

Fish welfare, fishing competitions, charter boat operations

1 Introduction

Recreational fishing is practiced by many people of all ages in Australia. It is estimated that more than 3.5 million Australians fish annually for recreation and for sport⁵ and research conducted in 2001 estimated that over 71 million finfish are captured recreationally per annum (Henry and Lyle, 2003). The number of people that fish recreationally around the world provides an indication that the sport is ethically acceptable in most cultures (Davie and Kopf, 2006). Certainly, with an estimated 1.8 million Australian households in 2001 containing at least one recreational fisher it would be reasonable to say that recreational fishing in Australia has ongoing approval in the community. It has, in general, broad social acceptance and has a social license to operate.

The world is changing though. Urbanization and modernisation are happening at an incredible rate. The direct experience people have of wildlife is reducing in urban societies. Attitudes towards fishing are changing in some people.

In several industrialised countries, recreational fishing has come firstly under moral and then legal pressure due to changes in societal values which include rising concerns of the welfare of fish (Arlinghaus, Schwab *et al.*, 2012). This is reflected in surveys which have shown that in some industrialised countries as many as one quarter of the general population perceive aspects of recreational fishing cruel (Riepe and Arlinghaus, 2014).

One example of where recreational fishing has come under moral and legal pressure is seen in Germany. In this country, effective lobbying by anti-angling groups has led to some aspects of fishing (namely catch and release fishing) being restricted or banned. Germany has animal legislation that specifies that nobody is allowed to inflict pain, suffering, or damage on a vertebrate animal (which includes fish) without a reasonable purpose. While the catching of a fish for food is considered a “reasonable cause” by German society, catching a fish with the intention to release it is not (Riepe and Arlinghaus, 2014).

The Australian Animal Welfare Strategy (AAWS) is an Australian Government initiative that was first developed in 2005. It was an agreed blueprint which aims to protect and promote the welfare of all Australian animals, including aquatic animals. The AAWS, through its participants and projects, clarified the roles and responsibilities of key community, industry and government organisations. Six broad working groups were established as part of the strategy, one of these being the Aquatic Animal Welfare Working Group (AAWWG). AAWWG has the responsibility to develop and implement the action plan for the aquatic animal sector.

A key initiative of the AAWWG was the development of Overarching Welfare Principles that were applicable to finfish being farmed, transported, captured from the wild by both commercial and recreational fishers, or kept in aquaria in restaurants or private homes (Appendix A). These Welfare Principles have guided welfare projects being undertaken through the AAWS. This project was developed and endorsed by the AAWWG.

⁵ <http://recfishaustralia.org.au/>

The AAWWG Overarching Welfare Principles that apply to this project are numbers (5), (6), (7) and (8) i.e.

5. *During any handling of live fish:*
 - *care should be taken to avoid any damage to the fish*
 - *fish intended to remain alive should be returned to the water promptly*
6. *Any fish selected for harvest should be killed as rapidly as possible, by humane means suitable for the species*
7. *For fish harvested from the wild timely handling from capture to death is essential to minimise suffering*
8. *Capture methods should be designed to minimise the capture of unwanted fish*

Humane slaughter and killing in the aquatic sector was also a national Research and Development Priority identified through AAWS. The Recfish Australia National Code of Practice for Recreational and Sport Fishing identifies four main areas of fishing responsibility for the recreational angler. The first of these is to treat fish humanely.

The Principal Investigator of this project is VRFish, Victoria's peak recreational fishing body. The lead writer of this report, Paul Hardy-Smith, is a member of the AAWWG and also a veterinarian. The Australian Veterinary Association (AVA), in its Code of Professional Conduct, notes that veterinarians, because of their special knowledge and expertise, have a responsibility to maintain and improve the health and welfare of animals where they are being used for companionship, work or for food. It also notes that changes in society, science and the law constantly raise new ethical issues regarding animals, and may challenge existing ethical perspectives. The AVA has a position paper on fish welfare, which is included in Appendix B.

Whether fish can suffer and are sentient beings with conscious perception are questions that are central to the issue of fish welfare. Davie and Kopf (2006) noted that in order to suffer, an animal must possess a sensory system able to detect noxious stimuli and importantly the brain must consciously perceive the stimuli as negative. If fish do not suffer then there are no welfare issues with capturing and killing or releasing fish.

However, there is considerable debate in the scientific literature regarding the ability (or not) of fish to suffer or feel pain. Rose et al. (2014), in their review of the issue of whether fish feel pain, concluded that they were unlikely to. These authors also concluded that the rationale and supportive evidence for the existence of consciousness in fishes was not compelling, nor neurologically feasible. Other authors do not agree with these conclusions, arguing that there is growing evidence that teleost fish can feel pain (for example see Torgersen et al. 2011) with Lund et al. (2007) stating that sentience in fish cannot be ruled out based on review of the scientific literature. Brown (2014) provides a review of the current state of knowledge on fish cognition and the evidence for pain perception. This author concludes that the evidence strongly suggests fish are sentient and capable of feeling pain.

It does though become quite clear when reading through the literature on this topic that the debate involving scientific and philosophical arguments is sometimes confused by emotional responses, to paraphrase Turnbull (2010).

Ongoing scientific debate about whether or not fish can feel pain could be used to justify a delay in taking any action to change current practices in the recreational fishing community. And ambiguity in the science does mean that any approach should be taken cautiously.

But people's attitudes are not necessarily based on science and Lund et al (2007) argues that the immediate question is an ethical one, that being for us to consider how probable sentience in fish must be shown to be before we feel obliged to act. As Bekoff (2007) noted, it is important to blend 'science sense' with common sense, which is reflected in the Overarching Welfare Principles and in this project.

Currently, recreational fishing has wide community support in Australia and a strong social license to operate. But with questions on issues of welfare being asked by the general community, the recreational fishing community must work positively to maintain its strong support.

Openly allowing a fish to slowly die in the hot sun by asphyxiation on a pier or jetty after being caught may not have attracted attention in the past, nor may a number of other welfare issues pertaining to the treatment of fish. Such incidents are increasingly being noticed now and for many such actions are unacceptable. Many recreational anglers acknowledge this, but there is still a strong need for wider education and understanding of the impact these actions can have on others and on the fish themselves.

This project follows on from the sentiments voiced by Cooke and Sneddon (2007), who argue that there are many choices informed anglers can make to improve the welfare of fish caught recreationally. An effective, pragmatic model to provide the choices to anglers has been developed through this project at the level of the fishing competition. The impact of the work conducted through this project is measurable – it has shown a mechanism to reduce unnecessary stress on fish and to improve welfare.

This project has also highlighted key issues in the recognition of fish welfare by charter boat operators. Charter boat operators have great influence on the general angling community, but economic drivers dictate that charter operators do what their clients want them to do. It is a somewhat circular ("catch 22") type situation – the charter operators fish in a certain way, clients are exposed to this style of fishing and consider it as the "industry standard", and therefore expect (and often demand) this attitude and style of fishing when out on fishing trips. There are two possible mechanisms whereby this cycle may be broken – change by charter operators or change by the clients of charter operators. Informing both groups of the choices they can make to improve welfare is likely the quickest way to help in changing current practices that may be detrimental to fish welfare in this sector.

The project has also shown that motivating change across some sections of the recreational fishing industry can be better accomplished if the motivation for change is not solely based on issues of welfare alone. It acknowledges that humans need a reason to change and that asking recreational anglers to change practices because they may cause unnecessary stress to fish may not be sufficient reason for them to make such changes. Additionally there is no legislation or regulations requiring them to do so and it is unlikely there will be, at least not in the short term.

Hence this project has incorporated other motivators into the model that bring benefit not just to fish, but to the recreational angler themselves. This includes showing how respecting welfare aspects of recreational fishing also improves the eating quality of the fish being caught and the

survivability of fish being released.

The work of this project has brought benefits to anglers and to the fish they catch - clearly a win-win outcome.

2 Objectives

The Project Objectives for this project were:

1. To undertake an analysis of current animal welfare practices within two sub-sectors of the recreational fishing industry: fishing competitions and charter operators based on the AAWS Aquatic Working Group's Overarching Welfare Principles that apply to this sector.
2. To develop a model or mechanisms whereby welfare improvement practices can be incorporated into competition and charter boat operations where analysis has identified that such changes may benefit fish welfare.

3 Methods

There were two broad methods used in this project for evaluating welfare through application of the Overarching Welfare Principles. One method was developed for working with two high profile fishing competitions and a second method developed for working with charter boat operators. Some differences relating to the specific nature of the method used for competitions and charter boat operator are described below.

3.1 For fishing competitions

The following general approach was used for evaluating welfare considerations in the two high profile fishing competitions that were originally identified by the Project Steering Committee:

1. The organisers of these high profile fishing competitions were contacted, and information about the project and its objectives were presented to the competition organisers.
2. If the organisers were willing, a provisional agreement was sought from them indicating their willingness to be involved in this project. The organisers then presented information about their competition to the project team.
3. Formal agreement was then sought from the competition organisers regarding their participation in this project and their conditions required for such participation, if any.
 - Where an official Letter of Agreement was required, this was prepared and signed by all parties.

The following specific approach was then used for each of the two competitions chosen.

3.1.1 For the Tea Tree Snapper Fishing Competition

In the Tea Tree Snapper Fishing Competition (the “Tea Tree”) up to two (2) snapper over 40cm can be weighed in by each competitor. Each fish that is weighed in grants the competitor an entry into the prize pool. Fish are weighed in dead.

1. A draft questionnaire was prepared by the project team. This would be used to evaluate competitors during the competition and assess attitude and behaviours of competitors relating to welfare issues.
2. The draft questionnaire was presented to the Tea Tree organising committee for approval. Approval was given.
3. Members of the project team and VRFish volunteers conducted an evaluation of competitors in the 2012 competition using the questionnaire (Appendix C) as a basis for the questions it asked of competitors. Competitors were surveyed while waiting in line to weigh in their fish during the designated weigh in periods. Hence only competitors that caught fish were surveyed. Results of this survey formed baseline information.
4. A summary of the results of the survey were circulated to the competition organisers and to the project steering committee and the findings discussed. Based on this evaluation and ensuing discussion, key welfare issues were identified.
5. Agreement was sought with the competition organisers to allow the project team to

implement an education and training strategy through their competition. Competition organisers agreed to this.

6. Educational and training material was developed to address welfare issues identified through competition evaluation. Where possible, research available in the scientific literature on specific welfare issues (e.g. barotrauma) and on the species concerned (i.e. Snapper - *Pagrus auratus*) was identified and utilised to provide a strong scientific basis for anything presented in the training material. The education and training material was circulated to competition organisers for approval.
7. A communications strategy was developed to disseminate education material prior to the 2013 competition.
8. The communication strategy was then implemented.

The communication strategy included the wide dissemination of a brochure (Appendix E) summarising the welfare issues that had been identified and the information on the impact of these issues on fish being caught and how anglers can minimise these impacts. The competition organisers agreed to a brochure being included in their pre-competition mail out, which was sent to over 1000 previous competitors prior to the 2013 competition. The information in the brochure was also made available on the web and disseminated through social media. The lead writer of this project, Paul Hardy-Smith, also gave a series of presentations at angling clubs and promotional evenings in the period leading up to the 2013 competition.

9. The questionnaire from the 2012 competition was modified for the 2013 competition, primarily to shorten the time it took to conduct individual surveys. The modified questionnaire is included in Appendix D.
10. A survey of competitors at the 2013 competition was conducted, again during weigh in periods. Over 250 competitors were surveyed.
11. The findings of second survey evaluated and compared to the results of the 2012 survey. A summary was then circulated to the Tea Tree competition organisers.

3.1.2 For the Mulwala Cod Classic Competition

This competition is a catch and release competition, where fish (*Maccullochella peelii* - Murray cod or *Macquaria ambigua* - Golden Perch) must swim away strongly for competitors to be awarded an entry into the competition draw.

Delay in confirmation of funding for the project meant that there was insufficient time to organise attendance in the first year of competition. As the organisers of the Mulwala Cod Classic (the Cod Classic) also conduct a number of other competitions through the year, an alternative method for evaluating this type of competition was employed as follows:

1. The lead writer of this project attended one of these other fishing competitions, the “Mulwala Cod Nationals” (the Cod Nationals) in April, 2013. Although the demographic of the competitors competing in this competition was different from those competing in the Cod Classic, it did provide insight into this style of competition and the welfare issues that may arise.

2. To evaluate the Cod Nationals, the lead writer attended the opening evening, and then accompanied one of the teams competing in the competition out on the water during the first day of the competition. The team included Mr Rod McKenzie, who is a high profile angler well known for his ability to catch and release very large (>1m) Murray cod. Rod also widely publishes in a number of high profile fishing magazines. Key issues of welfare were discussed during the day, particularly the holding of live fish on boats.
3. Key welfare issues that were identified by attendance at the Cod Nationals were then researched to ensure good understanding of the available scientific research in this area, and to allow consideration of the strategy to be used when evaluating the 2013 Cod Classic, held in December.
4. A team was organised to attend the Cod Classic and conduct targeted evaluation based on knowledge of competition format.
 - a. As a good will gesture, the lead writer of the project, a veterinarian, assisted organisers in the tagging of “Brian”, a 67cm Murray cod that, if captured, would provide the angler with \$20,000 cash prize. “Brian” was tagged under anaesthetic and released into Lake Mulwala without harm. All government authorities were notified about this tagging and necessary approval granted.
 - b. The key writer also collaborated with Rod McKenzie during the opening night of the 2013 competition and presented welfare and handling issues associated with catch and release fishing for Murray Cod and Golden Perch.
5. A survey was conducted of competitors bringing Murray Cod, Golden Perch and European Carp⁶ in to a number of the measuring stations during the first day of the competition.
6. A summary of the key welfare issues identified through the evaluation of the Cod Nationals and through the survey of competitors at the Cod Classic was provided for consideration to the organisers of both events.
7. Recommendations to address key welfare concerns in future competitions were agreed upon.

Ideally, adoption of key recommendations for this competition (see Results, next Chapter) will significantly improve the welfare considerations identified in the survey of the 2013 competition.

It would be useful to survey the 2014 competition to gauge whether improvement in welfare will occur based on implementing these recommendations. The Project funding does not extend to cover such a survey.

3.2 For charter boat operations

The methods used to work with charter boat operators were as follows:

1. In general, only “successful” charter boat operators were considered i.e. those that were

⁶ A considerable number of European (common) carp, *Cyprinus carpio*, are caught during this competition, essentially as by-catch. Competitors may bring any carp caught to a weigh in station where the carp can be left and the competitor will be awarded a ticket that will be entered into a separate competition for which the major prize is a boat, motor and trailer package.

popular, well booked and were known to be very good at catching fish.

2. In the first year of the project, a charter was booked with the charter operator. In the two Victorian charters, a single day charter was booked. With the Northern Territory and Queensland charter, the charter operation was visited over a number of days. Charter operations were seasonal.
 - a. For the two charter operations which were booked for a single day, the charter boat(s) operation was not informed about the background of the project team member attending the charter. This was due to the fact that the project team considered that the charter boat operators may modify their attitudes and behaviour if they knew this. This information was
 - b. For the third charter boat operations, the technical and professional background of the project team member became known during the period of the charter, which extended over a number of days. This was not a problem but was considered more of a benefit as this charter boat operators were very keen to learn more about welfare and quality considerations from the project team member.
 - c. For the fourth charter, the project team member was known to the charter operator. However, there were a number of other clients fishing with the charter operator and the project team member requested that the operator made no changes to standard operations while the project team member was fishing with the other members of the public.
3. While welfare issues were being evaluated, so too were reasons for the charter operator's popularity. Essentially, each charter operator is running a business that relies on clients (anglers) wanting to pay money for the charter operator to take them fishing. Hence the reasons why anglers booked specific operators were also considered. In the Northern Territory and Queensland charters, for example, visiting a remote location is also a reason some anglers book a charter. Such context is critical when considering where possible changes can be made. Changes that would impact on a charter operator's business may cause issues of human welfare, by putting a charter operation out of business. Ultimately, charter boat operators need clients to maintain their business.
4. If there were welfare considerations identified based on the Overarching Principles, then the key to being able to successfully address these welfare considerations and implement change was to identify solutions that could be incorporated into the charter operator's day to day operations and that:
 - Were considered reasonable by the charter boat operator to incorporate into his business;
 - Did not detract from the client's enjoyment of the fishing. Implementing changes that did detract from the client's enjoyment could lead to reduced bookings for the charter operator and diminishing business;
 - Brought about improved welfare for the fish being caught, killed and/or released.
5. In the second year of the project, three of the charter boat operators were revisited, one by accompanying the charter boat operator on a second charter (understanding that there was

no longer the element of anonymity), one by meeting face to face with the charter operator and one by discussing issues with the owner of the charter boat operation by phone. For the last operation, it was acknowledged that the original charter operator was not receptive to making any changes. Hence an alternative operator was chosen in the same locality and fishing for the same species, to evaluate whether similar attitudes persist throughout this particular recreational fishery.

4 Results of evaluation – Fishing Competitions

4.1 Introduction

The following chapter describes the evaluation of two high profile fishing competitions.

1. The Tea Tree Snapper Fishing Competition⁷ (“Tea Tree”) is a two day saltwater fishing contest hosted annually in November by the Snapper Point Angling Club in Victoria. Snapper (*Pagrus auratus*) are caught, killed and then taken to a measuring station to be weighed.
2. The Mulwala Cod Classic⁸ (“Cod Classic”) is a two day freshwater fishing competition held in December each year in New South Wales where Murray cod (*Maccullochella peelii*) and golden perch (*Macquaria ambigua*) are caught by competitors and then taken to a measuring station, where they are released alive once measured.

Both competitions have a considerable number of competitors (over 1,500 in the Tea Tree and over 2,500 in the Cod Classic) and offer valuable prizes, including boat/motor/trailer packages. Both competitions are well established and have many dedicated sponsors and are well known in the recreational fishing community. Both competitions are generally accepted in the local communities.

4.2 The Tea Tree Snapper Fishing Competition

In the winter of 1983, the Snapper Point Angling Club Inc. of Mornington, Victoria, began to plan a public fishing competition that would get anglers to go fishing at the start of the Snapper Season. There is an old adage in Victoria that says:

“When the Tea Tree blooms, the snapper are in the bay”

This was a key to planning the event. The Tea Tree usually blooms in the first week of November so the competition date was established as the Saturday before Melbourne Cup Day. The competition has grown from small beginnings on the water front at Mornington in 1984 to becoming one of the largest events on the Australian fishing calendar. The 30th Annual competition was held in 2013.

The competition targets snapper, *Pagrus auratus*. It draws thousands of competitors from around Australia, and incorporates the Victorian Amateur Snapper Championship. The competition has over \$125,000 worth of prizes. These include three boat/motor/trailer packages awarded as “random capture prizes”, which are drawn from a barrel. There are also prizes for the three heaviest fish in the open and junior categories – winners in each category receive a trophy and vouchers for tackle and equipment. The high profile, large number of competitors, and the importance of snapper as a recreational fishing target in Australian waters makes this competition an ideal opportunity to assess current attitudes and practices affecting fish welfare in the saltwater recreational fishing sector.

The Aquatic Animal Welfare Working Group of the Australian Animal Welfare Strategy (AAWS) developed overarching welfare principles which apply to recreational angling taking part in a competition such as the Snapper Tea Tree Competition are numbers 5, 6, 7 and 8 i.e.

⁷ The official site of this competition is available at <http://www.teatreesnapper.org.au/>

⁸ The official site of this competition is available at <http://www.codclassic.com.au/>

5. *During any handling of live fish:*
 - *care should be taken to avoid any damage to the fish;*
 - *fish intended to remain alive should be returned to the water promptly.*
6. *Any fish selected for harvest should be killed as rapidly as possible, by humane means suitable for the species;*
7. *For fish harvested from the wild, timely handling from capture to death is essential to minimise suffering;*
8. *Capture methods should be designed to minimise the capture of unwanted fish.*

This project was conducted over two years. This allowed an initial evaluation of the competition in the first year with the ability to quantify any changes in welfare attitudes and behaviours in the second year. From the initial evaluation, welfare issues arising from competitors' attitudes and practices were considered and a strategy devised, in close collaboration with the competition organisers, for education and incorporation of welfare improvements for subsequent competitions. Evaluation in the second year's competition aimed to quantify the extent of welfare improvements (if any) by competitors.

Fishing in the 2012 Tea Tree Snapper competition commenced at 5AM on Friday 2nd November and all fish had to be weighed in by 2PM on Saturday, 3rd November. Competitors were restricted to fishing in Port Phillip and Westernport Bays. A maximum of two snapper of a minimum 40 cm total length was permitted to be weighed in by each competitor, with fish accepted whole, gilled, or gutted at the time of weigh-in. Weigh-ins were held at each of the participating boat ramps (Carrum, Hastings, Mornington, and Rye) from 9PM to Midnight on the Friday night, and at Mornington racecourse from 10AM to 2PM on Saturday 3rd November, 2012.

To better understand and quantify attitudes and practices of competitors regarding welfare issues, a survey was conducted by VRFish and Panaquatic Health Solutions at the 2012 Tea Tree Snapper competition. The aim of the 2012 survey was to:

1. Collect baseline data on current practices related to fish handling and killing by competitors competing in this competition;
2. Evaluate attitudes towards fish handling, welfare, and quality amongst competitors and their knowledge on the links between fish welfare and flesh quality.

As the survey was conducted at measuring stations,

4.2.1 Initial survey of competitors at the 2012 competition

A questionnaire was drafted which consisted of 12 questions (Appendix B). Questions were designed to elucidate information on factors affecting fish welfare and quality, including how long fish were kept alive after capture, how fish were killed, and how fish were stored after they were killed. Additional questions were also included which were designed to capture the attitudes of competitors towards fish handling and quality, and to gather demographic data.

The draft questionnaire was provided to the competition organisers to confirm that they were comfortable with the questions being asked of their competitors during the competition. The organisers were indeed happy with the approach and the questions.

Questionnaires were printed out and a survey conducted of anglers during fish weigh-ins by Panaquatic, VRFish staff and volunteers at boat ramps on Friday 2nd November, and at Mornington

racecourse on Saturday 3rd November. Competitors lining up to have their fish weighed were asked if they were willing to participate in the survey, and responses from each participant were recorded on individual survey sheets (one participant per sheet) by the person conducting the survey. The responses were anonymous, with no names of competitors being recorded. However, specific demographic data such as age, sex, and the postcode of each competitor were recorded.

Prior to the Friday evening surveys, one of the key writers of this report fished Western Port as a *bona fide* competitor. He and the other volunteers then spent the greater part of Saturday conducting surveys and attending the prize giving ceremony.

Data analysis

Responses to each question were assigned a value (e.g. 1 = yes, 2 = no, 3 = don't know) and entered into a data table in Microsoft Excel (Microsoft Office 2010). Data were organised into a frequency table and summary values for each survey question were expressed as a percentage of respondents.

Results of the initial survey of competitors

A total of 235 individual survey responses were collected at the Tea Tree Snapper competition held on 3-4 November 2012. An additional 126 responses were excluded due to incomplete or illegible survey data.

The majority (63%) of surveys were collected at the Saturday weigh-in at Mornington racecourse, with the remainder spread across the five boat ramps surveyed (Figure 1). Most of the respondents were male (223, or 95%), and only nine respondents (4%) were female. Gender was not recorded from three (1%) respondents. The age ranges of the respondents were as follows (Figure 2):

- 109 (46.4%) respondents were aged 35-50
- 74 (31.5%) respondents were aged 21-35
- 42 (17.9%) respondents were aged 51-70
- 7 (3.0%) respondents were aged under 16
- 3 (1.3%) respondents were aged 16-21

No respondents were aged over 70 and respondents came from a total of 93 different postcodes.

Of the 235 respondents, 16 (7%) reported that they did not kill the fish that they caught at all, either immediately or after holding. Over half of the respondents that "killed" the fish that they caught did so by putting the fish directly into an ice-water slurry (Figure 3). The majority (74%) of people that reported killing the fish that they caught did so within 1 minute of bringing it onto the boat (Figure 4), and almost all respondents (87%) reported storing their fish in a container with either ice or an ice-water slurry (Figure 6).

Only 21 respondents (9%) reported that they kept fish alive after capture. Of these, 11 (52%) used a live well, while the remaining 10 (48%) used a tub, esky, or bucket with water. Over half of the fish that were kept alive (52%) were kept alive for longer than 60 minutes (Figure 4).

Of the respondents surveyed, 194 (83%) believed that how they stored the fish affected its quality for eating, 33 (14%) did not think that storage made a difference, and eight (3%) did not know or did not provide a response. Almost all of the respondents (232, or 99%) were planning to eat the fish

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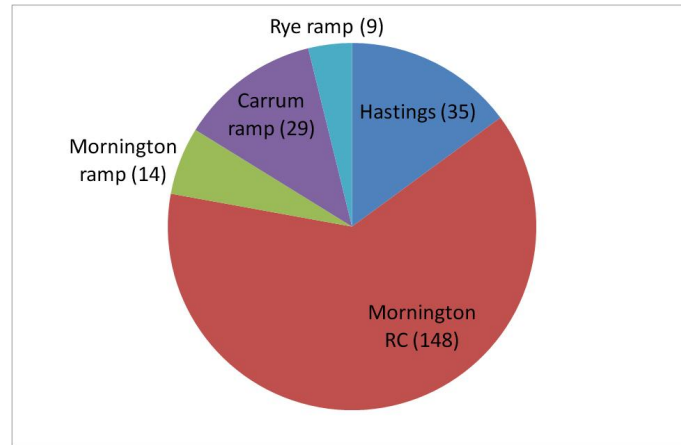


Figure 1 - Breakdown of Weigh in stations where competitors surveyed

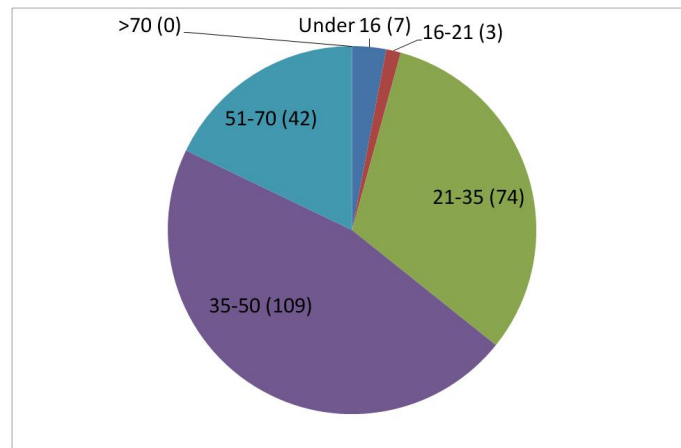


Figure 2 - Age range of competitors surveyed

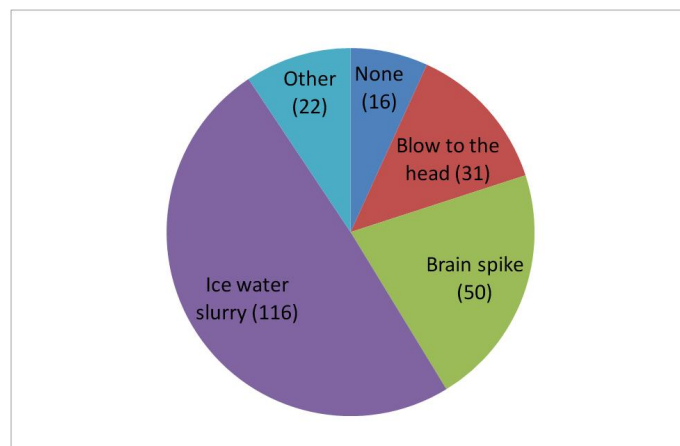


Figure 3 - Method of "killing" fish as identified by competitors surveyed

Note: Number of responses for each category is given in parentheses.

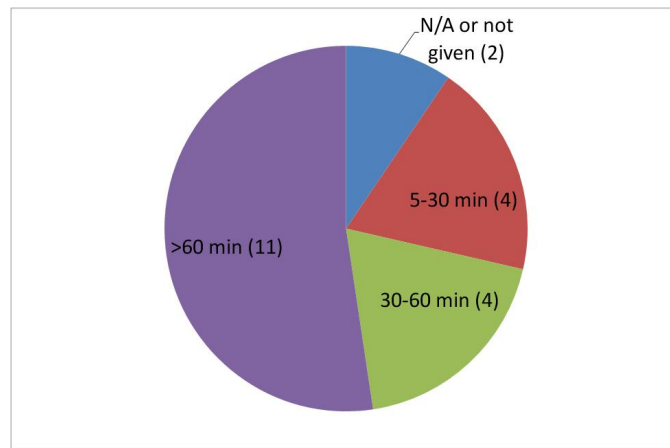


Figure 4 - Holding times for fish kept alive after capture

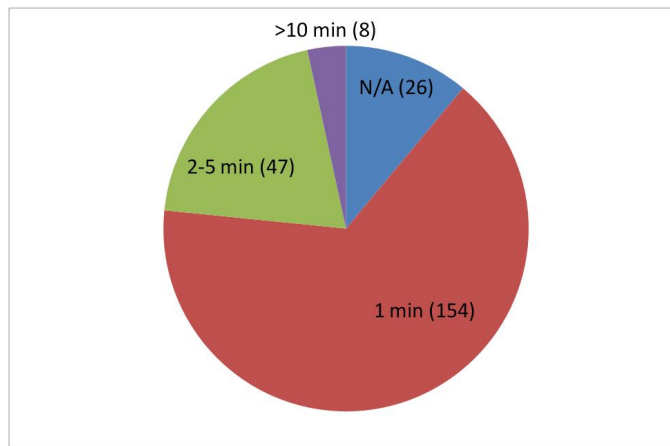


Figure 5 - Time between capture and "killing" of fish as identified by competitors surveyed

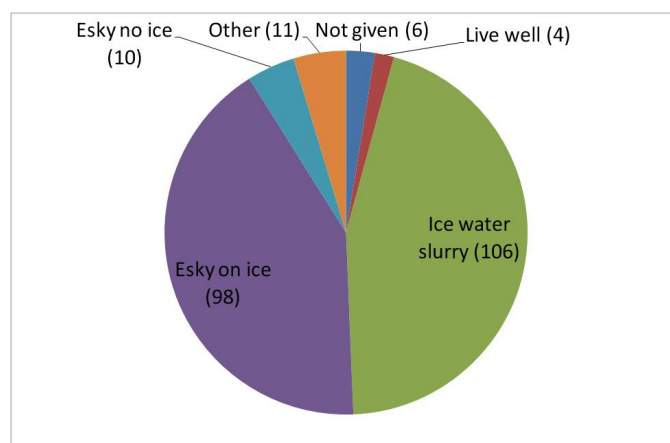


Figure 6 - Method used to store fish once caught and after fish killed

Note: Number of responses for each category is given in parentheses.

that they caught as part of the competition. Of the remaining three respondents (1%), one person responded that they

“would like to eat the fish but generally you can’t eat the fish that you weigh in for the Tea Tree as it has been sitting around for so long”.

The majority of respondents (207, or 88%) said that they took part in the competition for fun/social reasons, 70 (30%) said that they entered to win a prize, and 21 (9%) entered the competition because it was a fishing club activity. Several respondents selected more than one response for this question

Discussion on results of survey of 2012 competitors

Overall the response of the competition participants to the survey was positive from a welfare perspective, and valuable data was collected on current practices and attitudes related to fish handling among a specific sector of the recreational fishing community. One of the main findings was that the vast majority of people surveyed reported that they killed the fish that they caught, with only 21 people choosing to keep fish alive after capture. However, some methods of killing (e.g. placing a large snapper into an ice-slurry) may not cause immediate death of the fish, although to some of the competitors surveyed this constituted humane killing.

Maintaining live fish post capture

Of the 21 people that kept fish alive after capture, 11 reported using a live well while the remaining 10 used a tub, bucket, or esky with water to store their fish. Notably, 11 people reported keeping fish alive for over an hour. Keeping fish alive after capture presents a potential welfare issue in that fish may be subjected to sub-optimal water conditions for extended periods of time. This is more likely when a container is used rather than a live well that is fitted with aeration or flow through water. Confinement and poor water quality have been shown to cause stress (measured by changes in blood parameters) in largemouth bass (Carmichael *et al.*, 1984), and Pankhurst *et al.* (1992) showed that cortisol levels in snapper caught by rod and line increased significantly after 60 minutes holding in an onboard live well.

Water quality and the use of live wells during the competition is an area for further evaluation. It may be worth considering the provision of guidelines for live wells for future competitions, including minimum container size and water exchange/aeration rates.

Methods of killing fish

The most commonly used method for “killing” fish was ice water slurry, with almost half of respondents stating that they used this method. The use of ice water slurry as a sole method of killing fish is contentious and in a large, temperate fish species such as snapper may actually prolong death rather than shorten it. Several authors have reported that fish show strong aversive behaviour when placed directly into ice water slurry without stunning (Lambooy *et al.*, 2007; Roth *et al.*, 2009; Scherer *et al.*, 2005), and there is likely to be considerable variation in the time taken for loss of consciousness and death to occur (Poli *et al.*, 2005). Most significantly, Roth *et al.* (2009) reported that turbot reared and held at 14 °C were completely immobile (with muscle contraction and mouth gaping similar to rigor mortis) after 40 – 60 minutes in ice water slurry (-1.5 °C), but despite body temperature falling to 1 °C all fish recovered when transferred back into holding tanks at 14 °C. This suggests that ice water slurry on its own for this species is not an appropriate killing method, and

quite possibly not suitable from a welfare perspective for temperate species such as snapper.

This conclusion is supported by the findings of a separate project, which reviewed the use of ice slurry by recreational anglers as a killing method in Australia⁹. This project concluded that it was not possible to confirm whether or not the use of ice slurry as a primary killing method would deliver good welfare outcomes for the majority of finfish species targeted by fishers in Australian waters. With respect to larger species of temperate water fish (which the snapper is), immersion in an ice slurry as a primary killing method was likely not to be acceptable from a welfare perspective as there was no certainty that this method would rapidly render a fish unconscious until death without avoidable stress.

Percussive stunning and brain spiking have been shown by several studies to reduce the incidence of stress related changes in the blood and muscle of several fish species compared to other killing methods (Boyd *et al.*, 1984; Morzel *et al.*, 2002; Tejado and Huidobro, 2002). These methods are the preferred means of killing fish post-capture, and have the added benefit of delaying post-mortem changes in blood and muscle parameters associated with reduced flesh quality. It is encouraging that 81 respondents (34%) reported using either a blow to the head or brain destruction to kill the fish that they caught in the 2012 Tea Tree Snapper Competition.

Time to death

The time taken to kill fish after they were brought onboard was one minute or less for 66% of respondents, with 86% of all respondents stating that they killed the fish that they caught within 5 minutes of bringing them onboard. It is encouraging that only eight respondents reported that they took longer than 10 minutes to kill the fish that they caught. Increased time between capturing and killing a fish can increase capture stress, resulting in post-mortem changes associated with a reduction in flesh quality. Education of fishers regarding the killing of fish and impact on flesh quality related to delayed killing is an area for potential welfare improvement. It must be noted that the “time to killing” was based on the competitor’s estimate. It is quite possible that some competitors considered the fish “dead” once it had, for example, been placed into an ice slurry or an esky that contained ice. The actual “death” of the fish may though not occur at this time, but occur minutes later.

Flesh quality

A majority of the respondents (87%) reported that they chilled the fish that they caught after killing, either in an ice water slurry or in an esky with ice. While not a direct welfare issue, chilling of fish after killing is known to improve the quality and shelf life of fish (Borderias *et al.*, 2010), and should be encouraged among tournament competitors. The comments of one survey respondent that fish caught in the Tea Tree Snapper tournament cannot be eaten as they sit around too long suggests that not all tournament participants are aware of how to properly store their catch after killing. There is no reason why fish that are caught during the competition should not be fit for consumption, and this is evidenced by the fact that the vast majority of respondents (99%) stated that they would be eating the fish that they caught.

⁹ A review of the use of ice slurry and refrigerated seawater for the killing and holding of finfish, M. Barwick, B. Diggle and P. Hardy-Smith – in press

Welfare linked to quality

The results of this survey suggest that there may be benefits in providing educational material to recreational anglers on issues of welfare e.g. humane killing techniques and holding of live fish. It was acknowledged that some anglers may not change practices or attitudes to the way they handle and treat fish based on welfare considerations. However, most of the competitors surveyed indicated that they would eat the snapper that they had caught and had weighed in at the competition. Hence the desire for a high quality edible product was considered an important potential driver for change. Fortunately, the practices required to maximise the quality of a snapper caught in the competition also improve overall welfare and help to address the AAWWG Overarching Welfare Principles as they apply to recreational fishing.

4.2.2 The second year of competition – the 2013 Tea Tree Snapper Fishing Competition

The survey conducted during the 2012 Tea Tree Snapper competition yielded a large amount of valuable data on current practices and attitudes on fish welfare in a defined area of the recreational sector. Welfare issues identified through attending the 2012 Tea Tree competition and through the survey of 2012 competitors included:

1. The need for education of competitors on different killing methods used to kill fish being caught as part of the competition, and the welfare and quality aspects of each of these methods;
2. The importance from both a welfare and quality perspective of killing fish as soon as possible after being brought onboard and how to achieve this;
3. The welfare and survival implications relating to the time fish are kept out of water (“air exposure”);
4. The impact which keeping fish alive on board can have to fish, and the importance of optimal water quality in holding containers being used.

In addition, though not specifically a welfare consideration, properly storing fish once killed to optimise eating quality was identified as useful information that would benefit competitors.

Incorporation of welfare improvement practices into the second year of competition

The strategy adopted to incorporate these welfare considerations into the 2013 competition was developed using this information together with a review of the scientific literature. This included the development of the educational material and the implementation of a communications strategy to distribute this material to recreational anglers who may be competing in the 2013 competition.

The strategy also realised that there would be additional benefits in disseminating this information to the wider recreational fishing community, particularly those that targeted snapper. The strategy that was implemented was as follows:

1. A targeted review of the scientific literature was conducted to assess what research had been carried out in the specific welfare and product quality areas identified through the survey conducted on 2012 competitors. This included killing and handling procedures, barotrauma, the use of live wells, and air exposure. Any educational material that was

developed as part of the communication strategy had to be supported by the available science where possible and needed to avoid speculative or spurious content, of which there was plenty circulating in social media. Scientific research which studied specifically snapper was considered especially useful. The review process also included discussion of issues such as barotrauma in snapper with key researchers in this area, for example Dr Paul Butcher of NSW Fisheries.

2. A key document on welfare and product quality considerations when fishing for snapper was produced in a brochure form. This summarised the findings of the literature review and research conducted by the project team. A copy of this brochure is included in Appendix E. The findings from last year's competition survey and the literature review also formed the basis for more extensive information on these issues in a document included in Appendix F and which was made available on the Panaquatic website¹⁰.
3. The development of this brochure and supporting documentation included a review process by members of the Project Steering Committee, Snapper Point Angling Club officials and a number of local recreational anglers. This included:
 - a. A presentation by Dr Paul Hardy-Smith at the October 2013 Meeting of the Snapper Point Angling Club (SPAC). SPAC are the club who organise and run the Snapper Tea Tree Competition. It was considered important to present the welfare and fish quality information to be included in the brochure to members of SPAC first to ensure that they were comfortable with the information and to allow any concerns or questions regarding the information to be addressed before its printing and inclusion in the mail out in competitors' packs. Approximately 60 members of SPAC attended this meeting.
 - b. Review of the final wording in the brochure by the organising committee of the Snapper Tea Tree Competition. This was done after the presentation to SPAC and once the edited text of the brochure was ready to be sent to the printers.
 - c. Review of the final wording in the brochure by a number of anglers targeting snapper in Victoria. This was done to confirm that the wording in the brochure was not ambiguous and was understandable to the general angler.
4. A total of 2000 brochures were printed in the initial run. Over 1000 of these were included in the information package that was mailed out to each of the 2012 competitors in the weeks leading up to 2013 competition.
5. Presentations targeted at recreational anglers who may be competing in the 2013 Tea Tree competition was seen as another very useful part of the communication strategy. A key presentation given by Dr Paul Hardy-Smith about welfare considerations when fishing for snapper was given at "**Australia's biggest snapper talk**". Figure 7 shows the online promotional flyer for this evening, at which Dr Hardy-Smith was key speaker. The night is strategically given in the week preceding the Tea Tree Snapper Competition, which aligned well with the communication strategy for the competition. Approximately 350 anglers attended this evening. The presentation was very well received, with many questions coming from the audience after the welfare issues were discussed.

¹⁰ Available at <http://panaquatic.com/fishinfo.html>



**PAUL WORSTELING'S
TACKLE
WORLD**
MORNINGTON & CRANBOURNE

AUSTRALIA'S BIGGEST SNAPPER TALK

**TUESDAY 29TH OCTOBER @ 7PM
MORNINGTON MAZDA SHOWROOM**

Tackle World Cranbourne & Mornington presents Australia's biggest Snapper talk night on Tuesday 29th October with a great line up of guest speakers, snapper specials, prizes and much more.
Very special guests for the night include Paul Hardy Smith who will be taking you through some very important, but sometimes overlooked, aspects of Snapper fishing with everything from looking after your catch ensuring you have the best quality for the table, also correct and successful release techniques.

Then we have our super snapper panel:

- Port Phillip Bay gun Simon Rinaldi
- Westernport's finest Shaun Furtiere
- Certified Lowrance Technician Scott Harper

You want to know something about snapper fishing in our bays...???.....these guys will tell you!!!!

Venue:	Mornington Mazda, corner Nepean Hwy and Main St Mornington
Date:	Tuesday 29th October
Time:	6.30pm for pizza and drinks, 7.00pm talks start
Cost:	\$10 entry, free pizza and soft drink

This talk is only 3 days prior to the annual Tea Tree snapper competition, and our snapper panel will be providing you with up to date information on where the big fish are biting, the best tips and techniques and much much more. Book now to ensure you get a seat as this night is sure to be a sellout.

Figure 7 - On-line flyer promoting "Australia's Biggest Snapper Talk" at which a member of the project team, Dr Hardy-Smith was a key presenter

The brochure and accompanying information was also posted on Facebook (further discussed below). An example of comments that appeared on this post was included the following:

I had the pleasure of listening to Paul speak at a recent snapper talk held by tackleworld. A world of helpful information and by the sounds a good fisho too. Well done Paul for your informative approach lets hope the message gets through and more people think twice before filling there ego for catch and release on snapper.

Survey of competitors competing in the 2013 Tea Tree Competition

A total of 248 competitors were surveyed at the 2013 competition, held on 1-2 November to assess whether there was a change in the attitudes and practices of competitors towards welfare and quality issues when catching snapper during the competition.

After analyzing the data collected in the 2012 survey, the questions for the 2013 survey were refined to gather more specific data on how the participants were handling the fish that they caught. As a result the 2013 survey provides more comprehensive information on killing methods and handling time than the 2012 survey. The questions asked of competitors during the 2013 survey are included in Appendix C.

Survey results

A total of 248 individual survey responses were collected on 1-2 November, 2013.

Of the 248 responses:

- 167 (67.3%) were collected at Mornington racecourse (Saturday)
- 21 (8.5%) were collected at Mornington ramp (Friday evening)
- 18 (7.3%) were collected at Hastings boat ramp (Friday evening)
- 42 (16.9%) were collected at Carrum ramp (Friday evening)

Most of the respondents were male (227, or 91.5%), and 13 respondents (5.2%) were female. Gender was not recorded from 8 (3.2%) respondents. The number and percentage of female respondents in 2013 was slightly higher than in 2012 (7 respondents, 3.2%).

The age ranges of the respondents were:

- 18 (7.3%) respondents were aged under 16
- 7 (2.8%) respondents were aged 16-20
- 80 (32.3%) respondents were aged 21-35
- 87 (35%) respondents were aged 36-50
- 55 (22.2%) respondents were aged 51-70
- 1 (0.4%) respondent was aged over 70

In 2013 the number of respondents aged under 16 (18 respondents, 7.3%) was higher than in 2012 (7 respondents, 3.2%). The number of respondents aged 16-20 was also higher in 2013 (7 respondents, 2.8%) than in 2012 (3 respondents, 1.4%).

When competitors were asked what they immediately did to the fish once it came on board, of the 248 respondents surveyed in 2013:

- 107 (43.1%) actively killed the fish by stunning it with a blow to the head or brain spiking it in the brain. The majority (89, or 83%) did this within a minute of bringing the fish onto the boat, 16 (15%) did it in 2-5 minutes, and the remaining 2 (2%) respondents did not provide a time.
- 75 (30.2%) put the fish directly into a container with ice and water (“ice slurry”) without first spiking or stunning the fish. Of these, 62 (83%) did this within a minute, 10 (13%) did it between 2-5 minutes, and the remainder (3 respondents, 4%) took 5-10 minutes to put the fish into the ice slurry.
- 32 (12.9%) put the fish into a container with ice without first spiking or stunning the fish. Of these, 25 (78%) did this within a minute of bringing the fish onto the boat, 5 (16%) did it in 2-5 minutes, and 2 respondents (6%) took 5-10 minutes.

- 16 (6.5%) put the fish directly into a container with water. Of these 16, 15 (94%) did so within 1 minute, and 1 (6%) did it in 2-5 minutes.
- 12 (4.8%) cut the throat of the fish (thereby severing the ventral aorta) as their method of killing. Of these, 7 (58%) did this within a minute of bringing the fish onto the boat and 5 (42%) did it within 2-5 minutes.
- 4 (1.6%) threw the fish into a container with no ice.
- 2 (0.8%) threw the fish onto the deck.

Discussion

There were two important upward trends noted in the 2013 results compared to the 2012 results. Firstly, there was a noticeable increase in the number and proportion of respondents that reported killing their fish humanely (i.e. with a brain spike or blow to the head) in 2013 compared to 2012:

- In 2013, 43.1% (107 respondents) actively killed the fish humanely compared to 34.5% (81 respondents) in 2012 (Figure 8).

In addition, there was a marked increase in how quickly the fish were humanely killed in the 2013 competition:

- In 2013, 35.9% (89 respondents) killed the fish humanely within 1 minute, compared to 25.5% (60 respondents) in 2012 (Figure 9).

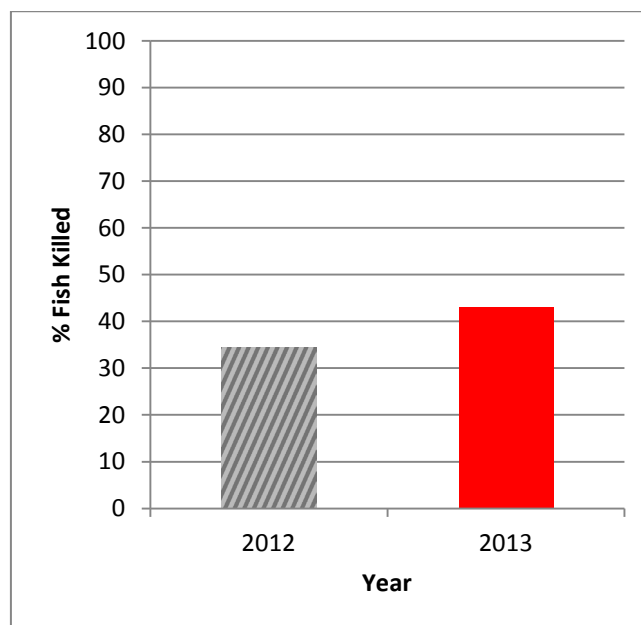


Figure 8 – Increase in the proportion of fish humanely killed by a spike or a blow to the head from the 2013 survey compared to the 2012 survey

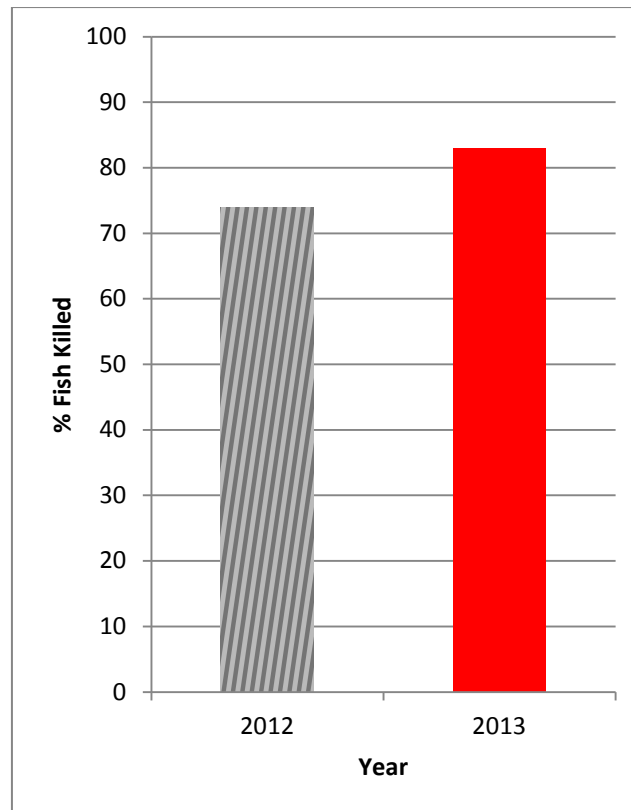


Figure 9 - Increase in the proportion of fish killed by a spike or blow to the head within 1 minute between 2012 and 2013

There was also a noticeable downward trend in the proportion of competitors surveyed that immediately put the fish that they caught on ice or an ice slurry in 2013 compared to 2012:

- In 2013, 107 respondents (or 43.1%) put their fish directly into an ice slurry compared to 105 respondents (51%) in 2012.

Another important downward trend was the proportion of competitors reporting that they left the fish they caught to die in a container or on deck:

- In 2013, only 4 respondents (1.6%) reported that they left the fish that they caught in a container or on the deck to die compared to 16 respondents (6.8%) in 2012.

The majority of the people surveyed (232 respondents, or 93.5%) reported that they did not use a container with water to keep the fish that they caught alive after capture. Only 16 respondents (6.5%) used a container with water to put fish in. Of these 16 respondents:

- 6 respondents kept the fish alive for 30 – 60 minutes;
- 4 respondents kept fish alive for >60 minutes;
- 6 respondents did not report how long fish were kept alive for.

Fewer respondents reported using a container with water to hold fish alive in 2013 (16 respondents, 6.5%) compared to 2012 (20 respondents, 9%). Additionally, the majority of the containers used in 2013 (13, 81%) had a volume of 70L or greater as reported by the respondents. This is a higher proportion than in the 2012 survey, in which 10 (50%) of the containers used to hold live fish were buckets and the volumes of the remaining 10 containers were not reported.

Of the respondents surveyed in the 2013 survey, 119 (48%) believed eating quality is affected by angling time (how long they took to bring in the fish), 201 (81%) believed eating quality is affected by how they handled and killed the fish after capture.

Almost all of the respondents surveyed in 2013 (240 respondents, 97%) believed that eating quality is affected by how the fish is stored after capture, which shows an increasing trend compared to the 194 respondents (82.6%) in 2012.

The majority of respondents (238, or 96%) were planning to eat the fish that they caught as part of the competition. Of the remaining 10 respondents (4%), 7 were not going to eat the fish and 3 did not provide an answer.

The majority of respondents (236 or 95%) said that they took part in the competition for fun/ social reasons, 155 (62.5%) said that they entered to win a prize, and 68 (27.4%) entered the competition because it was a fishing club activity. Several respondents selected more than one response for this question.

In summary then, the survey results from the 2013 survey showed:

3. An increase in the proportion of competitors humanely killing their fish with a spike or blow to the head - from 34.5% in 2012 to 43.1% in 2013;
4. An increase in the proportion of competitors who actively killed the fish within a minute of being caught – from 25.5% in 2012 to 35.9% in 2013;
5. A decrease in the proportion of competitors placing their fish immediately into an ice slurry with no other killing method being used – from 50% in 2012 to 43.1% in 2013;
6. An increase in the proportion of competitors who believed that the eating quality of the fish is affected by how the fish is stored after capture – from 82.6% in 2012 to 97% in 2013.

These are encouraging trends.

4.2.3 Extension of benefits from this project

Fisheries Victoria

Due to the emphasis on fish welfare and the additional material presented in the brochure on welfare issues when releasing fish, the work being done in this project came to the attention of Fisheries Victoria (FV), in the Victorian Department of Environment and Primary Industries (DEPI).

This project had been conducted outside of the regulatory environment as currently there are no regulations covering welfare aspects for the handling and killing of fish being caught recreationally, or other welfare aspects such as air exposure and choice of hooks.

Snapper is a key species in Victoria, and FV are responsible for the management of the commercial and recreational catch of snapper. A concern of FV is the practice of “high grading”, where a recreational angler has caught and retained their catch limit of legal size snapper, and then continues to catch more snapper, subsequently discarding the previously caught ones. Any snapper that are caught and are retained in a live-well, catch-bag, esky, bucket, or any other container counts towards the bag limit for the day. “High grading” is considered illegal in Victoria, not only for snapper but for all species of fish being caught by recreational anglers. An important reason for the concern

is that snapper that are released are often in very poor condition and some are even dead. Hence while the recreational angler may take home only three fish, he or she has been responsible for killing many more during the day's fishing. FV were very keen to reduce such incidental mortality.

While FV are keen to increase their enforcement of this regulation it would need to be consistent across all fish species being recreationally targeted in Victoria. However, some fishing competitions held in Victoria (e.g. Vic Bream Classic¹¹) are catch and release tournaments and "high grading" is an integral part of the competition. In the Vic Bream Classic, for example, competitors are allowed to weigh in up to five legal size bream at the end of each day of the competition. Legally, FV have set a daily catch limit of 10 bream per day in Victoria, all of which must be at least 28cm in length. Competitors may however catch well in excess of ten legal size fish but will release the smaller fish as larger fish are caught. Hence, based on the legal interpretation of the regulation, competitors who have caught and retained on their boat over 10 legal size bream during a single days fishing are engaging in an illegal activity, even if they only have five fish in their possession at any one time.

Such a competition could elect to have competitors catch and kill up to ten bream each day and submit the largest dead fish to be weighed. This would constitute a legal practice based on the current regulations. Understandably, the organisers of these tournaments consider releasing fish a more sustainable and responsible approach. FV were concerned that enforcing the "high grading" regulation would mean that the maximum number of bream any competitor could catch and keep in their live well was ten.

FV was very interested in the work being done through this project and its relevance to reduction of incidental mortality and there has now been collaboration between the project team and Fisheries Victoria to develop guidelines for fishing competitions wishing to keep "high grading" as a practice in their competition. One competition has already been granted an exemption due to the competition guidelines developed by the key writer of this project in collaboration with the competition organisers.

In addition, FV were very impressed with the brochure that was created as part of this project. As a result they included the brochure and the link to further information on their Facebook page¹². The screen shot of this (Figure 10) indicates that two days after the being posted, a total of 7,516 people had viewed this post.

Hence there have already been some valuable flow on benefits from this project.

Angling clubs

In addition, Dr Hardy-Smith has been asked to present in a number of local angling clubs. An example of the social media comments on one of the presentations given at a local angling club is shown in Figure 11.

¹¹ The official website of the Vic Bream Classic is located at <http://www.vicbreamclassics.com.au/>

¹² The Fisheries Victoria Facebook page is located at www.facebook.com/DEPIFisheries

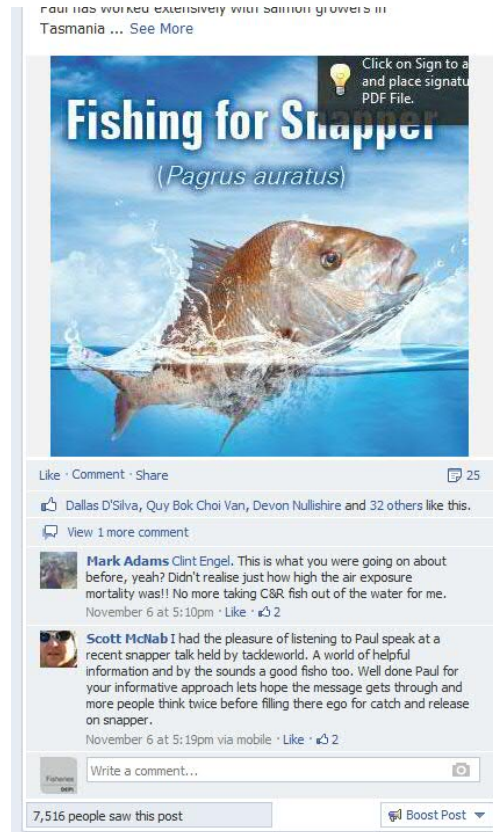


Figure 10 - Fisheries Victoria Facebook screenshot

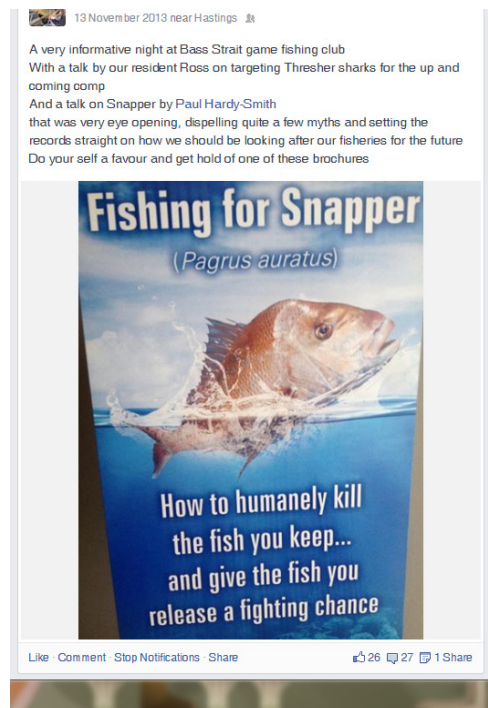


Figure 11 - The Facebook entry of a angling clubmember after attending the presentation by Dr Hardy-Smith

2014 Melbourne Boat Show

Dr Hardy-Smith was also invited to present information on this project at separate presentations given on three days of the 2014 Melbourne Boat Show, which was held in June, 2014.

4.3 The Mulwala Cod Classic 2012 and Mulwala Cod Nationals 2013

In December each year, one of Australia's richest freshwater fishing tournaments, the Cod Classic¹³, is held. The competition is a catch and release event for Murray cod (*Maccullochella peelii*) and Golden perch (*Macquaria ambigua*). It attracts over 2,500 competitors and 1400 boats. The prize pool totals in excess of \$125,000 including 7 boating (boat/motor/trailer) packages.

The high profile nature of this competition with its large number of competitors, and the importance of Murray cod and Golden perch as freshwater recreational fishing targets in Australian waters was the reason this competition was selected as being ideal to assess current attitudes and practices affecting fish welfare in the freshwater recreational fishing sector. The Cod Classic event director is Tony Bennett. Tony also organises a number of other similar but smaller competitions during the year, including the Cod Nationals, a team event which is held annually in April.

The overarching principles which apply to recreational angling taking part in a competition such as the Cod Classic Competition are numbers 1, 2, 4, 5 and number 8 i.e.

1. *For fish held in captivity, the key parameters (temperature, salinity, pH, dissolved oxygen, and metabolites) of the aquatic environment in which fish are maintained should be within the species' natural range of tolerance.*
2. *For fish held in captivity, the holding unit in which they are normally housed should provide*
 - *safety from predators,*
 - *refuge from environmental extremes beyond their natural range of tolerance,*
 - *appropriate space,*
 - *appropriate space and/or water flow to avoid chronic degradation of water quality parameters referred to in point 1 above.*
4. *For fish held in captivity, any visibly damaged or sick fish should be assessed and either treated appropriately or promptly removed for killing by humane means suitable for the species.*
5. *During any handling of live fish,*
 - *care should be taken to avoid any damage to the fish;*
 - *fish intended to remain alive should be returned to the water promptly.*
8. *Capture methods should be designed to minimise the capture of unwanted fish.*

Overarching Welfare Principles Numbers 1, 2 and 4 are relevant to this competition due to the fact that Murray cod and Golden perch being caught are generally kept in live wells while being transported to a measuring station.

4.3.1 Evaluation of the initial competition, the 2013 Cod Nationals

The original intention of this Project was to attend the 2012 Cod Classic and evaluate the competition in the context of the Aquatic Animal Welfare Working Group Fish Welfare Overarching Principles. The project team, in collaboration with the organisers, were then going to consider whether or not there were mechanisms available to incorporate welfare improvement practices into the competition, based on the first year's evaluation. Evaluation of the second year of the competition, held in December 2013, would allow evaluation of the incorporation of these practices.

¹³ Details of the competition are available at <http://www.codclassic.com.au/>

Due to the late commencement of this project, it was not possible to arrange the necessary resources to attend the Cod Classic being held in the first week of December, 2012. The options to the project team were to consider another large freshwater competition, but there are very few freshwater competitions of such magnitude and profile that are held in Australia each year. Choosing another competition and going through the necessary steps to gain approval from the organisers of such a competition could potentially have added considerable delays to the Project.

As the event organiser of the Cod Classic also run a number of other competitions with a similar format, the project team decided that a reasonable approach would be to initially evaluate one of these other competitions in the context of the overarching welfare principles and consider whether it would be possible to incorporate welfare improvement practices, if identified, into the 2013 Cod Classic. Tony Bennett was readily agreeable to this approach.

Hence the lead writer of this project, Dr Hardy-Smith attended the registration and opening events of the Cod Nationals held in April, 2012 and accompanied two of the more favoured competitors during the first day of the competition as an observer. Due to the strict rules of the competition, Dr Hardy-Smith was not allowed to provide any assistance to the two anglers nor was he allowed to fish himself while on the boat.

Findings

The 2013 Cod Nationals had it largest field to date. The cash prizes awarded in this competition are the largest amounts given in any freshwater event in Australia. Fifty eight anglers took part, 2 anglers making up each of the 29 teams competing. Many of the anglers were high profile fishing magazine writers and/or associated with the making, distribution and/or promotion of fishing tackle and equipment.

The Cod Nationals is a catch and release event fished over five days with each day being fished under a different fishing format. The objective is to catch Murray cod, with points being awarded to the team (and to the individual) for every cod caught during each day. There is a sliding point score system used which rewards fish of greater size. At the completion of each day, teams finishing in the top ten are awarded points ranging from 10 for first through to 1 point for tenth, the team finishing with the greatest amount of points after 5 days is declared the winner. The entry fee for this event is \$1,100 per competitor and \$2,200 per team, and there is over \$30,000 awarded in cash prizes, which is reported to be more than any other freshwater fishing competition in Australia.

The competition has strict rules and regulations. Some of the key points are:

- The competition targets Murray cod (*Maccullochella peelii*) only which is slightly different to the Cod Classic, where Golden perch (*Macquaria ambigua*) are also targeted. It is totally catch and release as is the Cod Classic;
- Lures only are allowed – bait fishing is prohibited. Hence there are no welfare issues with the use, for example, of live baits. This again is slightly different to the Cod Classic, where bait fishing is allowed;
- To have points awarded for fish less than 60cm (i.e. the NSW legal size for keeping of Murray cod) they must be immediately photographed on the boat and then released. An official Cod Nationals measuring trough is provided to each boat and each day a “fish ID token” is given to each team. The “fish ID token” must be displayed in the photograph of any fish caught on

that day;

- All legal size cod that are caught (i.e. length $\geq 60\text{cm}$) must be witnessed and measured by a tournament official. Thus all boats must have the capacity to keep a legal size cod alive during the period when the boat travels to a designated measuring station for measuring and then releasing. Only cod that swim away “in a healthy condition” are entered in the competition and have points awarded to the team, which provides a strong incentive for competitors to look after their fish;
- Competitors may only use one rod at a time to fish. Having to concentrate on a single rod minimises the potential for fish to take a lure and deep hook themselves before the bite is noticed.

Registration and “team auction” occurred on the Sunday evening before the competition. Dr Hardy-Smith attended the Sunday evening events, was introduced to the competitors and the reason for him being there was explained by Tony Bennett. There was general appreciation of him being there, which was made particularly clear by the competition organisers, who showed sincere appreciation for what the project was doing. Dr Hardy-Smith was asked to address the competitors and hence had the opportunity to explain the Australian Animal Welfare Strategy (AAWS) and the objectives of the VRFish project.

That evening each team was “auctioned” – basically, the teams had been examined and given “odds” and you could “buy” a team. If your team won, there was a substantial cash bonus given to you if you owned that team, based on the “odds”. It was all good fun and was in keeping with the spirit of the competition, which while serious (the \$10,000 cash prize to the winner provided a seriousness to the event) was still about having fun and enjoying the company of other like minded anglers.

Early on Monday morning, Dr Hardy-Smith met up with Rod McKenzie and Jamie Robinson (Team #3) to spend the day out on their boat fishing. The rules for day 1 of the competition were that competitors could use any type of lure to catch a cod, but would get a bonus team point for each legal cod caught on a “Balista” type lure, “Balista” sponsoring that day’s fishing.

Despite what must have been hundreds of casts during the day by both Rod and Jamie, no cod were actually caught. Hence the method of capture and getting a live, legal size cod to a tournament official was not actually physically viewed during this day. However, considerable discussion was had on the day about welfare issues associated with this style of competition, catch and release in general and the holding of live Murray cod for any length of time and ensuring they remain in good condition.

Welfare considerations

The competition is very well run. Through Dr Hardy-Smith’s attendance at this competition the project team gained a good understanding of how the competition is conducted and the welfare issues that are being addressed when conducting a large catch and release competition for an iconic freshwater Australian fish species. Some initial welfare considerations that the Project Team identified included the following:

1. The method used to catch the fish;

During the entire day, the 2 competitors that Dr Hardy-Smith accompanied always maintained a taut line between the lure and the rod. Two actual strikes occurred but without hooking. There was little possibility of a lure being left unattended or time for it to be swallowed by a large cod. Hence the potential welfare issue associated with leaving unattended baits (and having fish swallow the bait and the hook, hence leading to deep hooking) did not appear to be an issue for this style of competition. It potentially could be an issue for the Cod Classic, where bait fishing is allowed;

2. The measuring trough supplied to each team;

A measuring trough was provided to each team in which the fish were to be photographed. The measuring trough supplied to team #3 was noted to have some rough edges in it. While not a major issue, fish that are to be released should not come into contact with rough surfaces during handling. This issue was brought to the attention of the organisers, with a recommendation that the surfaces of measuring troughs are checked and confirmed to be smooth prior to being used.

3. Holding of live fish;

If a legal cod had been caught during the day it would have been placed into a live fish tank under the deck of the boat. Many questions were asked about the suitability of live fish tanks, whether there were specific dimensions that should be adhered to, how best to hold fish in the tank etc. The key issue in a live tank is to minimise stress to the fish and the primary means of doing this is to maintain optimal water quality. The exact dimensions of the tank are usually not as important as the water quality, although at the very least the tank must sufficiently large to be able to accommodate fish that may be over 1 metre, as this size of fish are caught in the area. With respect to water quality, a small tank maintaining high flows of fresh water can maintain very good water quality if it has live fish in it whereas the water quality in a large tank with little fresh water flowing into it may quickly become sub-optimal. The live tank on Rod Mackenzie's boat had the capacity to run high flows of fresh water through it. It also had sufficient space to allow holding of a large cod. This is a key welfare issue and was identified as an important area to evaluate in the Cod Classic.

4. Water temperature;

The temperature of the water was not a concern in April when the Cod Nationals were being held. However, it could become a concern during the warmer months of the year if cod were caught at say 5m where the water temperature may be 17-18°C and then held in a live tank drawing water from the surface, which may be at 22-23°C. This is a reason why it will be very useful to evaluate competitions held at different times of the year as this project is doing.

Discussion

The evaluation of the 2013 Cod Nationals identified a number of welfare considerations that pertain to this style of competition. It helped the project team also familiarise itself with the format of the competition. Unfortunately no fish were capture by the team Dr Hardy-Smith had been assigned to for the day. It did show that the competition is well run and conducted in a professional manner and speaking with the organisers and a large number of the competitors indicated that the welfare of the fish being targeted, the Murray cod, was considered of importance.

4.3.2 Evaluation of the 2013 Mulwala Cod Classic Fishing Competition

Attendance at the 2013 Cod Nationals, held in April on and around Lake Mulwala highlighted a number of welfare considerations concerning these types of competitions. The competition prides itself on being a “catch and release” competition, hence minimising any killing of fish. Catching and releasing of fish certainly gives the fish a chance to survive but its chances can be impacted through the ways in which fish are captured, held and subsequently released.

Many of the competitors competing in the Cod Nationals were involved in the recreational fishing industry in some way, for example through being tackle representatives or fishing magazine writers. Hence those fishing the Cod Nationals were not likely to be a true representation of the wider angling community and in particular those fishing the Cod Classic. The entry fee for the Cod Nationals, \$1,100, also means that the total number of competitors is reasonably small, there being 58 competitors at the 2013 event. The Cod Classic, with an entry fee of \$90 and up to 7 boats being offered as prizes, attracts a much larger field, with 2,653 competing in the 2013 event.

The information package provided to all competitors prior to the competition includes a page on catch and release of fish. This is informative and provides key information to improve the chance of survival of any fish caught during the competition and subsequently released. For example, the information provided includes:

- *Do not overplay a fish. Where possible retrieve the fish as quickly as possible;*
- *If possible use “circle hooks”. Circle hooks minimise gut hooked fish and increase the chances of the fish being lip-hooked;*
- *Where possible, do not remove the fish from the water. If possible, remove the hook/lure while the fish is still in the water;*
- *Do not place the fish on a hot dry surface;*

There was however one piece of information provided in this section that was considered to be of concern from a welfare perspective. The information stated the following:

- *If you need to transport a fish, it is recommended that you have either a live fish holding tank or an aerated holding vessel (minimum 60 litres). At the very least you should have a wet towel or wet hessian bag. Continually pour fresh water over the fish when it is being transported.*

Transporting a fish out of water was not considered ideal. The project team was interested to determine whether any fish were transported out of water during the competition and the conditions of such transport.

The rules and regulations for the competition include the following:

- *All species caught must comply with fishing regulations as required by NSW authorities.*
- *Fish must be caught on either fishing rods or hand lines.*
- *The minimum legal size for Murray cod is 60cm.*
- *The minimum legal size for Golden perch is 30cm.*
- *Competitors must be aware that you can use no more than 2 rods with 2 hooks in both Lake Mulwala and the Murray River.*
- *If fishing in the river, competitors must not fish above or tie onto the yellow buoys directly below the weir wall.*

- *It is the responsibility of competitors to be fully aware of regulations covering minimum size and bag limits of fish.*
- *Entrants must comply with NSW & VIC Waterways boating regulations and other relevant legislation.*
- *It is the responsibility of competitors to be fully aware of regulations covering appropriate boat licenses and safety equipment for NSW & VIC waters.*
- *The committee reserves the right to inspect any equipment or bait used by competitors.*
- *All regulations as outlined above must be adhered to. Breaches of these regulations will result in disqualification of the offending angler.*
- *Any boat found containing illegal equipment or bait will result in disqualification of all competitors in the boat.*
- *Competitors may only have fish measured that have been angled by themselves. Transferring of fish to other competitors will result in disqualification.*
- *Any competitor found to be in breach of any of the above rules or regulations will be disqualified from the competition.*

To be in the draw for a prize, a competitor must bring their live fish (Murray cod and Golden perch) to one of the 11 measuring stations situated around Lake Mulwala or to one of 4 measuring stations situated along the Murray River. There are also 12 on-water marshals, which can measure any native fish caught out on the water. The rules state that:

- *Competitors are completely responsible for making sure that Murray cod are presented in perfect condition so they can be released after measuring. Fish that fail to swim away in good health will NOT be entered into the competition. A receipt will be issued upon measuring of all native fish that are entered into the competition.*

With respect to carp, the following is stated in the rules and regulations:

- *All carp brought in for measuring will be issued with a prize draw ticket, not an official catch receipt. It is the competitor's responsibility to deposit this ticket in the prize draw barrel in front of the main marquee.*

There is no reference made to the health of the carp or whether they need to be brought in live or dead. All carp brought in are kept at the measuring station to be picked up at the end of each day's competition and used for fertiliser production.

At the Cod Nationals Dr Hardy-Smith accompanied a boat out fishing for the first day of the competition. For the Cod Classic, it was determined that the most productive way to evaluate welfare considerations during the competition would be to evaluating fish brought into the measuring stations, rather than to go out in individual boats. A team was therefore assembled consisting of two veterinarians, a veterinary student and helper to allow attendance at a number of measuring stations during the first day of the competition. As each live fish was brought in by a competitor, details of the method of capture, time of capture, method of transport and other information was gathered. This is also allowed evaluation of the general attitudes of competitors to welfare of fish.

Unlike the approach to the Tea Tree Snapper Competition, an information brochure on the catching and releasing of Murray cod and Golden perch was not developed.

Tagging of “Brian”

As a goodwill gesture, Dr Hardy-Smith anaesthetised and tagged a 67cm Murray cod for the organisers the day prior to the first day of the 2013 competition. The organisers had named the cod “Brian” – capture of the tagged cod during competition would win a \$20,000 cash prize. “Brian” however was not caught.

Presentation on welfare issues of catch and release fishing

During the registration period that evening, Dr Hardy-Smith was invited to join in a presentation being given by Rod McKenzie (also known as “CodMac”¹⁴) on catch and release of cod. Dr Hardy-Smith had fished with Rod on the first day of the Cod Nationals. Rod has caught over 300 Murray cod that are greater than 1 metre in length and so is held in high esteem by the Murray cod angling community. The key issues Dr Hardy-Smith presented on were the effects of deep hooking, air exposure, fight duration and barotrauma on fish being caught.

4.3.3 Results of evaluation of the 2013 Mulwala Cod Classic

A total of 37 Murray cod, 15 Golden perch and 31 carp were brought to measuring stations attended by the research team on the first day of competition.

- Figure 12 is a summary of the method of bringing the fish to the measuring stations.

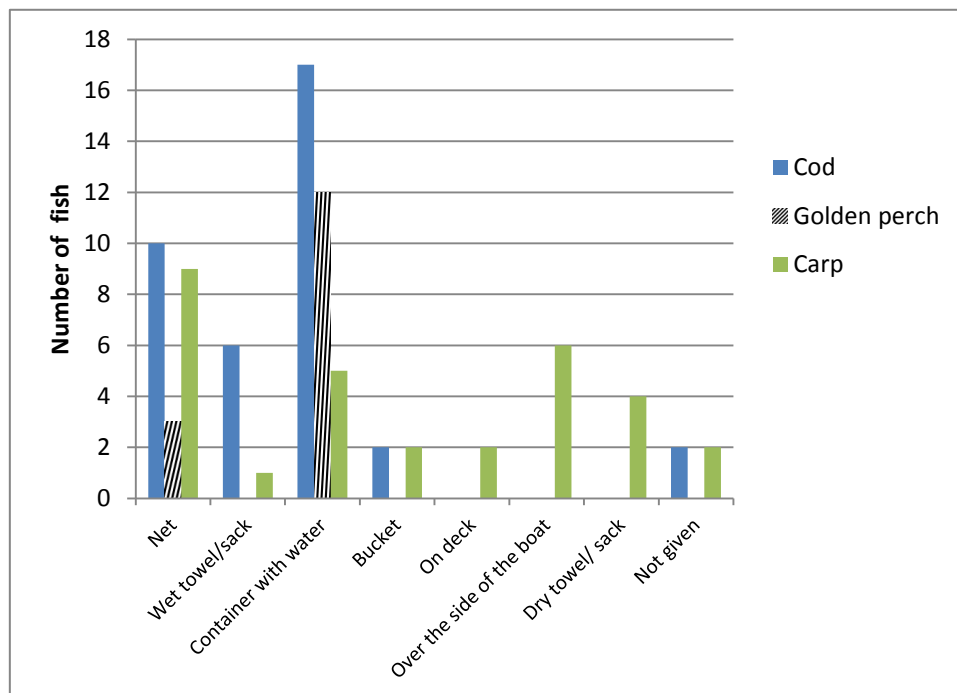


Figure 12 – Summary of the methods by which surveyed competitors brought fish to the measuring station

- The time between capture and measuring is shown in Figure 13.

¹⁴ <http://www.codmac.com.au>

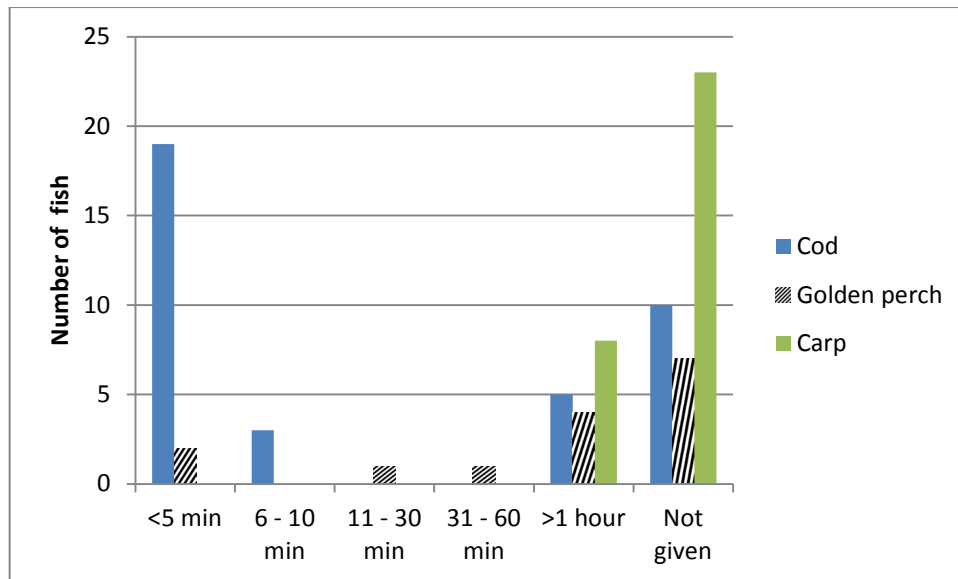


Figure 13 - Summary of the time between capture of fish by a competitor and the measuring of the fish at a measuring station

- 10 cod (27%) were brought to the measuring stations contained in a net. It is quite possible that these cod spent some or all of the time traveling to the measuring station out of water. Fortunately most of the cod brought into the measuring station in a net were recorded as being at the station within 5 minutes of being captured. One though was recorded as being 9 minutes in the net.
- 6 cod (16%) were brought to the measuring stations in a wet towel or sack, one of these being brought in the back of a car. Fortunately, all were recorded as being at the measuring station within 5 minutes of being captured.
- 3 Golden perch (20%) were recorded as being brought to the measuring stations in a net. One was kept in water over the side of the boat while traveling, the other had water bucketed over it while it was in the net on deck with a third fish being recorded as dead on arrival. For the two Golden Perch that were still alive, the time between capture and arrival at the measuring station was recorded as being five minutes. No Golden Perch were recorded as being brought to the measuring stations in a towel or sack.
- All cod and Golden perch that had been held for greater than one hour were kept in a live well during this period. Many carp were kept for longer than an hour and many were alive when they were presented at the measuring station.
- Carp were not returned to the water and many were noted to be left to die on the bank. Of the 27 carp brought into one measuring station (Hogans Beach), 1 had been killed, 3 were dead when they arrived and 24 were still alive. Of these 24, three had been captured at least an hour before arrival at the measuring station, 4 had been captured at least three hours before arrival and 1 had been captured at least 5 hours before arrival.

4.3.4 Discussion

The Cod Classic is a big event, with many competitors fishing the area around Lake Mulwala over a two day period. The event is very well run, and has done a lot to promote handling practices that

improve the possibility of fish being released surviving by stipulating that all cod and Golden perch must be released.

If a competitor chose not to enter the competition, they could legally capture and kill up to 2 Murray cod per day and up to 5 Golden perch, providing they were of legal size and providing they had a valid NSW fishing license.

Competitors wishing to get a ticket in the prize draw needed to have any cod or Golden perch that is measured swim off in good condition. This provides a very good incentive for competitors to look after their fish and generally this was observed. Those competitors not having live wells were quick to make their way to a measuring station to get their fish measured and released.

There were however some important welfare considerations identified during the evaluation of the first day of competition. The two key considerations were:

1. At least 27% of cod brought to the measuring stations in a net were likely out of water during some or all of the time being transported, and even more importantly at least 16% of the cod were brought to the measuring station in a wet towel or bag. A net was used to transport at least 20% of the Golden perch. Hence, a significant proportion of both cod and perch being transported to the measuring stations were exposed to air during some or all of the transport time. The advice given in the information booklet does state that *“where possible, don’t remove the fish from the water”* but also indicates that transporting a fish in a *“wet towel”* or *“wet hessian bag”* is an acceptable practice, *“at the very least”*. However, as noted in Cooke and Suski (2005):

No matter what the species, air exposure is harmful to fish.

How serious the effects of transporting fish out of water and exposing them to air can depend on a number of factors, including:

1. The level of exertion during the capture process;
2. The temperature of the air that the fish is exposed to;
3. Whether or not the fish has recently been feeding. Fish that have recently fed will have an increased requirement for oxygen compared to fish that have not fed.

Looking at ways to ensure competitors understand the importance of minimising air time and providing possible options for them to avoid it if they do catch a cod or Golden perch was a way of addressing this consideration.

2. The treatment of the European carp being caught was another welfare consideration identified during the evaluation. Carp are considered a noxious species in New South Wales, the state in which the competition is held. Catching them and removing them from the waterways to be made into fertiliser is to be encouraged. However, they are also a fish, deserving of being treated like any other fish. It was obvious that many competitors did not treat them in the same manner as they treated a cod, with carp coming into measuring stations in very poor condition, many of them still alive, but only just. Once at measuring stations some fish were actively killed by a blow to the head however, a large number were not actively killed but were allowed to die over a prolonged period.

These two key welfare considerations were discussed with the organiser of the competition. With

respect to the killing of carp, the organiser suggested that the rules of the competition be changed for the following year to stipulate that carp must be immediately killed and brought to a measuring station dead for them to qualify for the prize draw. This is a good suggestion and would address this welfare consideration.

The welfare consideration relating to exposure of Murray cod and Golden perch to air is more difficult. Many competitors competing in the Cod Classic use their own boats which do not have live wells as apart from when fishing in the Cod Classic these competitors either immediately release any fish they catch or kill the fish to be later eaten. Many of the boats that were observed during the evaluation of this competition did not have live bait tanks or the room to keep a large container on deck in which they could hold a Murray cod in water.

Installing a live tank on a boat incurs a cost that many of the competitors would find difficult to justify. A solution to this welfare consideration may be the development of some form of low cost temporary water holding system in which competitors can hold fish for short periods while transporting, either in their boat or in a car. Research is currently being conducted on the design and functionality of such a system.

Other welfare considerations that were identified during the evaluation included:

1. The holding of fish in live tanks where the water temperature in the live tank is higher than the water temperature from which the fish has been caught. This consideration had been noted at the Cod Nationals;

On a hot day, the water temperature on the surface of Lake Mulwala can be two to three degrees Celsius warmer than the deeper waters. However, the water for the live tanks is drawn from the surface of the lake, whereas a fish being kept in the live well may have been caught from deeper area.

The team evaluating the Cod Classic devoted all their time to evaluating fish coming into measuring stations, and did not go out on boats to evaluate the live tanks. However, it may be possible to address this consideration by limiting the time competitors can hold fish in live wells during periods when the surface water is significantly different than the deeper water.

2. Handling of fish and the use of knotless nets;

There were still a number of fish being carried to measuring stations using knotted nets. These nets have the potential to damage the skin of the fish. The competition information includes a recommendation to use a knotless fine mesh or rubber type net, which is a good recommendation. Unfortunately some competitors are not observing this recommendation.

We would also suggest that a recommendation be included in the information given to competitors that they are always with their rods/lines while they are in the water (particularly bait fishing) and that lines should remain tight. This will assist in minimising the possibility of deep hooking fish.

4.3.5 Evaluation of short term holding bags

A short research trial was conducted to assess simple, low cost, collapsible on-board holding systems for Murray cod. The need for such systems was identified through the evaluation of the 2013 Mulwala Cod Classic, where a number of Murray cod and golden perch were brought to measuring

stations out of water.

The trial was conducted on the Goulburn River near Shepparton, Victoria. Two boats were used. One in which the trial holding bags were set up (Figure 14), the other used to catch Murray cod for the trial.

Details of this trial are provided in Appendix G.



Figure 14 - Set up of trial testing holding bags for short term holding of Murray cod

5 Results of evaluation – Charter boat operations

5.1 Introduction

As noted in Chapter 3, the approach to working with charter boat operators was to identify successful charter boat operators, book a charter with these operators and evaluate the fishing practices and behaviours of these charters, from a welfare perspective. If welfare considerations were identified, then solutions were considered that could; Be incorporated into the charter operator's day to day operations and that were considered reasonable by the charter boat operator to incorporate into his business; did not detract from the client's enjoyment of the fishing, and brought about improved welfare for the fish being caught, killed and/or released.

In general, the Overarching Welfare Principles which apply to the type of recreational angling as done on these charters are numbers 5, 6, 7 and 8 i.e.

5. *During any handling of live fish;*
 - *care should be taken to avoid any damage to the fish*
 - *for prolonged handling of fish out of water (e.g. health checks, vet treatment, artificial reproduction, etc), an anaesthetic appropriate for the species and frequent irrigation of skin and gills is essential*
 - *fish intended to remain alive should be returned to the water promptly.*
6. *Any fish selected for harvest should be killed as rapidly as possible, by humane means suitable for the species*
7. *For fish harvested from the wild timely handling from capture to death is essential to minimise suffering.*
8. *Capture methods should be designed to minimise the capture of unwanted fish.*

5.2 Estuarine fishing for snapper and other species in temperate waters

5.2.1 Initial charter

This charter operation was based in Western Port, Victoria. The initial charter was conducted in November, 2012 and targeted snapper (*Pagrus auratus*) in Western Port Bay. The size of the fish caught ranged from 1.5-4.5kg. The water temperature was approximately 16°C. A number of other species were captured during the charter, including Flathead (*Platycephalus* spp.), gummy shark (*Mustelus antarcticus*) and Port Jackson shark (*Heterodontus portusjacksoni*).

The method of capture was line fishing using bait (dead pilchard, dead squid) and circle hooks (6/0). All fishing was conducted in 5-6m of water with the boat anchored while fishing. A 30lb monofilament leader of approximately 80-100cm was used with the main line being braid.

Findings

For fish captured to be killed and eaten

- Fish were captured in 5-6m of water so little possibility of barotrauma for fish taken from this depth. All lines were attended and slackness was not allowed to develop in lines.
- On identifying a “bite”, rod tips were raised to confirm hook was set.
- From time of hooking until fish was boatside and able to be netted/handled (“angling time”) was approximately 2-6 minutes. Larger fish were netted using a wide throated net with knotless netting. The fish was then brought onto deck where fish were rendered unconscious with either a sharp blow to head or killed by spiking through the side of cranium using landmarks developed by the charter operator. Both was done while fish were still in the landing net and before hook was removed.
- The gill arches were cut immediately after rendering unconscious or spiking so the fish bled out and did not regain consciousness.
- Fish were then placed into an ice slurry made up of ice and saltwater.
- The hook in all fish caught was set in the mouth and easily removed.

For fish captured to be released

No snapper captured were released as the total number of fish caught was 12 which was the legal allowable catch for snapper of this size (>40cm in length) for 4 people fishing in Victorian waters. If fish had been released, it is likely they would have been captured in a similar manner, netted at the side of the boat, brought into the boat where they would have been laid on deck on the netting and the hook removed using pliers. Fish would then have been lifted in the net back over gunwale of the boat and released.

This method however would have resulted in extended air time for the fish. The air time would have increased if anglers had wanted to take photos of the fish while out of the water.

Discussion

In general, this charter operator was already aware of welfare issues when catching fish. Fishing in this depth of water (5-6m) meant there was not have a concern with barotrauma in the fish. This is an issue when catching snapper at depths greater than 10-15m (Butcher et al. 2012). Anecdotal evidence suggests that during the “snapper season” in Port Philip and Westernport bays (which generally runs from late September until Christmas) there are a number of anglers who target fish in deeper water (>15m) and do not consider there to be any welfare issues in releasing fish from this depth. This issue has been addressed through working with the organisers of the Tea Tree Snapper Competition (refer to Chapter 4). There was some discussion about what the exact depth was that barotraumas would become an issue when catching snapper.

A number of other welfare issues were considered and discussed during this charter. As circle hooks were being used, no fish caught were deep hooked. Also, a knotless net was used to boat the fish. Knotless nets have been shown to do considerably less damage to the integument (skin) of fish and hence are preferred over knotted nets when fish are to be released. “Air time” was another consideration.

Most fish were stunned within 15-30 seconds of being brought onto the boat. The charter operator preferred to pith the fish and did so effectively using a lateral approach to the brain.

The consideration of welfare issues by this charter operation was very good. Hence another charter operator fishing in a similar area was booked to determine if the consideration of welfare issues was similar in other operators. Unfortunately weather conditions meant that on arrival at the vessel on the morning of the charter the charter operator made the decision to cancel the charter.

5.2.2 Follow up charter

The original charter operator attended a presentation given by Dr Hardy-Smith during the lead up to the 2013 Snapper Tea Tree Competition. During discussions after the presentation, the charter operator indicated a willingness to conduct a second charter to discuss issues raised during the presentation and how they could be incorporated into the day to day running of his charter operation. Hence a second trip was organised.

The second charter was conducted in November 2013 and targeted both Snapper (*Pagrus auratus*) and King George Whiting (*Sillaginodes punctatus*). The size of the fish caught ranged from 1.5-3.5kg for snapper and 300-750g for whiting. The water temperature was approximately 16°C.

A number of other species were captured during the charter, including Flathead (*Platycephalus* spp.) and Leatherjackets (*Monacanthidae* spp.).

The method of capture was line fishing using bait (dead pilchard, dead squid) and circle hooks (6/0). All fishing was conducted in 5-6m of water with the boat anchored while fishing. A 30lb monofilament leader of approximately 80-100cm was used with the main line being braid.

As per the previous year, species were targeted by line fishing using bait (dead pilchard and squid for snapper, blue mussels for whiting), circle hooks (6/0 for snapper, size 2 and size 4 for whiting). Fishing for snapper was conducted in 15m of water, which was deeper than in the previous year. Fishing for whiting was conducted in 3-7m of water. The vessel was anchored at all times during the fishing. For snapper, a 30lb monofilament leader of approximately 80-100cm was used with the

main line being braid. For whiting, a 10lb leader was used with the main line also being braid.

Findings

For fish captured to be killed and eaten

- There were a number of snapper caught from a depth at which barotrauma could occur. Clinically, there was no evidence of barotrauma in these fish. However, once the daily bag limit of snapper was caught, the fishing lines were pulled in and the vessel moved to a shallower area to target another fish species (King George Whiting).
- More time on this charter was spent discussing welfare considerations such as barotrauma, air exposure, holding fish alive on board a vessel, style of hooks, the impact of stress on reproductive viability of snapper and the key landmarks for spiking the snapper.
- The use of the “ikigun” was also explained and this gun was used on a number the snapper that were caught.
- Methods to quickly and humanely kill King George Whiting were shown, including stunning and spiking. There are some charter operators killing whiting by breaking the neck of the fish. There is no information available to determine the suitability of this form of killing. However, a concern that is not specifically a welfare consideration (though may be if the whiting maintains awareness after the neck is broken) is the bruising of the musculature around the head that would be a result of this form of killing.

For fish captured to be released

- When fishing for snapper, lines were brought in when the bag limit was reached. With one fish left to catch to reach the bag limit, two lines went tight at the same time. Both fish were brought in with the first fish being kept and the second fish being released while still in the water.
- There were a number of toad fish (*Tetractenos hamiltoni*) caught while fishing in shallower waters. These were immediately released off the hook, generally while in the water. The duration of time from hooking to release of these fish was approximately 15-20 seconds.

Consideration of the welfare aspects of the charter and areas for improvement

As noted in the initial charter, this charter operator is generally well aware of welfare considerations when catching fish. What was important though was the comments he made regarding the information and often mis-information about handling of fish and the impacts that certain practices (e.g. catching fish from depth, air exposure, duration of fight) can have on the fish. The charter operator gained much from the presentation given by Dr Hardy-Smith on these issues in snapper. He was particularly thankful of being now able to clearly define a depth at which barotrauma has been shown to occur in snapper (11m) as this will assist his charter operations in where he targets fish, particularly if his clients wish to release those fish. He also requested copies of the brochure that had been created for the Tea Tree competition to distribute to his clients.

He was also very impressed with the information on the impact of air exposure on fish and again will be using this information when fishing with clients to assist in releasing fish as quickly as possible

and minimising air exposure time, particularly when taking photographs.

5.3 Offshore fishing for pelagic species in temperate waters

5.3.1 Initial charter

This charter operation was based in Portland, Victoria. The initial charter was conducted in April, 2013 and targeted Southern bluefin tuna (“SBT”) (*Thunnus maccoyii*). The size of the fish caught ranged from 15-25kg. Albacore tuna (“albacore”) (*Thunnus alalunga*) were also captured during the charter. The water temperature was approximately 17°C.

The method of capture was trolling using lures (skirted and hard body varieties) that were trolled on or relatively near the surface at varying distances behind the boat which was moving at a speed of approximately 6-8 knots. Line used was monofilament with a breaking strain of 24kg.

Generally 8 lures were trolled at a time. 1 to 6 fish may be hooked at any one time. There were 5 anglers in the boat and a skipper and deckhand.

The depth of water where fishing was conducted ranged between 400m and 600m. The depth the lures were trolled out varied from just beneath the surface to approximately 6m depth.

Findings

For fish captured to be killed and eaten

The time from when an SBT or albacore “struck” a lure to when it was brought alongside the boat varied between 5 and 10 minutes. Once alongside the boat, the fish was gaffed and brought into the boat and laid out on the deck. Albacores, which were generally smaller, were often lifted into the boat by the leader without gaffing.

On being brought into the boat, fish were bled by cutting the lateral vein on each side of the fish in the depression created where the pectoral fin sat. The fish were then placed in a live hold under the deck of the cockpit area of the boat to bleed out. The water temperature in this hold was approximately 18°C.

The first four SBT brought onto the vessel in this manner were not stunned or spiked prior to bleeding i.e. the fish were not rendered unconscious before being bled. These fish were approximately 20-25kg.

At this point the author requested that the fish be stunned prior to being bled and the skipper indicated that this was in fact what he usually did, it was just that he had lost the spike he used to do this. Hence all fish subsequently caught to be kept and killed were spiked in the brain when brought onto the boat. The skipper of the charter vessel was however not happy that the albacore were stunned or bled, believing that they were of better quality when put directly into the live tank and allowed to die there.

No ice was carried or used on this charter vessel. The operator of the charter also stated that commercial SBT fishers no longer spike their fish on capture. However, all SBT harvested from cages in Port Lincoln are immediately spiked.

For fish to be released

A number of SBT were released due to the fact that there was a catch limit of two SBT per angler. Trolling was still carried out after this limit was reached. Generally most albacore were kept for consumption, the limit in Victoria for albacore being 5 fish per angler¹⁵.

The capture of the SBT which were subsequently to be released was as described above except all fish were brought onto the vessel by lifting the fish using the leader attached to the lure.

The fish were then dropped onto the checker plate aluminium deck of the boat. The style of checker plate is shown in Figure 13.



Figure 15 - The pattern of raised tread on the floor of a checker plate aluminium boat whereby the tread is to minimise slippage for operators

The hook was then removed from the fish and the fish was then thrown back into the water. On a number of occasions the fish would be left lying alive on the deck for 30-60 seconds before being released. Some fish were left on the deck for a longer period while other fish were brought in.

Consideration of the welfare aspects of the charter and areas for improvement

The AAWS Aquatic Animal Welfare Working Group's "Overarching Welfare Principles" which apply to recreational angling are numbers 5, 6, 7 and 8 i.e.

5. *During any handling of live fish:*
 - *care should be taken to avoid any damage to the fish*
 - *for prolonged handling of fish out of water (e.g. health checks, vet treatment, artificial reproduction, etc), an anaesthetic appropriate for the species and frequent irrigation of skin and gills is essential*
 - *fish intended to remain alive should be returned to the water promptly.*
6. *Any fish selected for harvest should be killed as rapidly as possible, by humane means suitable for the species*
7. *For fish harvested from the wild timely handling from capture to death is essential to minimise suffering.*
8. *Capture methods should be designed to minimise the capture of unwanted fish.*

¹⁵ Catch limits are available at <http://www.dpi.vic.gov.au/fisheries/recreational-fishing/catch-limits-and-closed-seasons/marine-and-estuarine-scale-fish/albacore-and-skipjack-tuna>

In the context of the style of fishing being conducted there were a number of issues of consideration given the compliance with the overarching principles. Specifically:

1. The suitability of the fishing equipment used to capture fish

The charter operator supplied all fishing equipment used to capture the SBT and albacore. Fishing equipment was of a high quality. Monofilament line used on the reels was 24kg breaking strain which appeared of suitable strain given that the time taken to capture fish was not prolonged and no line was observed to break during the charter. A length of 150lb leader was used which connected to the lure. The leader was approximately 1.5m long.

2. Release of fish

The method used by this charter was of concern. Fish being dropped onto the deck of the vessel would have sustained considerable damage to their integument (skin). While often not immediately obvious, such damage would manifest as significant lesions on the side of the fish post release and would have compromised the health of fish released in this manner.

Scale loss due to handling after capture has been associated with mortality in garfish (Butcher et al. 2010) and the author has experienced significant lesions developing 24-48 hours on the integument (skin) of SBT which have been roughly handled (personal observation). Fungal lesions associated with abrasions has been linked to post-capture mortality in small mouth bass (Cooke and Hogle 2000).

3. Killing of fish

The skipper of this charter vessel indicated that there was no need to kill or stun the fish prior to bleeding. There was also no attempt to render the first fish caught unconscious prior to bleeding the fish. Death would therefore be by exsanguination. Exsanguination without stunning as a means to cause death in a fish has welfare issues (Robb and Kestin 2005 amongst others).

4. Chilling of fish post killing

Although not strictly a welfare consideration, from a product quality perspective fish being left whole in water at 18°C after capture means that the internal temperature of the fish would have remained above 18°C for some time after capture, tuna being able to increase their internal body temperature a number of degrees above ambient. Chilling of fish post killing is well known as a method to improve product quality (Mishima *et al*, 2005, Sigholt *et al*, 1997). Not chilling fish would have impacts on the quality of the fish if it was to be eaten. This was confirmed when the eating qualities of fish killed while on the charter were compared to those that had been caught on board the author's boat where the fish were immediately killed when coming onto the boat, bled and then gilled and gutted before being placed into an ice slurry within 10 -15 minutes of capture.

Discussion

From a business perspective, this charter operator is very successful, as he is known to catch many fish and is booked well in advance during the SBT season, which runs from March through to July. This would also indicate that his practices are generally accepted by the general angler who is signing up for his charters. Discussion with the charter operator indicated that he considered the

methods he used to catch, kill and/or release fish to be similar to commercial wild catch operators.

This was incorrect and this was explained to the charter operator. There was no indication however that he considered there to be a need to change any of his practices.

5.3.2 Follow up charter

Due to the indication by the first charter operator that there was no need or desire to change practices, a second charter operator was chosen for the second year of this project to determine whether practices observed on this first charter were common to the industry. The second charter operator was also very successful from a business perspective, being booked well in advance. The member of the project team had a discussion with this charter operator before booking the charter to indicate that he wished to evaluate the practices used during the charter. The charter operator was amenable to this.

The second charter was conducted in April, 2014 and again targeted Southern Bluefin tuna (“SBT”) (*Thunnus maccoyii*). The size of the fish caught ranged from 15-20kg. Albacore tuna (“albacore”) (*Thunnus alalunga*) were also captured during the charter. The water temperature was approximately 17°C.

The method used by this second charter operator was similar to that used by the first i.e. trolling lures (skirted and hard body varieties) on or relatively near the surface at varying distances behind the boat which was moving at a speed of approximately 6-8 knots. Line used was monofilament with a breaking strain of 24kg. Two bigger lures were used and trolled on monofilament with a breaking strain of 37kg. The fishing gear used was in excellent condition.

Generally 7 lures were trolled at a time. One to six fish may be hooked at any one time. There were again 5 paying anglers in the boat and a skipper and deckhand.

Depth of water ranged between 400m and 600m. The depth the lures were trolled out varied from just beneath the surface to approximately 6m depth.

Findings

For fish captured to be killed and eaten

The time from when an SBT or albacore “struck” a lure to when it was brought alongside the boat varied between 5 and 10 minutes. Once alongside the boat, the fish was gaffed and brought into the boat and put straight into the underfloor “kill” tank until all fish for that strike had been captured. At that point the deckhand took a knife and proceeded to cut both lateral veins of all fish while the fish were still lying in the kill tank. At no time was any fish spiked or stunned and no ice was carried or used on this charter vessel.

For fish captured to be released

A number of SBT were released. Fish that were to be released were generally not gaffed, although it did come to our attention that some operators do gaff fish in the lower jaw even if they plan to release those fish. No effort was made to prevent a fish hitting the side of the boat or the deck of the boat, even if it was to be released. Fortunately the deck on this vessel was not aluminium but fibreglass with a rubber mat over it.

Discussion

The key welfare consideration identified on this second charter operation was the lack of active killing of fish that were being kept for human consumption. Fish generally died through air exposure and exsanguination. Both methods are not considered humane.

The charter boat operator was amenable to discussion on this issue, and this discussion was enlightening. He explained that in the past he had immediately spiked fish when they came on board and bled them. However, he also explained that this slowed down his operation and reduced the number of fish he caught. In his opinion his business survived on him being able to report (generally on social media pages) that he was capturing large numbers of fish. This is what his clients were looking for and willing to pay for. Doing anything that may slow down the actual number of fish caught would be detrimental to his business, in his opinion.

This is a critical point with respect to being able to implement change with these operators. There is the opinion that the clients booking with them are not concerned about the welfare of the fish but are concerned primarily about being able to catch a large number of fish.

Looking at some of the social media pages there are comments similar to the following:

“some call blue fin tuna "CAT FOOD"...

“If you keep fish bleed, gut, gill and pack in ice as soon as possible. If you leave them on the deck or without ice then they are basically cat food”

The second comment was made in a post by a prominent fishing celebrity. There is therefore a perception amongst some recreational anglers that Southern bluefin tuna are not a high quality species, which is vastly different from the commercial sector. However, it may be this perception that is the reason why charter operators don't take ice out with them, don't spike fish and look after the catch. Their clients are not demanding it.

The way therefore to change practices within the charter operations for this sector may thus be to change the attitudes and understanding of their clients. When clients start to ask why fish are not immediately killed and why fish are not immediately placed on an ice slurry then charter operators that do not immediately kill the fish and that do not look after the fish once dead may start to change their practices.

5.4 Estuarine fishing for barramundi in tropical waters

5.4.1 Initial charter

This charter operation was based in the Northern Territory. The initial charter was conducted in May, 2013 and targeted Barramundi (*Lates calcarifer*). The size of the fish caught ranged from 4-10kg (70-95cm). Black jewfish (*Protonibea diacanthus*) were also captured during the charter. Fishing was conducted in the mouth of a major river system. Water was brackish and water temperature was approximately 27-29°C.

Two forms of fishing were conducted during this charter.

1. Lure casting

This consisted of casting lures (hard bodies and soft plastic types) from a boat and retrieving the lures in a manner designed to attract and catch the targeted fish. If the lure was struck and the fish hooked, it would be played out and retrieved to the boat.

Small baitcasting reels and rods were used. Line was braid (30lb) using a 60-80lb monofilament leader.

2. Trolling

In this form of fishing the same gear was used but instead of casting the lures from the boat and retrieving them, the lures were trolled behind a slow moving boat over areas where it was considered likely the fish would be residing. Again, if a fish was caught it would be played out and retrieved to the boat.

The depth of water in which the lures were cast or trolled varied from 20cm to 6m.

Findings

For fish captured to be killed and eaten

Most fish caught were intentionally released. However, a few fish were kept for the table each day. The procedure used on these fish was as follows:

1. The fish would be brought to the side of the boat by the angler. From time of hooking until fish was boatside was generally around 2-5 minutes.
2. An “environet¹⁶” would then be used to capture the fish while still on the line and lift the fish into the boat. “Lip Grips” (see Figure 16) would be used to hold the fish by the lower mandible while the hooks were removed. The fish would then be given a sharp blow to the head to render it unconscious. Sometimes removal of the hooks occurred after stunning.
3. Once the hooks were removed, the gill arches were cut to allow bleeding and to prevent the fish from recovering. After washing the fish, the fish was placed into an esky which had ice in it.

¹⁶ Manufactured by Shimano



Figure 16 - "Lip grips" used to hold the lower mandible of the fish

On the hard body lures, treble hooks were used. Removal of these hooks generally took longer than removal of the single hook used when soft plastics were fished with. Hooks were removed with pliers. All charter boat operators were relatively skilled and efficient at the removal of the hooks. All hooks were barbed.

For fish captured to be released

Most of the barramundi caught (and all the black jewfish caught) were released immediately after capture. Generally, the initial procedure of capturing the fish and bringing them to the boat was as indicated above for when fish were caught and killed i.e.

1. The fish would be brought to the side of the boat by the angler. From time of hooking until fish was boatside was generally around 2-5 minutes.
2. An "environet" would then be used to capture the fish while still on the line and lift the fish into the boat. "Lip Grips" would be used to hold the fish by the lower mandible while the hooks were removed.
3. At this point, the fish was either immediately released or handed to the angler if a photo was to be taken. The general method of holding was to have the fish grips holding the lower mandible of the fish in one hand and then to support the belly of the fish in the other (see Figure 17).

The time the fish was out of water depended on how prepared the angler was when taking the photograph.

Once the photograph(s) was taken, the fish was released into the water. Some anglers held the fish by the lip grips until the fish showed signs of recovery (usually indicated by a strong flap of its tail). Other anglers simply let the fish go into the water.



Figure 17 - Method of holding live fish for photo

Consideration of the welfare aspects of the charter and possible areas for improvement or further research

The AAWS Aquatic Animal Welfare Working Group’s “Overarching Principles” which apply to recreational angling are numbers 5, 6, 7 and 8 i.e.

5. *During any handling of live fish;*
 - *care should be taken to avoid any damage to the fish*
 - *for prolonged handling of fish out of water (e.g. health checks, vet treatment, artificial reproduction, etc), an anaesthetic appropriate for the species and frequent irrigation of skin and gills is essential*
 - *fish intended to remain alive should be returned to the water promptly.*
6. *Any fish selected for harvest should be killed as rapidly as possible, by humane means suitable for the species.*
7. *For fish harvested from the wild timely handling from capture to death is essential to minimise suffering*
8. *Capture methods should be designed to minimise the capture of unwanted fish.*

In the context of the style of fishing being conducted (catch and release for recreational anglers) the charter operators generally operated according to the overarching principles. Specifically:

The suitability of the fishing equipment used to capture fish

Anglers on the charter either used their own fishing equipment or borrowed equipment from the charter operators. Equipment was generally of good quality. The use of knotless nets such as those used have been shown to significantly reduce the incidence of injury in barramundi (De Lestang 2008) compared to knotted style nets.

On at least one occasion the braid line being used broke while a fish was being played. This would have resulted in a fish being released with a lure, leader and a segment of braid still attached. It is quite possible that the hooks on the lure would have detached themselves from the fish once the

tension on the line was released when the line broke. However, it is a risk when using braid that small abrasions on the braid can significantly reduce its breaking strain.

The killing of fish

The method of killing the fish generally involved rendering the fish unconscious prior to bleeding the fish. This was relatively quick. Dr Hardy-Smith conducted some trials on killing barramundi with a commercially available stunning gun (Figure 18). There were some promising results from these trials which may assist in welfare improvement for fish being killed.



Figure 18 - Demonstration of killing barramundi with the ikigun®

The release of fish

Fish were generally released relatively quickly back to the water, minimising time in the air. The amount of time out of the water was usually influenced by the anglers themselves and not the charter operators. The desire by anglers to take photos of their catch is universal, and it would be reasonable to comment that the larger the fish, the greater is the desire to take a photo. As far as the author is aware there is no specific research which has been conducted on the target species (barramundi) which provides evidence of what impact the time out of the water can have on survivability of the fish once released. Such research has been conducted in other species – for example, Cooke et al. (2001) found that rock bass exposed to air for 180 seconds required 4 hours for cardiac (heart) output to return to normal levels. Similarly, Ferguson and Tufts (1992) reported that rainbow trout exposed to air for 60 seconds following exhaustive exercise took four hours for blood pH to return to normal.

When a fish was released, it was only possible to make a very quick assessment of its survivability (seconds) as after release it was quickly lost in the turbid estuarine water. It would be very interesting to conduct research that examines a longer period post capture for survivability. This may be a worthwhile area of research. Research by De Lestang et al. (2004) found an elevated physiological response in barramundi caught by angling and this was response was stronger in summer than in winter. These authors reported an overall (summer and winter) survival rate for caught and released barramundi of 90.5%.

Discussion

From a business perspective, this charter operation is successful, being booked well in advance during the fishing season, which extends from March through to November.

Generally, the guides are knowledgeable about methods of handling fish once caught and release of fish. There is however no formal training provided in this area, as far as we are aware. This was reinforced by the numerous questions asked of the project team member by one of the guides, who was eager to learn all he could about welfare considerations regarding the style of fishing conducted by this operation.

There are a number of welfare considerations that were identified. Some short, targeted training sessions with the guides would help to improve these areas in general, in our opinion. These considerations were:

Air exposure

While guides understood the need to get fish back into the water as quickly as possible, the reasons why air exposure can be so damaging to a fish were not well understood. Some simple training in this area would be beneficial. Guides can then better explain to the client why they pay so much attention to minimising the time out of the water.

Hooks

The lures being used at this charter operation were often treble hooks with barbs. These hooks are very effective at catching fish but also can cause increased damage to fish compared to single hooks. Having the barbs still on the hooks means that the time taken to remove the hooks may be prolonged, increasing air exposure. The use of single hooks and barbless hooks, at least for some of the time fishing, would be beneficial.

Handling

Generally, fish were kept in the environets when brought onto the boat. This is good as these nets are generally wet. However, on a few occasions fish were allowed to lay unprotected on the deck of the boat. Some simple education to explain why this is not good practice would assist in minimising this happening, in our opinion.

Killing of fish

Quickly killing any fish that was to be kept to eat from both a welfare and quality perspective was possibly not given the importance it deserves. Providing a demonstration with the captive bolt pistol showed how easy it was to kill a fish quickly. Further training in this area is thus warranted.

5.4.2 Follow up

A copy of the report on the initial trip to this charter operation was forwarded to the operators as a draft. A number of discussions have been had subsequent to this, including with the owner of the charter operations.

There was no indication during these discussions that either the owner or the manager wished to pursue any further evaluation on their charter activities. They considered how they were running the

charter to be acceptable.

The project team has therefore not revisited this charter operation.

5.5 Offshore reef fishing for various species in tropical waters

5.5.1 Initial charter

This charter operation was based on the Great Barrier Reef, Queensland. The initial charter was conducted in July, 2013 and targeted Red Emperor (*Lutjanus sebae*).

The size of the fish caught ranged from 2-8kg. Reef sharks (*Carcharhinus* spp.) were also captured during the charter. Fishing was conducted on the reef with the depth of water being approximately 15m and the water temperature being 27-28°C.

Fish were caught on baited handline. Handline used was approximately 80lb breaking strain with a running sinker style rig, the small bean or ball sinker running down to a single 7/0 or 8/0 “J” style hook (non-circle) used. Bait was a mixture of pelagic skin and muscle and pilchard.

The line was baited and dropped to the sea floor. Tension was maintained on the line at all times in order to feel when the fish took the bait. On feeling a fish bite, the line was given a quick jerk to set the hook and the fish brought to the surface.

Fish were captured from 15m depth. Time from bite to bringing fish to surface varied between 30 seconds to 4 minutes. There were six anglers fishing, varying from a 14 year old girl to a seventy year old retired businessman. The strength of the angler influenced the speed of retrieval once a fish was hooked.

Findings

For fish captured to be killed and eaten

The entire fishing session with this operator lasted 15 minutes. In this time approximately 18 fish were caught. Of these, 12 were kept for consumption and approximately 6 were released.

Initially, fish to be kept were brought up onto the boat and placed in a plastic bin where a cut was placed in the lateral gill area to bleed the fish. No attempt was made to stun or kill the fish. This was due mainly to the belief by the charter operator that rendering the fish unconscious by a blow to the head or killing the fish would stop the heart beating and prevent effective bleeding of the fish.

It was explained to the charter operator that this in fact was not that case and that the heart of the fish would continue to beat for a few minutes after the fish was rendered unconscious. Hence subsequently all fish being kept for eating were given a short, sharp blow to the head (cranium) prior to bleeding.

The charter operator commented later in the day after the fish were filleted and consumed that there indeed did not appear to be any negative impact on the bleeding out or eating qualities of the fish given the blow to the head.

For fish captured to be released

Fish to be released were generally not brought onto the boat but released from the hook and before being brought over the gunwale. A “de-hooker” device was used to remove the hook from a shark that was caught. All fish were hooked in the mouth.

As far as the author could tell, there were no obvious clinical signs of barotrauma evident in the fish

that were killed or released. Fish being released swam off vigorously. This is supported by research conducted by Brown et al. (2008) who identified that red emperor were particularly robust in the ability to withstand and recover from the effects of barotrauma, even when caught at depths up to 50m, which is much deeper than fish being caught during this charter operation.

Discussion

In the context of the style of fishing being conducted (catching for human consumption and catch and release by recreational anglers) there were a number of welfare considerations identified, both positive and negative. Specifically:

Period of time catching fish

After approximately 15 minutes of fishing and the capture of 18 fish, the charter operator elected to stop fishing. There was sufficient fish captured for consumption and the charter operator was concerned that the capture of too many fish could impact the sustainability of this fishing location for other anglers. This was of benefit from a welfare perspective. It was however a luxury, as the location was only known by this charter operator and it is unlikely that any other charter operators or recreational fishers will fish this location.

Release of fish

Fish to be released were released quickly with minimal air time. Where possible fish were not allowed to drop onto the deck of the vessel. The charter operator was reluctant to allow anglers to spend too much time taking photos during the fishing, rather wanting photos to be taken once fishing was completed. This is good from a welfare perspective. Conditions were also inclement where fishing was being conducted, with a strong (20-25 knot) wind. Hence human welfare was also being considered!

Killing of fish

The charter operator initially just bled the fish hence death would have been by exsanguination. This is not considered humane. However, his reason for doing this was due to his belief that once stunned or spiked the heart of the fish would stop and there would not be a good “bleed out” of the fish. Once it was explained that this was not the case, rather, that the heart of the fish will continue to beat for some time after stunning/spiking, the charter operation changed practices and stunned fish prior to bleeding.

Chilling of fish post killing

Although not strictly a welfare consideration, from a product quality perspective, leaving fish whole and out of the water in air when the air temperature was approximately 25°C would have an impact on the quality of the fish if they were to be kept for a number of days. As it was, most of the fish was eaten that evening hence it is unlikely that the quality impact was significantly affected. Putting fish on slush ice after capture would have been useful though and has been discussed.

5.5.2 Follow up

The owner of the charter operation visited Melbourne in February, 2014 and met with the Dr Hardy-

Smith. He was interested in discussing fish quality further. The information put together for the Tea Tree Snapper competition was explained, and its relevance to his operation discussed. In particular, the relevance of welfare considerations including barotrauma, air exposure, spiking and stunning were explained.

The owner was very keen to ensure that his practices addressed welfare considerations. He has indicated that he will be adopting the recommendations of immediately killing fish to be eaten and for minimising air exposure for fish to be released.

He also requested copies of the brochure created for the Tea Tree snapper competition to distribute to his clients. It would be useful to create a similar brochure for the fish he is targeting and he has been made aware of the work done in other projects (e.g. Brown et al. 2008 and work conducted by the Northern Territory government) which have conducted specific work on some of the species his clients catch.

6 Discussion

This project examined high profile fishing competitions and charter boat operations from a welfare perspective. The project was conducted by VRFish, the Victorian Recreational Fishing Peak Body, and Panaquatic Health Solutions Pty Ltd, which consists of veterinarians and other scientists that specialise in fish health.

Australians are fortunate to be able to go out and fish recreationally and over 3.5 million go out fishing each year. There are many reasons why it is so popular but undoubtedly one of the key reasons is because many of Australia's fish make excellent eating. Recreational fishing is generally accepted in our society.

The world is changing though. Urbanization and modernisation are happening at an incredible rate. People's experience of nature and wildlife is reducing. Attitudes towards fishing are changing in some parts of our society.

The Australian Animal Welfare Strategy (AAWS) was an Australian Government initiative that aimed to protect and promote the welfare of all Australian animals, including aquatic animals. The Aquatic Animal Welfare Working Group (AAWWG) had the responsibility within AAWS to develop and implement the action plan for the aquatic animal sector, which was one of the six AAWS sectoral groups.

A key initiative of the AAWWG was the development of "*Overarching Welfare Principles*" that were applicable to fish¹⁷ whether they were farmed, transported, captured from the wild by both commercial and recreational fishers, or kept in aquaria in restaurants or private homes. The specific Overarching Welfare Principles that apply to this project and on which welfare considerations were evaluated are as follows:

5. *During any handling of live fish:*
 - *care should be taken to avoid any damage to the fish*
 - *fish intended to remain alive should be returned to the water promptly*
6. *Any fish selected for harvest should be killed as rapidly as possible, by humane means suitable for the species*
7. *For fish harvested from the wild timely handling from capture to death is essential to minimise suffering*
8. *Capture methods should be designed to minimise the capture of unwanted fish*

In addition, Overarching Welfare Principles 1,2 and 4 are applicable to the holding of live fish during the Mulwala Cod Classic fishing competition.

It is important for the recreational fishing community to ensure the strong social license it has is not eroded. And there is the potential for this to happen from a welfare perspective. There is though also the potential for the recreational fishing community to positively strengthen its current social license through its attitudes to fish welfare and how it practices its fishing.

This project acknowledged that science has so far not been able to resolve the issue of whether or not fish feel pain or have the ability to "suffer". This project also acknowledged that society does not

¹⁷ In this report, the word "fish" refers only to vertebrate finfish and not to invertebrates such as molluscs or crustaceans.

always base its opinions on science. It could be argued that any potential action or actions taken based on fish welfare should be delayed until the science can resolve the issue one way or the other.

The recreational fishing community is though a part of the wider community, and the wider community is not delaying its opinions on fish welfare because the science is unresolved. This project has identified that there are many within the recreational fishing community that want to understand more about fish and about what they can do to respect the fish they catch and minimise the stress they impose on it. There are also many who want to know how to maximise the eating qualities of what they catch.

This project has evaluated two major fishing competitions and a number of high profile fish charter operations. It has developed a model process for evaluating competitions and educating competitors on welfare issues. It has also identified processes whereby a change in attitudes and practices of some charter boat operations around fish welfare may be achieved.

Perception of pain in fish

The issue of fish welfare is complex, with ambiguity in the science leading to divergent views on whether fish can be considered “sentient” beings, whether fish are conscious of, or indeed have the capacity to feel, pain. We therefore cannot at present look to the science to provide definitive answers to these questions.

While science may finally prove that fish are not sentient beings and cannot feel pain, the science may also prove that fish are actually sentient, can suffer and do feel pain. Given that there is this possibility, Lune et al. (2007) noted that the immediate question regarding fish welfare can be considered an ethical one - at what point should we feel obliged to act on issues of fish welfare? From another perspective, at what point could the current social license to operate be undermined by recreational anglers fishing in ways that don't respect the fish and that may be construed as being inhumane by the wider community?

Changing welfare considerations in Australia

The Aquatic Animal Welfare Working Group of the AAWS acknowledged that calls for change of practices to address welfare considerations may have significant impact across the four key sectors in Australia (ornamental fish trade, commercial wild capture of fish, farming of fish and the recreational fishing community). The working group acknowledged that fish should be afforded the same treatment irrespective of whether they are kept in a tank, farmed in a cage or caught in a net or on a line. A set of Overarching Welfare Principles was developed by the group that could be applied to fish across all four sectors. These Overarching Welfare Principles embraced a respect for the fish but also included measures that brought together animal welfare and product quality, realising that the two were intimately linked in those sectors where fish are harvested for food. The Overarching Welfare Principles stated clearly that the overall aim of the aquatic sector (fish that are farmed, being transported, kept in aquaria, captured from the wild both commercial and recreational, or in aquaria in restaurants) should be to minimise suffering from capture to slaughter within the constraint of practical application inherent to each sector.

In this way, the work conducted through these Overarching Welfare Principles looked to influence practices in these sectors that addressed welfare considerations for the fish, but that would also improve profitability, quality of seafood and sustainability. Then, if fish were later found to not be

sentient beings and not be able to perceive pain, any changes implemented would still have helped the businesses and improved recreational experiences and fish stocks due to these changes.

This acknowledges comments made by Rose *et al.* (2014) with respect to the “*benefit of doubt*” issue regarding fish welfare. Rose *et al.* (2014) consider that a consequence of giving fish the “*benefit of the doubt*” regarding pain has been to mandate policy as if the matter was resolved in favour of fish pain interpretation, a manoeuvre these authors say that exempts valid science from policy and does not increase fish welfare.

The project we are reporting on does not mandate policy changes, but has worked towards implementing pragmatic changes that protect fish welfare but at the same time ensure recreational fishing experiences can continue.

Recreational fishing sector: Overarching Welfare Principles

The Overarching Welfare Principles that apply to the recreational fishing sector are discussed above. A complete list of the Overarching Welfare Principles can be found in Appendix A.

This project was designed to take these Overarching Welfare Principles into the recreational fishing sector and use these Principles to evaluate current practices in this sector and to determine if:

1. Changes to current practices were needed for the competitions and charter boat operators to better align with the Overarching Welfare Principles; and
2. If changes were identified, determine methods to assist these changes being taken up by this sector.

The recreational fishing sector is however a very large sector, with more than 3.5 million Australians estimated to fish annually for recreation and for sport¹⁸ and with over 71 million finfish being captured recreationally per annum (Henry and Lyle, 2003). There is certainly a social license to recreationally fish in Australia but there are no formalised training programs available to assist in the education of recreational anglers on issues of fish welfare from capture to release or the methods used for killing fish that are both humane and optimise product quality.

Earlier considerations of fish welfare and recreational fishing

This project, while not a formal training program, has developed methods that may be incorporated into such a program. It is not the first project to evaluate fishing competitions or to address issues of fish welfare but it is the first project that has solely evaluated fish welfare.

A number of other initiatives that have evaluated fishing competitions include the NEATFISH standard for evaluation of fishing competitions¹⁹, work conducted through “Info-Fish”, which includes the National Strategy for the Survival of Released Line Caught Fish (Info-fish 2005), the “iki jime” project²⁰ which was also initiated through the AAWS Aquatic Animal Welfare Working Group, and information included in the Recfish Australia guidelines and state based recreational fishing associations.

¹⁸ Website available at <http://recfishaustralia.org.au/>

¹⁹ Website available at <http://www.neatfish.com/>

²⁰ Website available at <http://www.ikijime.com/>

NEATFISH did a very good job in creating a self-evaluation tool kit to assist competition organisers to classify themselves on their environmental, social and economic impacts. NEATFISH, while it awards greater points for competitions that practice catch and release, is based at the competition level and is not involved in the education or training of competitors in best practice of handling, releasing and/or killing of fish. This project addresses these areas. NEATFISH will also score a competition badly if, for example, it targets spawning aggregations of fish. Hence a competition that indeed does this may not see any value in self-evaluating itself, knowing that it will score poorly. This can lead to an all or nothing outcome – competitions that know they can potentially score well using the NEATFISH scoring system evaluate themselves and competitions that know they will not score well do not.

Interestingly, one competition that did embrace NEATFISH was the Mulwala Cod Classic. The organiser of this event undertook a comprehensive evaluation through NEATFISH and managed to land a 5 star rating. Unfortunately this rating system did not help the competition achieve or gain anything in the long run. The organisers believed this in part was because the NEATFISH classification system was not supported by the fishing competition industry.

Adoption of welfare considerations: Fishing competitions

Competitions do want to improve their practices and this was well exemplified in the findings of this project, with competition organisers welcoming the project team to become involved in their competitions.

The Tea Tree Snapper Competition, for example, was started in 1984 to promote fishing for Snapper. Every spring (*“when the Tea Tree blooms”*) snapper come into Port Phillip and Western Port Bays in Victoria to spawn. A local angling club started the competition and continues to run it each year. It is an established competition. As this project found, in general the competition is very well run but when evaluated using the Overarching Welfare Principles for guidance where were a number of welfare considerations identified that, if addressed, would improve survivability of fish that were released and increase the use of humane methods for killing fish. A communication strategy was developed in collaboration with the competition organisers to educate future competitors about these considerations. Following this the survey of the second year of competition showed definable change in competitor practices, particularly in the way fish were being killed and the time taken to kill fish that were caught. The holding of fish in live wells also decreased.

While it is early days, such results are extremely encouraging and confirm that the approach taken can lead to change. It is quite possible that the changes being made by the competitors surveyed are also being made by the wider recreational fishing community in their day to day fishing. Scanning of social media is providing evidence of this, with anglers starting to admit “spiking” and “iki jiming” the fish they are catching in their discussions²¹.

Adoption of welfare considerations: Charter boat operators

In general, charter boat operators are aware of welfare issues although their source of information

²¹ The following example of a recent post on a local snapper chat site suggest that there is still some education needed with respect to the correct technique for spiking large snapper:
Yes it still had have a bit of life in it Martin even though it was Iki spiked

on what constitutes good practice when handling and releasing fish, for example, is often self learnt and based on information gained over social media or internet searches. As this project showed, there is significant variability in how much the day to day practices being carried out by different charter boat operations is impacting on the survivability (when released) and the quality (when killed) of the fish being caught.

Importantly though is the dilemma of the client for some of these operations. If the belief is that the client wants to catch as many fish as possible in the allotted charter time, then anything that may reduce the number of fish being caught is construed as affecting client satisfaction and potentially reducing overall business profitability. Understandably, charter boat operators will not make changes to their practices if they honestly believe that it may impact on their business. However, if clients became less concerned with numbers and more concerned with the quality of the product (and the potential for the survival of a fish if released) then this may translate to charter boat operators investing more time in understanding practices to improve fish quality or minimise stress on capture. Additionally, implementing better practices may actually improve business profitability, if that is what the client wants.

Thus not only is there a need for better understanding in the industries servicing the recreational fishing market, but also a better understanding in some segments of the fishing community.

On-going work in this area is likely to be rewarding, and is also likely to continue to bring benefits to the fish and to the recreational fishing community targeting those fish.

7 Conclusion

The Project Objectives for this project were:

1. To undertake an analysis of current animal welfare practices within two sub-sectors of the recreational fishing industry: fishing competitions and charter operators based on the AAWS Aquatic Working Group's Overarching Welfare Principles that apply to this sector.
2. To develop a model or mechanisms whereby welfare improvement practices can be incorporated into competition and charter boat operations where analysis has identified that such changes may benefit fish welfare.

This project has achieved these two objectives. Specifically:

- i. The project analysed current animal (fish) welfare practices within recreational fishing sub-sectors by collaborating with two major fishing competitions in Australia (The Snapper Tea Tree competition, and the Mulwala Cod Classic) and undertaking charters with five different fishing charter operators around Australia.
- ii. The project created an interim report on the assessment (audit) of the audit of competition and charter operations and presented this to the Aquatic Animal Working Welfare Group of AAWS. This clearly identified welfare issues of concern and provided recommendations for change;
- iii. For evaluating high profile fishing competitions, this project then developed a model process that could be applied to any fishing competition in Australia to assess issues of fish welfare and to implement and deliver positive behavioural change amongst recreational fishers. Positive behavioural change was clearly demonstrated by the project team, as is documented in this report.
- iv. The project has produced this final report documenting these achievements.

This project, whilst not dismissing the potential of fish to be sentient beings capable of perceiving pain, recognised the scientific ambiguity and debate surrounding the issue of perception of pain in fish. There is however unambiguous science regarding stress in fish. There is also a changing social environment relating to fish welfare based on ethical considerations which this project acknowledges. The findings of this project provide practical guidelines on for the responsible behaviour of anglers in the capture, handling and euthanasia of fish, supported by considerations of optimising fish flesh quality or optimising the survival of fish following capture and release.

It has provided information to the recreational fishing community to show that practices that benefit fish welfare in general also benefit the angler.

It is believed that such guidelines will be acceptable to the broader community as well as to the recreational fishing community, and may serve as a model for consideration of fish welfare in Australia.

8 Recommendations

This project is the first project to solely evaluate sectors of the recreational fishing community from an animal welfare perspective. It has used the Overarching Welfare Principles developed by the Aquatic Animal Welfare Working Group of the Australian Animal Welfare Strategy (AAWS) as a guide when doing this.

The project team was aware of concern shown by some members of the recreational fishing sector regarding “fish welfare” and the potential for fish welfare to influence and even mandate recreational fishing policy and regulations to the detriment of the recreational fishing sector.

This project has shown that addressing issues of fish welfare in the recreational fishing community can actually lead to positive benefits for anglers. It has opened up the conversation on fish welfare in a manner that assists better understanding in the recreational fishing community as to how their actions can impact on the fish they catch. It also has helped to show that respecting fish and its welfare is not something to be feared, but rather should be embraced.

The project though has only begun the process. Unfortunately, funding for AAWS has ceased and hence AAWS no longer exists. For the last few years AAWS has driven the process through which this project was conceived and funded. AAWS created the momentum in a very positive way.

There is now a real need for the process to continue within the recreational fishing community, but it no longer can rely on funding through AAWS. It is hoped alternative funding will be available to ensure the recreational fishing community can gain better understanding of fish welfare and utilise this understanding to strengthen the social license there currently is in our society for recreational fishing.

9 Extension and Adoption

This project has opened up the discussion on fish welfare in the recreational fishing community. Fish welfare is considered a key issue to be built into the VRFish communication plan as a key focus of this plan is the recreational fishing community's social license to operate.

VRFish promoted the need for recreational anglers to be proactive on the issue of fish welfare at the 7th World Recreational Fishing Conference in Brazil²². Interestingly, this conference was the subject of a protest from local animal rights activists.

The work done through this project was also presented by Dr Hardy-Smith at the American Fisheries Society's 145th Annual Meeting, which was held in Portland, Oregon in August, 2015²³. The organisers of the session titled *"Fishing Blind: Highlighting the Need for the Development and Communication of Species-Specific Guidelines for Catch-and-Release"* had contacted Dr Hardy-Smith, to determine whether it would be possible to present this work at their session. Dr Hardy-Smith accepted the invitation and presented a paper titled "Measurable improvements in survival of released fish and fish welfare by working with high profile fishing competitions – an Australian experience".

The work of this project continues via a number of other actions including:

- The Spring Edition of the VRFish magazine "Fishing Lines" being devoted to the issue of fish welfare and what anglers can do to be responsible;
- Continued Facebook and Twitter posts on the VRFish/Department of Environment and Primary Industries Snapper Survival Project;
- Communications in the Club Marine magazine, Modern Fishing and Victorian Fishing Monthly; and
- VRFish radio interviews regarding snapper survival.

This project has worked closely with competition organisers and charter boat operators to ensure that welfare issues have been addressed openly and with complete transparency. Indiscriminate communication has the potential to deliver incorrect messages and this has been avoided.

There is though still much to be done.

²² More information about this conference is available at <http://www.7wrfc.com/>

²³ More information on this meeting is available at <http://2015.fisheries.org/>

10 Project materials developed

A number of project materials were developed through this project. These included:

1. An educational brochure developed as part of the communications strategy for the 2013 Tea Tree Snapper Fishing Competition (see Appendix E). This brochure specifically addressed humane methods of killing snapper and how to maximise survival of snapper that are released.
2. A flow-on from this project has been the material used in the VRFish/Victorian Department of Environment and Primary Industries project titled “Help released snapper survive”. Dr Hardy-Smith utilised information gained through this project to assist in the technical content of this complementary project.
3. Presentations on fish welfare that have been delivered at angling clubs, fishing information evenings and the Melbourne Boat Show.
4. A questionnaire was developed which was used when surveying competitors in 2012 Tea Tree Competition (see Appendix B)
5. A second questionnaire was developed and used when surveying competitors in 2013 Tea Tree Competition (see Appendix C)
6. A number of prototype “short term fish holding bags” have been developed and trialled to assist in the welfare of Murray cod and golden perch being caught and transported to measuring stations during the Mulwala Cod Classic (see pages 47 and 48).

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Appendix A: Overarching Welfare Principles

In the context of Aquatic Sector of the Aquatic Animal Welfare Working Group under the Australian Animal Welfare Strategy (AAWS), only vertebrate finfish are considered Aquatic Animals; other aquatic vertebrates are considered under other Sectors of AAWS. **(Note 1)**

The approach taken with animal welfare to date within the Aquatic Animal sector has been to establish overarching Principles against which sub-sectors can build their specific best practice guidelines to achieve animal welfare. **(Note 2)**

The overall aim of the aquatic sector (fish that are farmed, being transported, kept in aquaria, captured from the wild both commercial and recreational, or in aquaria in restaurants) should be to minimise suffering within the constraint of practices inherent to that sub-sector. **(Note 3)**

Specific measures include:

1. For fish held in captivity, the key parameters (temperature, salinity, pH, dissolved oxygen, & metabolites) of the aquatic environment in which fish are maintained should be within the species' natural range of tolerance.
2. For fish held in captivity, the holding unit in which they are normally housed should provide
 - safety from predators,
 - refuge from environmental extremes beyond their natural range of tolerance,
 - appropriate space,
 - appropriate space and/or water flow to avoid chronic degradation of water quality parameters referred to in point 1 above. **(Note 4)**
3. For fish held in captivity the feed supplied should meet known nutritional requirements, and be distributed in a manner and frequency which avoids starvation for periods longer than the species natural range of tolerance.
4. For fish held in captivity, any visibly damaged or sick fish should be assessed and either treated appropriately or promptly removed for killing by humane means suitable for the species.
5. During any handling of live fish,
 - care should be taken to avoid any damage to the fish

- for prolonged handling of fish out of water (e.g. health checks, vet treatment, artificial reproduction, etc), an anaesthetic appropriate for the species and frequent irrigation of skin and gills is essential
 - fish intended to remain alive should be returned to the water promptly.
6. Any fish selected for harvest should be killed as rapidly as possible, by humane means suitable for the species
 7. For fish harvested from the wild timely handling from capture to death is essential to minimise suffering. **(Note 5)**
 8. Capture methods should be designed to minimise the capture of unwanted fish.

Explanatory Notes

Note 1: The duty of care principles are couched within the Australian Animal Welfare Strategy under which these specific aquatic animal principles will be applied.

Note 2: As a code there is no legislative basis. Words such as ‘must’ hold no relevance. Animal Welfare legislation is the place for definitives and the code assists operators to meet those definitives through words such as ‘should’.

Note 3: Suffering is inclusive of pain and other issues of animal welfare.

Note 4: This principle when read with principle 1 covers all aspects. The detail of parameters such as water flow, stocking density, behavioural aspects and space will be in the sub-sector code themselves depending on operational method and species.

Note 5: ‘Capture’ as defined in sub-sector codes.

Appendix B: Australian Veterinary Association Position Statement - Fish welfare

When fish are farmed, kept in aquaria or captured from the wild for commercial or recreational purposes all efforts must be taken to minimise suffering of the fish.

The Australian Veterinary Association (AVA) should be actively involved in the development and review of regulatory and advisory frameworks for fish welfare.

Background

Definition

For the purpose of this position statement fish denotes finfish and does not include aquatic invertebrates such as molluscs or crustacea.

Guidelines

The AVA recognises the diversity of the fish sector and supports the establishment and implementation of effective welfare Code of Practices for each of the four sub sectors, i.e. recreational, aquaculture, ornamental and wild capture. The Codes of Practice should be able to be enforced and should incorporate the following principles.

1. Holding fish in captivity

- a. The quality of water should be maintained within the species' natural range of tolerance, which includes the temperature, salinity, pH and dissolved oxygen of the water. Metabolic wastes should not be allowed to increase to levels that cause unnecessary suffering of the fish.
- b. The holding unit in which fish are kept should provide protection from predators.
- c. The food supplied should ensure that known nutritional requirements for the fish being held captive are satisfied, except in cases where purging is required to decrease unwanted flavours in the fish.

2. Sick fish

- a. Sick or injured fish should be euthanased, or treated if treatments are available and legal for the fish species being treated. Sick fish should not be sold.

3. Handling of live fish

- a. Any handling of live fish should be undertaken in a manner that avoids damage and stress to the fish. Prolonged handling (e.g. for health checks, veterinary treatment, artificial reproduction etc) should be undertaken using an anaesthetic approved and appropriate for the species and numbers of fish involved.
- b. Any captured fish that is to be released should be handled as little as possible, and if possible should not be removed from the water, to increase the chances of a successful release. The use of knotless nets and circle hooks is encouraged because such devices will minimise physical damage to the fish prior to release.

4. Killing of fish

- a. The killing of any fish should be carried out promptly and by humane means suitable for the species and numbers involved, recognising that methods may vary between species and according to available technology and equipment.

Date ratified by AVA Board 18 June 2009

Appendix C: Questionnaire used when surveying competitors in 2012 Tea Tree Competition



TIME: _____



Tea-Tree Competition Survey – Fishers to be asked the following questions at measuring stations if willing. Initial introduction may be:

“Hello – we are conducting a short survey on fish quality and welfare as part of a national project. Would you mind us/me asking you a few questions on your catch?”

(If more information is required/wanted you can add that the project is being conducted by Panaquatic and RecFish Australia (VRFish) and is federally funded).

1. Did you keep fish alive after capture?

- A. Yes (go to Q2) B. No (go to Q3)

2. If you answered “Yes” in question 1,

i. Did you use a live bait tank?

- A. Yes B. No

ii. Approximately how long did you hold the fish alive?

- A. < 5 mins B. 5-30 minutes C. 30 – 60 minutes D. > 1
hour

3. If you answered “No” in question 1, did you kill the fish that you caught with any of the following methods?

- A. Blow to the head B. Brain Spike C. By putting it
into an ice-water slurry D. Other _____

4. If you answered “No” in question 1, how quickly did you kill the fish after bringing the fish onto the boat?

- A. Within a minute B. 2-5 minutes C. 5-10 minutes
D. >10 mins

5. If your answer in question (3) was "putting it into an icewater slurry", how quickly did you put the fish into the ice slurry after bringing the fish onto the boat?

- B. Within a minute B. 5 - 10 minutes C. 10-30 minutes
D. >30 mins

6. How was the fish stored after bringing the fish onto the boat and killing the fish?

- C. Live well B. Ice-water slurry C. On ice in an Esky (or similar)
D. In an esky or similar (no ice) E.
Other _____

7. Do you believe that how you store your fish affects its quality for eating?

- A. Yes B. No

8. Are you planning on eating the fish (either you, friends or family) after the competition?

- A. Yes B. No

9. Why are you taking part in the competition?

- A. To win a prize B. Fun or social C. Fishing Club activity

10. Male or Female (Please circle)

11. Age range

- A. Under 16 B. 16-21 C. 21-35 D. 35-50 E. 51-70**
F. 71 or over

12. Postcode _____

Appendix D: Questionnaire used when surveying competitors in 2013 Tea Tree Competition

LOCATION: _____ TIME: _____

1. What did you do with the fish when you first brought it onto the boat?

A. Killed it with a blow to the head or spiking it

How quickly after coming onto the boat did you do that?

- a. Within 1 min b. 2-5 min c. 5-10 min d. >10 min

And what did you do then? _____

B. Killed it by cutting its throat

How quickly after coming onto the boat did you do that?

- a. Within 1 min b. 2-5 min c. 5-10 min d. >10 min

And what did you do then? _____

C. Threw it on the deck

How long did you leave it on the deck?

- a. Minutes b. Hours

And what did you do then? _____

D. Threw it in a container (*without water*)

How quickly after coming onto the boat did you do that?

- a. Within 1 min b. 2-5 min c. 5-10 min d. >10 min

Did the container have any ice?

- a. Yes b. No

E. Threw it into a container (*with water*)

How quickly after coming onto the boat did you do that?

- a. Within 1 min b. 2-5 min c. 5-10 min d. >10 min

Fresh or saltwater? _____

What was the volume of the container (approximately)?

- a. _____ b. Don't know

Did the container have any ice in the water?

- a. Yes b. No

If YES, how much ice compared to water (e.g. 1 part ice to 1 part water – 1:1. 1 part ice to 2 parts water – 1:2 etc – approximation only?)

And what did you do then? _____

If NO ice, while the fish were in the container with water, did you have:

a. Flow through water b. Aeration c. None (static)

How long did the fish stay in the water?

a. <15 min b. 15 – 30 min c. 30 – 60 min d. > 1 hour

And what did you do then? _____

2. Was a photo taken before or after this?

a. Yes, before b. Yes, after c. No

3. Did you weigh or measure the fish before or after this?

a. Yes, before b. Yes, after c. No

4. Do you believe that the quality of the fish for eating is affected by:

i. How quickly you bring the fish onto the boat after hooking it

A. Yes B. No

ii. How you handle and how quickly you kill the fish?

A. Yes B. No

iii. How you store the fish after killing it?

A. Yes B. No

5. Are you (including friends or family) planning on eating the fish after the competition?

A. Yes B. No

6. Are the fish handling procedures that you used for the competition the same as what you would normally use when you go fishing?

A. Yes B. No

7. If you answered NO to Question 6, how did the fish handling procedures that you used for the competition differ from what you usually do? (If the respondent answers that they have kept fish alive for the competition but would normally kill them, ask how they would normally kill the fish and how quickly after bringing them onboard)

8. When you bag out (catch your limit), do you keep fishing?

A. Yes B. No C. Yes but for other species

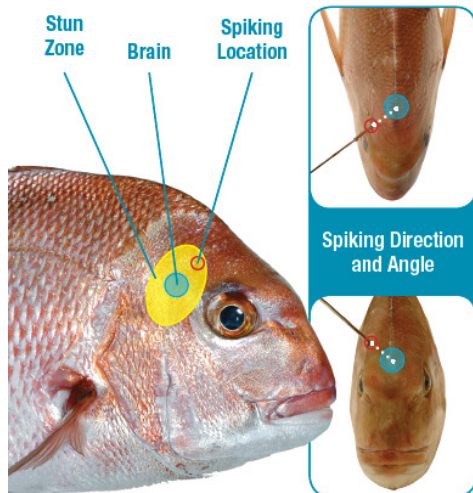
D. Don't usually reach the bag limit

9. If you knew that some of fish that you released after capture would NOT survive, would that change the way that you fish?

A. Yes B. No

10.	Why are you taking part in the competition? Rate EACH from 1 – 5 (5 is the highest rating and 1 the lowest)	Comp. 1	Comp. 2	Comp. 3	Comp. 4	Comp. 5
	To win a prize					
	Fun or social					
	Fishing club activity					
11.	Sex (M=male, F=Female)					
12.	Age range (tick the box that is appropriate for the age of each competitor)					
	Under 16 years					
	16 – 20 years					
	21 – 35 years					
	36 – 50 years					
	51-70 years					
	Over 70 years					
13.	Post Code					

Appendix E: Educational brochure developed as part of the communications strategy for the 2013 Tea Tree Snapper Fishing Competition



Chilling your catch after killing

The key to keeping fish in prime condition is immediate chilling after killing to a temperature slightly above the freezing point and maintaining this temperature until you eat it.

An easy way to chill your fish to optimise its quality **after killing** is by putting it into an ice slurry, which consists of ice and water in ratios of greater than or equal to 1:1 (ice:water). Kill the fish first - putting a live fish into an ice slurry before killing may actually **prolong its death**.

For big fish, opening the gut cavity first will help ensure even quicker cooling but avoid cutting into the intestine, which will release gut contents and lead to quicker spoilage. If the intestine is cut, remove it all and rinse before putting the fish into the ice slurry.

Releasing fish to give them a fighting chance

Besides barotrauma and gear choice, other issues to consider when releasing fish include:

Tight lines

Keep your lines tight and avoid slack. Having slack in a line increases the chances of deep hooking fish, even when using circle hooks. Gut hooked fish have much lower survival chances if released.

Air exposure

No matter what species of fish you catch, air exposure is harmful to the fish. You should do everything possible to avoid air exposure in any fish you plan to release. Every second counts. Try holding your breath while you have the fish out of the water – effectively they are!

Handling and nets

Simple – if you release a fish, handle it as little as possible and keep it in the water to avoid air exposure if you plan to release it. If you need to use a net, make sure it is of the knotless variety. The scales of the fish actually sit under the delicate outer layer of skin which can be easily damaged. Rough, knotted nets do more damage than knotless. It's best if everything that comes in contact with the fish is wet.

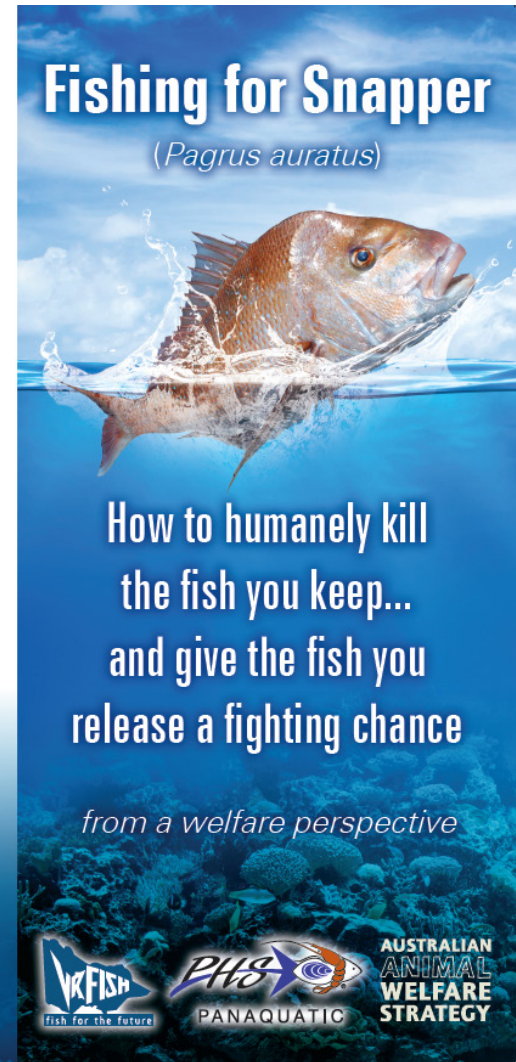
And if you have to pick up the fish, don't hold it by the mouth or tail and let it hang vertically. Support its weight by holding it horizontally, remembering to get it back in the water ASAP.

Developed by:
Panaquatic Health Solutions Pty Ltd



This project is supported by funding from the Department of Agriculture as part of the Australian Animal Welfare Strategy.

Cover photo of snapper courtesy of Scott Gray
© PANAQUATIC HEALTH SOLUTIONS PTY LTD





We all love fishing for snapper, be it to get a feed or to simply be out on the water with friends. It is important though to fish responsibly, and that means being aware of the impacts our fishing can have on the fish we love.

This brochure provides information to help you fish responsibly and sustainably and still be able to take home a great feed.

To think about before you even start fishing...

Barotrauma

Divers coming up from depths can get barotrauma. Snapper too can be affected when caught at depths as shallow as 11m. The damage done can have short and long term impacts. Bringing fish slowly to the surface won't help either - unlike divers, snapper have a closed swim bladder which can expand dramatically as they come up from depth. Fish may swim away looking fine but still be affected and in bad cases can die, sometimes days or weeks later, if predators don't get them first. For spawning fish the stress of barotrauma may cause damage to the gonads (reproductive organs) and reduce egg quality, if eggs are released at all.

So - if you catch a fish from depth, know that it will likely sustain internal damage. The best approach when fishing from depths is to stop fishing when you've caught what you need.

Gear choice

Duration of fight

The less time you take to land your fish, the better the quality if eaten and the more chance it has if released. Use gear that allows you to get your fish in quickly. Studies have shown that a proportion of fish that get exhausted during the fight will die if released. The proportion is greater the more the fish has to fight and the longer it is exposed to air after the fight. So minimise the stress you place on each fish you catch by getting it in quickly. It's better in all ways.

Gut hooking

Gut hooking greatly reduces the chance of survival for fish that are to be released. Using large in-line circle hooks will minimise gut hooking and also reduce catching of undersize fish. Avoid slack lines and remember that you need to change the way you set the hook when using circle hooks. Don't strike too hard; applying gentle pressure with the rod usually works by pulling the hook to the side of the mouth where it catches and sets.



Killing fish you want to keep

If you plan to keep your fish to eat, kill it quickly! It will taste better and it's better for the fish. Keeping in a live well will stress it further and it definitely should not be left to thrash around on the deck, even for a minute or two. Below are two humane killing methods to use. With each method, the heart will keep beating for a while even though the fish is senseless. Hence bleeding will still occur.

1. Stun and bleed

Knocking a fish on the head with a club or 'priest' is a quick and easy way to stun a fish and render it senseless. Hitting the skull at high speed and having sufficient weight in the club is important to jolt the brain, the internal movement doing the damage.

The area to aim for is shown in the diagram over the page. Once stunned, pith or spike the fish (see below) or bleed the fish by cutting the throat or cutting across one or both sets of gill arches. This will prevent recovery.

2. Pithing or spiking ("iki jime")

Spiking the brain ("iki jime") requires more skill and precision than stunning the fish. It immediately destroys the brain though. The position and angle to insert the spike is shown in the diagram. Further details on spiking of snapper can be found at www.panaquatic.com

Details on the iki jime process and brain locations for other fish can be found at www.ikijime.com

Appendix F: Information providing more detail on welfare issues pertaining to snapper and made available on-line

Give the fish you release a fighting chance

from a welfare perspective

Prepared by Drs Paul Hardy-Smith and Jon Daly, Panaquatic Health Solutions Pty Ltd

October, 2013

Introduction

Many of us love fishing for snapper, be it to get a feed or to simply be out on the water with friends. It is important though to fish responsibly, and that means being aware of the impacts our fishing can have on this iconic Australian species.

This article provides information to help those targeting snapper to fish responsibly and sustainably. It discusses what to do to maximise the eating quality of any fish caught. It also explains the issues to consider when catching a fish and then releasing it. Many anglers think that as long as the fish is put back in the water and swims away, it is OK. But this may not be the case. Many are not. on issues to consider when releasing a fish, before the fish has been caught and then what to do (and not do) after it has been caught to give it the best chance of survival when released.

Where possible, the authors of this article have used scientific research conducted specifically on snapper (*Pagrus auratus*) to base their comments on. Where such research is not available, research conducted on other species of fish considered relevant has been mentioned.

As with all recreational fishing, anglers must observe all relevant local recreational fishing regulations, including daily bag limits and permissible methods of capture.

A. To think about before you even start fishing...

Barotrauma

Divers coming up from depths must always be aware of ascending too quickly, as the rapid change in pressure can cause any trapped air to rapidly expand causing damage to surrounding tissues, a condition known as “barotrauma”. Snapper and many other fishes too can be affected by barotrauma if they are brought to the surface from depths.

Snapper have a closed swim bladder (sometimes called a gas bladder) that under normal conditions allows them to be “neutrally buoyant” in the water column so that they neither sink nor float at any given depth. The amount of gas in the swim bladder is controlled through a complex system of blood vessels, gases dissolving out of the blood to fill the swim bladder and dissolving into the blood to empty it. Understandably, this is not a quick process and hence they cannot adapt quickly to changes in water depth or pressure as there is no “release valve” to quickly dump gas. While air can be quickly “dumped” from a diver’s Buoyancy Compensation Device (BCD), a snapper cannot do this.

It has been suggested that fish require between 4 – 48 hours to adjust the volume of their swim bladder, and that fish would need to be brought up at a maximum rate of **2.5 metres per hour (4 hours for 10m)** to allow for buoyancy regulation (Rummer and Bennet, 2005). This means that bringing a fish up slowly won’t help, as has been suggested elsewhere.

While the risk of barotrauma increases with increasing depth, there is evidence that any snapper caught at depths greater than 10 metres is at risk of being impacted by barotrauma. In 2012, researchers from NSW conducted a study examining the effect of barotrauma on survival of snapper caught as part of the recreational snapper fishery in Coffs Harbour NSW (Butcher et al., 2012). Working with a local snapper fishing tournament, the study found that 61 of 315 snapper (of average length 26.5-95.5 cm) which were caught at depths ranging from 6 to 60.5m had clinical signs of barotrauma. The shallowest depths where clinical signs were observed was **11m**. The same study found that **all** snapper caught by angling at **15m or greater** had a distended abdomen and/or a prolapsed cloaca (i.e. signs of barotrauma), and **95% of snapper** caught at depths **greater than 20m** had a ruptured swim bladder (the tear being from 0.1 - 3.0cm in length). Fortunately, the damage was less the shallower the fish were caught, but even when catching fish from **15m**, one in every five fish had a ruptured swim bladder. Depending on the depth, many fish had other damage. At depths greater than 20m this included organ displacement (65.6%), liver (84.4%), peritoneal cavity haemorrhages (40.6%), and

gastric herniation extending into the buccal cavity (56.0%) or, less frequently, out of the mouth (9.4%). This sort of damage can have short and long term impacts on the fish being caught. How quickly the fish were brought to the surface did not help.

In another experiment researchers caught another species, red snapper (*Lutjanus campechanus*) and brought them into a laboratory where they could watch the changes developing internally in the fish by slowly increasing and decreasing the pressure in a flow-through high pressure chamber (Rummer and Bennet, 2005). The researchers x-rayed the fish and conducted post mortems at the end of the experiments. What they found was that decreasing pressure led to progressive expansion of the swim bladder causing organ displacement, followed by compaction of internal organs, and then swim bladder rupture. As they note:

“Displacement injuries are the first to occur as the expanding swim bladder increases in volume and begins to contact internal organs and systems. Continued decompression results in more severe compaction injuries as the swim bladder becomes confined by the body wall and pressure on organs increases dramatically”.

These researchers also estimated that even under the best conditions, fish will require between **4 and 48 h** to make necessary adjustments to swim bladder volume.

For **spawning fish** the stress of barotrauma may also cause damage to the gonads (reproductive organs) and reduce egg quality. Stress has been shown to affect reproduction in snapper by decreasing reproductive hormones such as oestrogen and testosterone and increasing stress hormones like cortisol (Carragher and Pankhurst, 1991). These researchers measured the hormones in 84 snapper caught by longline from 20m depth. They found that long term stress (up to five days post-capture) inhibited ovulation (release of eggs). Other researchers have also show that the hormonal changes in response to stress can have a negative effect on eggs in the ovaries of mature fish (Cleary et al., 2000), which may impact on spawning success. Cleary et al. 2000) noted that their results:

“Confirm that both wild and hatchery-reared snapper are highly susceptible to stress-induced impairment of reproduction”

There is also unpublished data suggesting that evidence of damage to the male reproductive organs (testes) has been observed in snapper coming up from depths as shallow little as 11m. Therefore catching snapper that are coming into spawn, or spawning, will cause stress. This stress will increase if fish are being caught from depths and suffering batotrauma.

There appears to be no way an angler can reduce the possibility of barotrauma occurring in a snapper if it is caught from depths greater than 11m. Because of this, the best approach when catching snapper from depths is to stop fishing when sufficient fish are caught to meet the needs of the angler, or when “bag” limits are reached, whichever comes first.

Gear choice

Duration of fight

Generally, the less time it takes to land a fish, the better the eating quality of the fish and the better its chances of survival if released. As noted in Cooke and Suski (2005), citing Wood (1991):

“Angling is essentially a combination of aerobic and anaerobic exercise that results in a series of physiological changes including a depletion of energy stores and an accumulation of lactate, as well as acid-base changes and osmoregulatory disturbances.”

These changes can result in reduced eating quality of the fish and a shorter storage life. Hence if the fish is to be kept and those who eat it impressed, gear should be used that gets the fish in quickly once caught, thereby minimising the duration of exercise (and stress) the fish goes through.

Studies in other species of fish have shown that a proportion of fish that get exhausted during the fight to be captured will die after being released, even if released as soon as it gets to the surface. In one study on rainbow trout (*Oncorhynchus mykiss*) (Ferguson and Tufts 1992), the researchers exhausted fish in a tank and then compared the survival of these fish with “control” fish (i.e. fish that had not been exhausted). While 100% of the control fish survived after 12 hour, **12% of the exhausted fish died**. And these fish were in tanks. It is quite possible that more fish may have died if predators had been around during the recovery period, as occurs when angling.

Interestingly, these researchers also showed the dramatic impacts of holding a fish out of the water (“air exposure”) after exhaustive exercise. Some of the fish exhausted as described above were held out of the water for 30 seconds before being put back in a recovery tank. Another group was held out of the water for 60 seconds. After exhausting the fish and then holding them out of the water for **30 seconds, 38% of the fish died**. Air exposure for **60 seconds** led to **72% dying**. This shows the dramatic impact of air exposure to an exhausted fish.

So - the potential for fish to die after being caught is greater the more the fish has to fight and the longer it is exposed to air after the fight. This is supported by Cooke and Suski (2005), who also note the following:

“There is general consensus among the current body of catch-and-release research that the duration of the actual angling event experienced by the fish correlates positively with the magnitude of physiological disturbance and the time required for recovery.”

Minimise the stress the stress placed on each fish caught by getting it in quickly. It’s better in all ways.

Deep/gut hooking

Deep hooking, where the fish swallows the hook and it catches in the wall of the gastro-intestinal tract (e.g. stomach, oesophagus) or in the gills, greatly reduces the chance of survival for fish that are to be released. A study on juvenile snapper found that 52% of deep-hooked fish die after release, compared to only 3% in shallow-hooked fish (Grixiti et al., 2010).

The type of hook used can influence the number of fish gut hooked. In-line circle hooks are becoming increasingly popular over the more conventional ‘J’ style hook. Figure 1 shows a conventional ‘J’ hook and a circle hook.



Figure 19 - A conventional 'J' hook on the left and an in-line circle hook on the right.

As noted in Cooke and Suski (2003), the most obvious difference between a circle hook and a conventional ‘J’-style hook is that, with a circle hook, the point of the hook is generally oriented to be perpendicular to the shank, whereas in J-style hooks the point is generally parallel to the shank. This paper reviewed the use of circle hooks in many different species of fish, and concluded that mortality rates are consistently lower for circle hooks than J-style hooks. The researchers did note though that there were species differences. The following statement made by Cooke and Suski (2003) is of importance:

“Our meta-analysis revealed that, in general, hooking mortality rates were reduced by ~ 50% by using circle hooks relative to J-style hooks. The reduction in mortality associated with use of circle hooks resulted primarily from the tendency of circle hooks to jaw-hook fish, resulting in shallow hooking depths. Gut hooking, and hence deep hooking, was generally rare for fish captured on circle hooks, minimizing the opportunity for damage to vital organs and excessive bleeding.”

Anglers however must understand how circle hooks work. Figure 2, taken from Cooke and Suski (2004), shows the mechanism by which fish are generally caught:

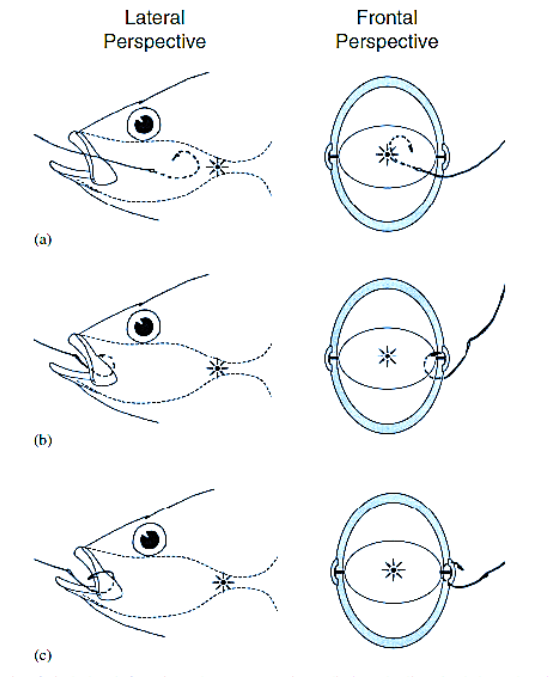


Figure 20 Schematic of circle hook function when pressure is applied to the line (both lateral and frontal views). From Cooke and Suski (2004)

The authors of this article have used large (6/0 and 7/0) in-line circle hooks for a number of years to catch snapper, mainly in Western Port. Rarely has a fish been in any area other than the mouth.

While specific, scientifically validated studies have not been conducted on larger snapper, we strongly believe the use of **large in-line circle hooks** has the potential to minimise gut hooking and also reduce the catching of undersize snapper.

There are a few important points though when using circle hooks. Firstly, the gape of the hook must be kept relatively clear to allow hooking to occur. So don't use too big a bait. Secondly, instead of jerking the line when a bite is felt, anglers should gently load up the rod. Jerking the line can pull the hook out of the mouth and miss the fish. Gently loading causes the hook to catch on the flesh of the jaw as it pivots outwards. Because of their design generally the hook will not back out on its own as the fish is brought in.

B. Killing fish you want to keep

If the fish is being caught to be eaten, it is best if it is killed quickly. It will taste better and it's better for the fish. Putting a fish in a live well after catching it will cause further stress and result in significantly increased cortisol levels (Pankhurst and Sharples 1992). There should be no need for an angler, fishing recreationally for a feed, to leave a fish thrashing around on a deck of a boat or the planks of a pier. Such thrashing and slow death will cause a reduction in the quality of the fish when eaten and is likely not so great for the fish itself.

The following two methods of killing a snapper are considered to be humane and also result in rapid loss of consciousness in the fish. It is important to note though that in both methods the heart will continue to beat for some time, hence bleeding will still occur.

1. Stun and bleed

Knocking a fish on the head with a club or 'priest' is a quick and easy way to stun a fish and render it senseless. Hitting the skull at high speed and having sufficient weight in the club is important to "jolt" the brain. It is the internal movement of the brain relative to the skull that caused the damage and results in a rapid loss of consciousness (Robb and Kestin 2002, Poli et al. 2005). Fish can though "wake up" after being stunned, so they should always be bled by cutting the throat or across one or both sets of gill arches and/or spiked (pithed) after stunning to ensure they never regain consciousness. Figure 3 indicates the area where a quick, sharp blow should result in an effective stun.

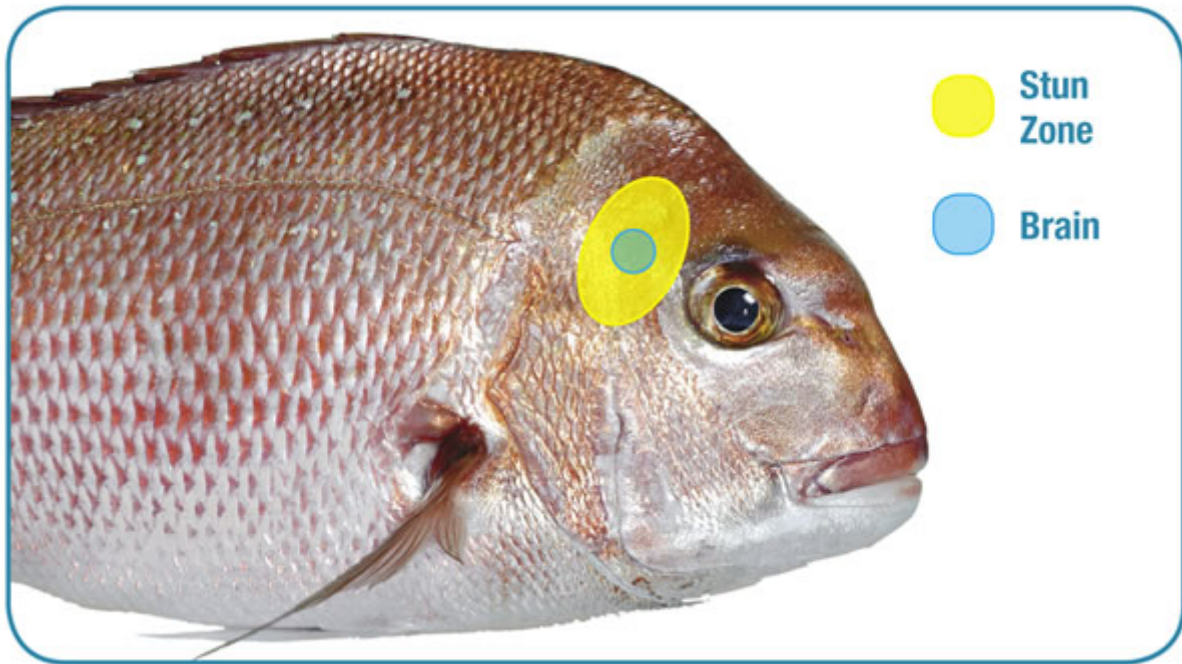


Figure 21 – Head of snapper showing area to aim for to stun the fish

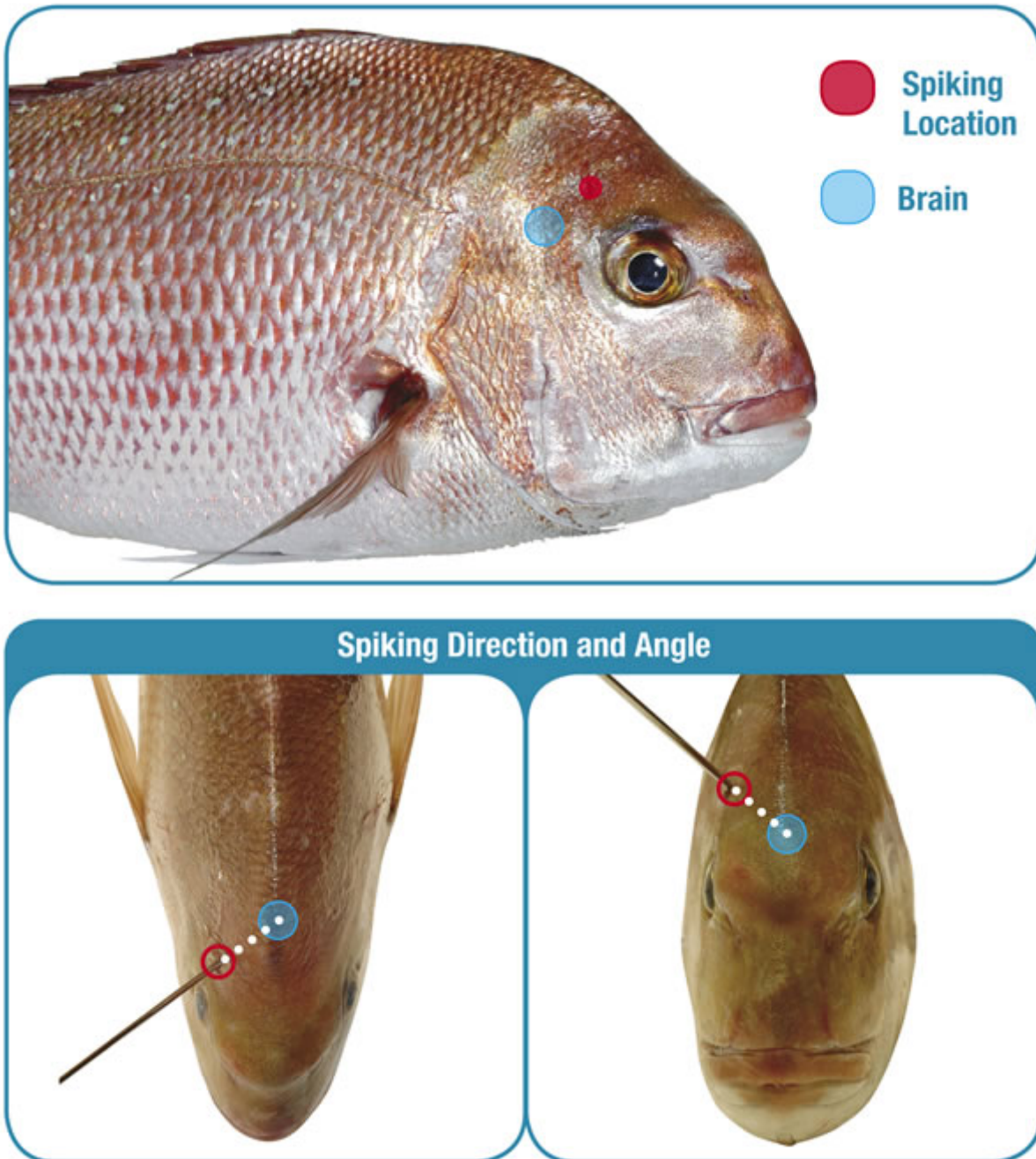
It is important when stunning not to hold the fish too firmly as it is the movement of the brain inside the skull that does the damage. Essentially, the brain is “shaken”. Holding the head too firmly will reduce the degree of movement.

2. Pithing or spiking (“iki jime”)

Spiking the brain (‘iki jime’) requires more skill and precision than stunning the fish. It immediately destroys the brain though (Robb and Kestin 2002, Poli et al.. 2005).

The brain is located deep in the head of the fish, and is protected by a bony case. The thickness of the bone varies. Trying to spike the fish by going directly in from the outside will hit some of the thicker bone and the likelihood of injuring the fish, but not killing it, is high.

A much better approach is to come down from an angle. This ensures the spike only has to go through the much thinner bone above the brain, resulting in a quicker and easier kill. The landmarks for where to spike and the angle to insert the spike are shown in Figure 4. The initial point of penetration of the spike is through skin and muscle which will feel soft and not bone. If the spike at the point of penetration hits hard bone, it is not in the right place.



Figure

Figure 22 - Head of snapper showing point at which to insert spike ("spiking location") and angle to direct spike to ensure the brain is penetrated

Details on the iki jime process and brain locations for other fish can be found at www.ikijime.com

C. Chilling your catch after killing

Another important way to ensure fish keeps in prime condition is immediate chilling **after killing** to a temperature slightly above the freezing point and maintaining this temperature until it is eaten (Sigholt et al., 1997).

An easy way to chill fish to optimise its quality after killing is by putting it into an ice slurry, which consists of ice and water in ratios of greater than or equal to 1:1 (ice:water). Ice-water slurry has been shown to be an effective means of storing fish to maximise shelf life and quality (Rodriguez et al., 2005). An ice slurry can be made by filling a suitable container (preferably insulated, such as an esky or insulated fish bin) with normal cubed or crushed ice. Addition of ice to water at ratios of greater than or equal to 1:1 (ice:water) forms an ice slurry with water temperatures around -2°C to 2°C, with the final slurry temperature depending on the water temperature before addition of the ice, the quantity and temperature of the ice used, and whether the slurry and/or ice is made up with freshwater or seawater. For cooling fish, ice slurries made using ratios of 2 or more parts freshwater ice to 1 part seawater are usually recommended for best effect, producing a slurry with a temperature ending up around -0.5°C. Ice slurries made with freshwater ice and

freshwater will produce a temperature of no lower than 0°C. Using a little seawater to make up the ice slurry can cause the temperature of the ice slurry to get below 0°C.

The fish should be killed first though - putting a live fish into an ice slurry before killing may actually **prolong its death**. If fish are not killed first, the time taken for fish to die in an ice slurry may adversely affect some physicochemical properties, for example Acerete et al.. (2009) reported that lactate and cortisol levels in European sea bass killed in ice slurry were significantly higher than in undisturbed fish and were comparable to levels in fish killed by CO₂ or asphyxia. Similarly, Bagni et al.. (2007) reported that death by asphyxia (the usual way the fish die if not killed first) in chilled water (i.e. an ice slurry) was highly stressful based on data on rigor mortis development in crowded and uncrowded groups of sea bass and sea bream. Although some studies report improved flesh quality and shelf life in fish killed by ice slurry compared to some other methods, it has been suggested that these benefits “could be obtained equally well if the fish were killed before chilling” (Robb and Kestin, 2002). Temperate species that are acclimated to lower water temperatures may take longer to lose brain function when placed in an ice-water slurry than if they were left on deck (Robb and Kestin 2002), and muscle contraction in response to the low temperature of an ice-water slurry may give the appearance that a fish is dead when it is actually still alive (Roth et al.. 2009).

For big fish, opening the gut cavity first will help ensure even quicker cooling but cutting the intestine should be avoided as it may release gut contents and lead to quicker spoilage. If the intestine is inadvertently cut, then all intestinal contents should be removed and the cavity well rinsed before the fish is put into the ice slurry.

D. Releasing fish to give them a fighting chance

Besides barotrauma and gear choice, there are some other important issues to consider to give fish that are released the best chance of survival. These include:

Tight lines

Keeping lines tight and avoiding slack is important to reduce the chances of deep hooking fish, even when using circle hooks. Research on black bream found that fishing with a slack line was almost twice as likely to result in deep hooking as fishing with tight lines (Grixti et al.. 2007). As previously noted, gut hooked fish have much lower survival chances if released. If not using in-line circle hooks, setting the hook immediately when a fish accepts the bait by fishing a tight line probably restricts the time available to chew and swallow the bait, decreasing the chance of deep hooking (Grixti et al.. 2007). However, this may not be effective with large, hungry snapper that engulf a bait.

Air exposure

No matter what the species of fish being caught, air exposure is harmful to the fish. The gills of the fish are quite delicate. In the water, they are supported and have a large surface area across which gas exchange (e.g. oxygen, carbon dioxide) can occur. When a fish is taken out of the water, the delicate structure collapses. The effect of air exposure can be dramatic as discussed above in the study by Canadian researchers working with rainbow trout (Ferguson and Tufts 1992) where it was found that 38% of fish that were exercised to exhaustion and then held out of water for 30 seconds died within 12 hours, and the mortality rate increased to 72% when exhausted fish were held out of water for 60 seconds. These researchers concluded that the brief period of air exposure which commonly occurs in many catch and release fisheries is an important additional stress in an exhausted fish and may ultimately have a significant impact on the number of released fish which survive.

A similar study in rock bass found that fish held out of the water for 1-3 minutes following exhaustive exercise showed significant cardiac disturbances and took up to 4 hours for normal cardiac output to return.

Anglers should do everything possible to avoid air exposure in any fish they plan to release. Seconds really do count. One useful way to show the significance of this is for an angler hold his or her breath when they lift a fish out of the water and only breath again once they’ve released it. This is essentially what the fish is doing.

Handling and nets

If a fish is to be released it should be handled as little as possible. Ideally it should not even be taken out of the water. If a net is used, it should be made out of knotless material to avoid damaging the skin of the fish. Many anglers do not realise that the delicate outer layers of the skin sit OVER the scales, and not under them. Rough, knotted nets do more damage than knotless and can cause damage to fins and scale loss that can affect post-release mortality rates (De Lestang et al.. 2008, Barthel et al.. 2003). One study done on bluegill (*Lepomis macrochirus*) found mortality rates for fish landed with fine, knotted nets was 14% compared to 10% for fish landed with coarse knotted nets, 6% for fish landed with knotless nets, and 4% for fish landed with rubber nets. Interestingly, none of the fish that were landed without a net died in this study (Barthel et al.. 2003).

And if a fish must be picked up, it should be supported and not held by only the mouth or tail. In a study done on barramundi, it was found that lifting a fish up by “lip grippers” only caused separation between the second and third vertebrae, especially on the ventral side. Barramundi didn’t seem to recover from this (Gould and Grace, 2009)

The weight of the fish should be supported by holding it horizontally, and getting it back into the water as quickly as possible if it is to be released.

And finally - photography

All of us love to get the picture of the “big one”. However, hopefully after reading this anglers will be aware that holding a fish up for a photo can have an impact on it, particularly if it is to be released.

For fish that have been caught to be eaten, it is not an issue. Kill the fish first and then take the photo, either before or after putting it in an ice slurry.

For fish that are to be released, consider taking a photo with the fish in the water. If the photo simply has to be taken with the fish out of the water, have everything ready to go before the fish is even caught. Then, when taking the photo remember that every second the fish is being held up it is impacting its possible survival when released. If a fish is good enough to be photographed, it is good enough to be given every chance of swimming off and surviving.

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Appendix G: Trial to assess short term holding of Murray cod in collapsible on-board tanks

Introduction and Methods

Two collapsible holding tanks (bags) were set up on a small (3.7m) aluminium “tinny” on the Goulburn River, near Shepparton, Victoria. Each bag held between 40-80 litres of water. Fishing was conducted from a second boat which had an on-board live tank. When a Murray cod was caught it was immediately placed into the on-board live tank and then the second boat would travel back to the first boat and the Murray cod was transferred over to one of the holding tanks. Analysis of water quality was conducted during the holding of the Murray cod, which was for a minimum of 30 minutes or until Dissolved Oxygen fell below .

Results

Three trials were conducted. DO was the limiting factor (Table 1). Figure 1 plots the decrease of oxygen in each trial. The 28 and 40 litres per kg trials were both sufficient to support a Murray cod in good quality water for 60 min. 12 Litres per Kg was only sufficient for 35 minutes.

Table 1. Summary of trials and water quality

Note: No aeration, water hardness 16.6mg/L equivalent CaCO_3 , air temperature max of ~30 degrees.

	Trial 1 3.3kg (fishx2) in 50L Insulated bag	Trial 2 2kg fish in 80L Not insulated	Trial 3 1.8kg fish in ~50L [60L down to 40L] Insulated
Litres/kg	~12	~40	~28
Time until DO <50%	35 mins (end point of experiment)	Not reached	Not reached
DO at 60 min	N/A (Put rapala aerator on dropped to 47%)	5.9 mg/L (71%)	5.1 mg/L (62%)
Starting DO	7 mg/L	7.4mg/L	7 mg/L
pH drop 60min	6.71 – 6.48	7.16-6.72	7.00-6.56
Ammonia max	0.5ppm	Not detected	0.25
CO2 max	7	3	3 (local spot of 8 found)
Temperature range	0.1 degrees	0.2 degrees	0.1 degrees

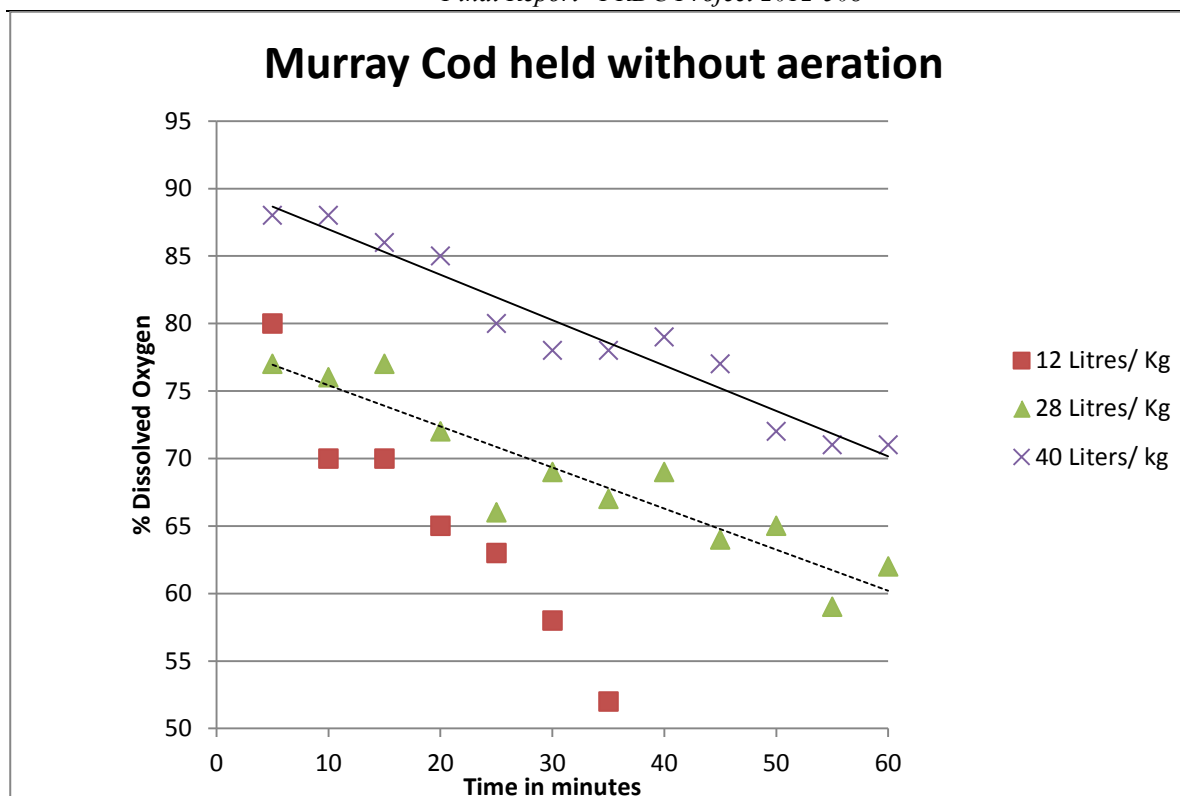


Figure 1

Oxygen consumption per kg of fish over an hour

The data from Table 2 provides an oxygen consumption rate of approximately 70 mg dissolved oxygen per kilogram of fish per hour.

Table 2 Calculations for oxygen consumption of line caught Murray cod

For simplicity calculations are an underestimate as they do not include added oxygen from exposed surface area of water.

Weight of fish	Start mg/L	End mg/L	Difference	Tank volume	Total consumed	Per kg/hour
2	7	5.1	2.9	~50	145	72.5
1.8	7.4	5.9	1.5	80	120	67

Use of additional Aeration

Initial observations showed that the aerators on their own were not able to raise the Dissolved Oxygen level. At the completion of a trial all of the aerators were added to trial 2 at the 75 minute mark, [these were a minimiser (\$80+) and two diaphragm air pumps (\$20+ each)].

The starting DO was 5.7mg/L; after 10 minutes of running the aerators the DO was raised to 5.9mg/L. Unfortunately; this experiment was not continued further. However, using these rough calculations 0.2mg over 80L is equivalent to 16 mg of dissolved oxygen over 10 minutes. These assumptions would suggest that the maximum output of these three combined aerators was only 160 mg dissolved oxygen per hour.

Discussion

A 60cm Murray cod can be expected to weight up to 3 to 4kg in weight. 90 to 100cm fish can weigh above 15kg. To hold a fish without aeration will require greater than 12L per kg to reach the target of 1 hour. Even a 35 minute target for a 10kg cod would require 120L tank, if no aeration is used.

With three combined aeration devices it appeared that 160mg of oxygen was added to the water over 1 hour. This trial suggests a 1kg Murray cod will utilise 70mg of dissolved oxygen each hour. Thus the combined aerations devices may only cover 2kg of line caught Murray cod over an hour.

Therefore it is critical that alternative aeration devices are included in this holding system.