



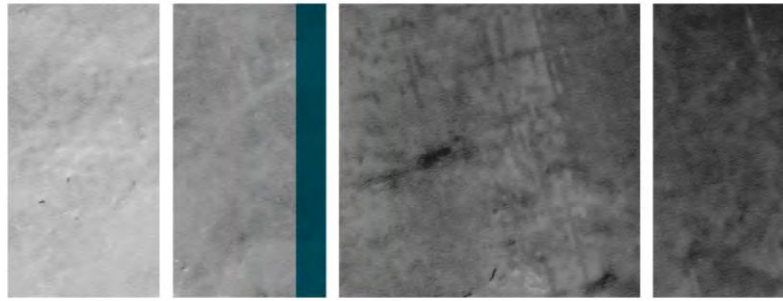
PESTSMART



Social drivers behind participation in pest fish-out competitions

Andrew Norris
Guy Ballard





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Guy Ballard²

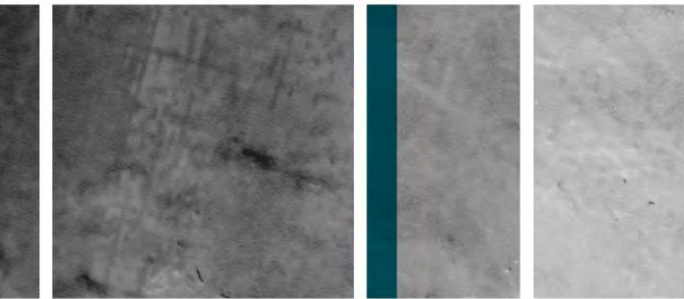
¹Queensland Department of Agriculture, Fisheries and Forestry

²New South Wales Department of Primary Industries

2013

An Invasive Animals CRC Project





Social drivers behind participation in pest fish-out competitions

Report prepared for Invasive Animals Cooperative Research Centre's Freshwater Project 10.U.8: Carp control in the Logan and Albert Rivers Catchment.

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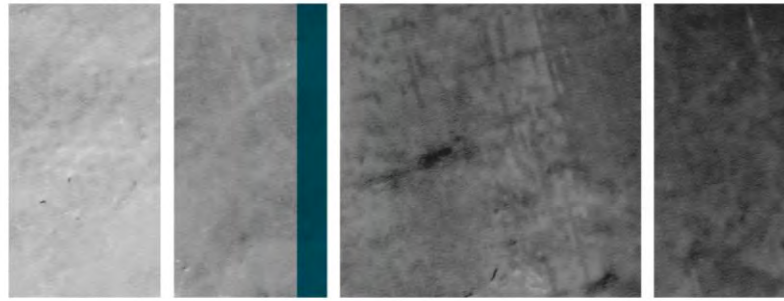
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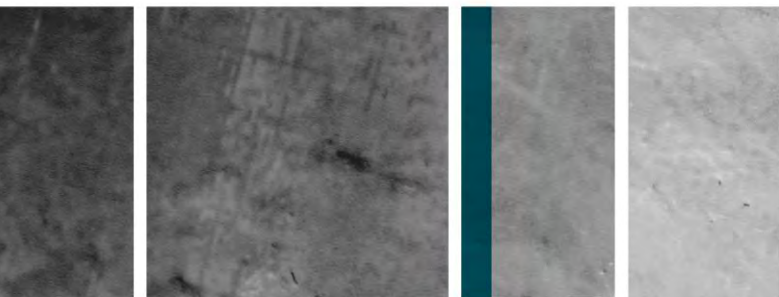
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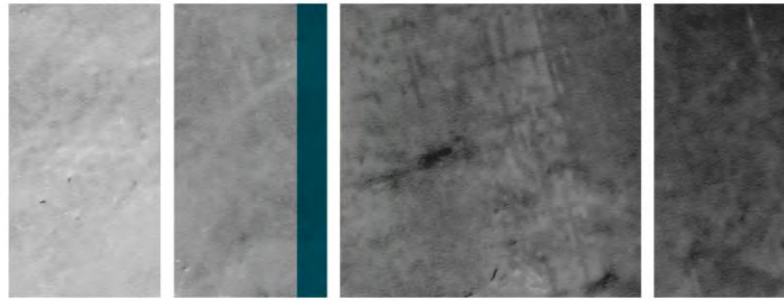
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Summary

It is now widely accepted that it is important to understand the ‘human dimensions’ of wildlife management issues to achieve management goals (Conover 2002; Miller 2009). One of the key areas of interest within human dimensions is participation and uptake of management initiatives by the community. A clearer understanding of the drivers behind community participation will lead to better engagement with stakeholders and ultimately increase the uptake and success of management actions.

Many community groups are concerned about the impacts of pest fish, particularly carp, (*Cyprinus carpio*) in their local waterways and want to actively address the issue. To combat the impacts and spread of these pest fish some groups have organised community ‘fish-out’ events.

The objectives of this project were to investigate the drivers, or reasons, behind participation in carp fish-out competitions and how participants perceive the presence of carp in the rivers. Competitors at six competitions were asked to complete a survey looking at their drivers behind participation, perceived impacts of carp and demographics.

A total of 509 competitors completed surveys were received. The results differed little between competitions. A broad cross-section of the community participated in the events, although more males completed the surveys (67%). Just under half (41%) of the respondents were members of a fishing club and their mean age was 43.7 ± 0.6 years. The majority (73%) of respondents went fishing at least once a month. The competitions were also of interest to more occasional anglers. Males and club members both fished significantly more frequently than other respondents.

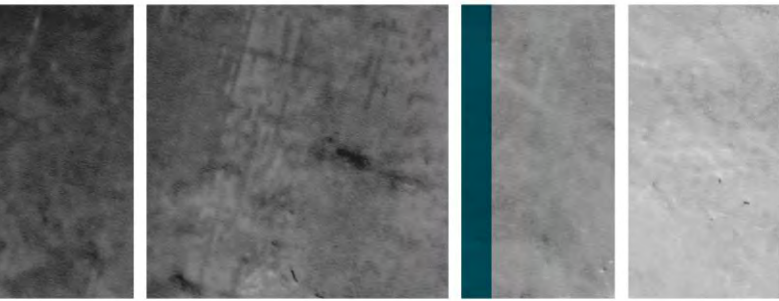
The most common reasons given for entering a competition were to:

- socialise
- have a good time
- remove carp from the river.

Few participants listed demonstration of their angling skill, being challenged as an angler or winning prizes as motivations for entering. When asked to specify the principal reason for participation, the most frequent responses were:

- having fun (26%)
- removing carp (21%).

The principal reason varied significantly with club membership, age and gender. Club members placed more emphasis on relaxation than having fun. Females more frequently listed having fun or spending time with the family as their primary driver, and males listed removing carp and socialising as their primary drivers. Younger participants (<20 years) entered to have fun, but older participants were there to relax. Few young people listed removing carp as their key motivation. In contrast, this was the most frequent response for those over 50 years of age.



It appears that participants were highly satisfied with the experience received from the competitions - 98% said they would probably or definitely participate again. Carp catch rates were low, suggesting that motivations were related to the activity in general or were non-catch oriented.

The majority of respondents (84%) believed that the negative impacts of carp outweighed their benefits. Only 4% of respondents thought that on balance carp were beneficial.

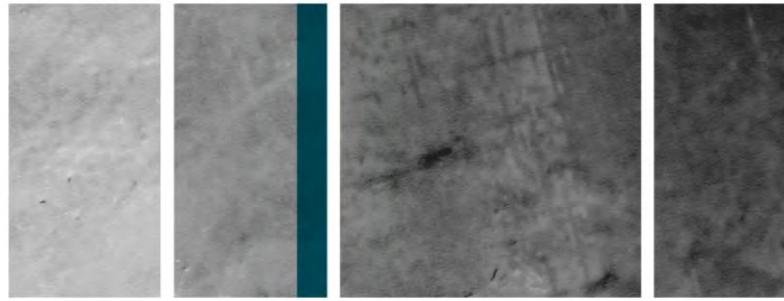
Nearly all participants believed carp were having detrimental impacts in local waterways. When asked what the worst impact of carp was, causing fewer native fish was the most frequent (53%) response. Other common responses included: making it harder to catch native fish (17%), dirtying the water (13%) and decreasing aquatic vegetation (11%). Age and club membership significantly influenced responses.

Two thirds of respondents believed there were no benefits to the presence of carp in Australia. Those who reported benefits were associated with carp's sporting prowess, abundance and ease to catch. Non-angling club members valued these aspects higher than angling club members, who thought carp reduced their chances of catching native species.

Carp were deemed to have the greatest detrimental impact on both the status of native fish and river health, when compared to other potential impacts. After carp, pollution, salinity and other pest fish were thought to have the greatest impacts on river health. After carp, perceived detrimental impacts on the status of native fish were:

- other pest fish
- removal of riparian vegetation
- pumping for irrigation.

The family focus of carp fishing competitions attracted a range of people who may not ordinarily be involved in fishing or other fishing competitions. This provides an opportunity for fisheries and natural resource managers to communicate with a section of the community that may not have an in-depth understanding of the issues surrounding pest fish and that may be missed by more conventional extension activities. Ensuring that these events maintain a family focus will assist continued participation from, and access to, this group.



1. Introduction

Wildlife management research in recent years has highlighted two areas of importance (Decker et al 2001; Sinclair et al 2006):

- management of the wildlife itself
- management of the ‘human dimensions’.

It is now widely accepted that it is important to understand the human dimensions of wildlife management issues to achieve management goals (Conover 2002; Miller 2009).

This is particularly the case in pest management where the definition or classification of a pest is based on the human perception that an organism’s detrimental impacts outweigh its benefits in a given scenario. For example, the presence of horses on a farm is considered beneficial, but the presence of the same animals in the Australian high country is deemed detrimental due to their environmental impact (Nimmo and Miller 2007).

Human dimensions have often been defined as informing people, educating people, seeking people’s opinions and regulating people’s behaviour (Sinclair et al 2006). One of the key areas of interest within human dimensions is participation and uptake of management initiatives by the community. A clearer understanding of the drivers behind participation will lead to better engagement with stakeholders and ultimately increase the uptake and success of management actions.

Motivation and participatory satisfaction are both key factors in determining participation in activities. At the most basic level, people will be motivated to participate in pest control if pests interfere with something they value (Horn 2006). Motivations can be viewed in terms of two sets of elements (Fisher 1997; Arlinghaus 2006):

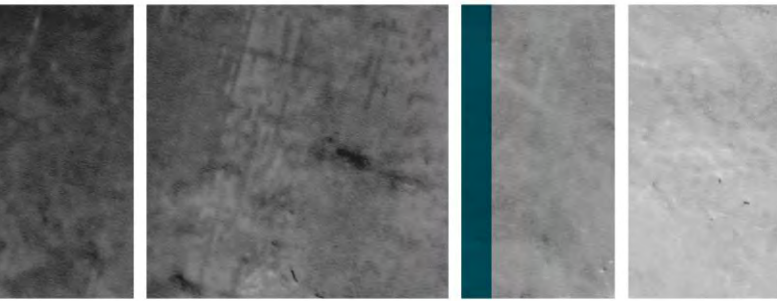
- those that are activity-specific (ie unique to that activity)
- those that are activity-general (ie common to a range of activities).

The relative contributions of these determine whether an activity will appeal to a highly focused or a broader audience.

Repeated participation is highly influenced by satisfaction. Satisfaction is derived from the difference between the experience a person desires or thinks they should receive and the perceived fulfilment of the desired outcomes (Holland and Ditton 1992; Burns et al 2003). High satisfaction should lead to greater willingness for repeated participation.

In an era of limited leisure time and diverse recreational opportunities, community pest management activities must provide satisfaction to retain or attract participants. This study examined the drivers behind participation in carp fishing competitions in Australia as a case study to explore the topic.

Common carp (*Cyprinus carpio*) are a well established and widespread pest fish species in Australia (Lintermans 2004). Carp are now the most abundant large freshwater fish in the Murray-Darling Basin, comprising up to 90% of fish biomass in some locations, and are the



dominant species in many fish communities in southeastern Australia (Reid and Harris 1997; Brown et al 2003).

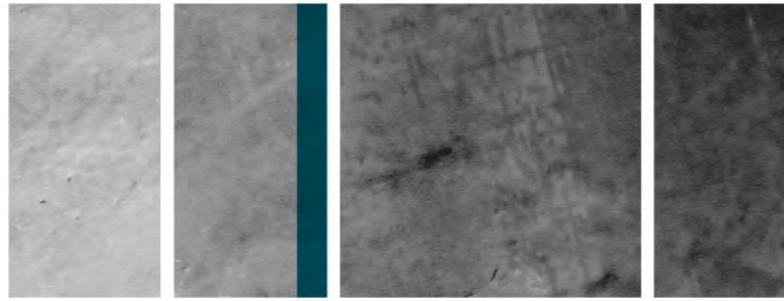
Carp can have detrimental impacts on native aquatic plants, animals and general river health, particularly through their destructive feeding habits (Koehn et al 2000; Gilligan and Rayner 2007). Although often found in degraded areas, it is still not entirely clear whether carp are a cause or a symptom (Hume et al 1983; Gilligan and Rayner 2007). In some cases carp have probably been blamed for degradation that is actually the result of human activities.

Many community groups are concerned about the impacts carp are having in their local waterways and want to actively address the issue. A range of fisheries techniques can be used to reduce carp populations in small areas, but no broad-scale management technique has yet been developed. To combat the impacts and spread of these pest fish some groups have organised community ‘fish-out’ events. These events are becoming more popular as people see them as a fun way to help deal with the pest fish problem. Many of the competitions are organised by local fishing groups who see the events as a real opportunity to have an impact on local pest fish populations and/or raise money for the restocking of native species or other community based projects.

The reasons for fishing among angler groups have been extensively investigated (eg Loomis and Ditton 1987; Wilde et al 1998; Schramm et al 1999; Hunt and Ditton 2001; Schramm and Gerard 2004). This information has been used to help develop satisfying fishing experiences (Graefe and Fedler 1986; Siemer and Brown 2004) and to predict how anglers will respond to management actions (Fedler and Ditton 1994). Motivations for fishing and the key aspects for angling satisfaction vary subtly between the general angling population and those that participate in tournaments (Graefe 1980; Falk et al 1989; Siemer and Brown 1994). However, research on the motivations of anglers participating in pest fish-out events is scarce. A greater understanding of the drivers behind participation in these events may provide insight that can help increase community uptake and participation in other pest fish management or natural resource management initiatives.

Until recently, little research had assessed community knowledge levels and social attitudes towards carp in Australia. The control of invasive species is a human construct affected by public opinion (Morzillo et al 2007) and issues surrounding their management are often highly emotive (Wallis et al 2009). Clearer understanding of community knowledge levels will enable fisheries and natural resource managers to identify the effectiveness of current extension and dialogue activities. Insight into community perceptions of the impacts of pest fish and other processes on ecosystem health and native fish species will assist managers to assess the potential for uptake of proposed management plans and control measures.

The objectives of this project were to investigate why people participated in carp fish-out competitions, how they perceived the presence of carp in the rivers, and consider how this information could be used in extension to increase community participation in natural resource management activities.



2. Methods

Registered entrants from six carp fishing competitions held in southern Queensland were asked to complete a questionnaire. The competitions surveyed were:

- the inaugural 2007 Goondiwindi Carp Cull
- 2008 Surat Carp Busters Family Fishing Competition
- 2008 Thallon Carp Comp
- 2008 Goondiwindi Carp Cull
- 2008 Mungindi Carp Busters Fishing Competition
- 2008 Dirranbandi Carp Comp.

All 2008 competitions were part of the 2008 Regional Carpbusters Series, organised by the Queensland Murray-Darling Committee Inc.

Initially, we conducted a focus group discussion at Goondiwindi to gain a range of different views and perspectives and to develop relevant questions and response options. The outputs of the focus group were utilised to design a questionnaire which would be fast and easy for participants to complete. The questionnaire was designed to keep writing to a minimum and to enable appropriate statistical analysis (see Appendix A).

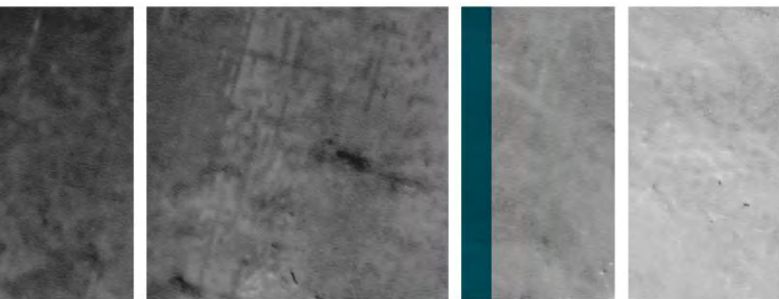
The survey focused on three main areas of interest:

- drivers behind participation in pest fish-out competitions
- perceived impacts of carp
- angler demographics.

The same survey was used for the first five events. The survey was slightly modified for the final event (2008 Dirranbandi Carp Comp) to capture participant's opinions on the carp competition series and changes in pest fish knowledge and angling techniques.

At each event, surveys were only issued to anglers registered in the competition who were over 18 years of age. To encourage the return of surveys, those who returned completed surveys were entered into a draw to win a \$250 camping package at that event. The prize package was set up on display near the competition registration area to increase interest and survey participation rates. The winner of the camping package was drawn at random during the presentation ceremony of each competition.

The data from each competition were pooled into one large dataset. We compared individual events where substantial differences in results between competitions existed. To explore the role of demographics in responses, we analysed dependent variates (responses) by generalised linear models (McCullagh and Nelder 1989). The continuous variables were subjected to analysis of variance with four independent terms, and all two-way interactions. The discrete dependent variates were cross-tabulated against the respective independent terms, and tested via Pearson's Chi-square (Snedecor and Cochran 1980).



3. Results

A total of 509 completed questionnaires were received from the six carp fishing competitions surveyed (Table 1). The completion rate for the questionnaires was similar between events, averaging $59.4 \pm 5.1\%$. Many participants commented that the chance to win the camping package provided the incentive for them to complete the survey.

Table 1. Senior entrant number and survey response rates for the six carp competitions evaluated.

Event	Completed surveys	Adult entrants	Response rate (%)
Goondiwindi 2007	61	111	55.0
Surat 2008	98	175	56.0
Thallon 2008	134	177	64.1
Goondiwindi 2008	98	156	54.4
Mungindi 2008	48	71	67.6
Dirranbandi 2008	70	111	63.1
Total	509	857	59.4

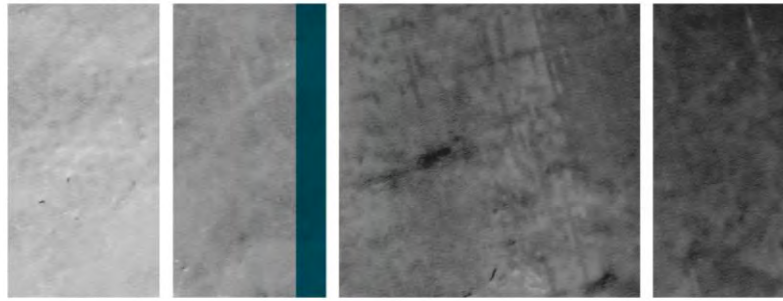
3.1. Demographics

A broad cross-section of the community participated in the carp competitions. The age of participants ranged from 18 years (the minimum age for survey issue) to 78 years, with a mean of 43.7 ± 0.6 years (Figure 1). Six respondents did not provide details of their gender, but of those that answered, the gender ratio was strongly biased towards males (67%) and less than half (41%) the people surveyed were currently members of a fishing club.

3.2. Participation

The majority (73%) of adult competition participants went fishing at least once a month (Figure 2). The competitions also attracted a number of people who fished less frequently with approximately a quarter of survey participants fishing twice a year or less.

The frequency with which participants went fishing varied significantly with their membership to a fishing club ($p < 0.001$), the number of competitions they had previously entered ($p < 0.001$) and gender ($p < 0.001$). Members of fishing clubs went fishing more frequently; 80% fished at least once per month (with 24% fishing weekly). In contrast, of non-members only 67% fished more than once per month (with 16% fishing weekly). Few club members only went fishing once a year or less. Those who had participated in more than two fishing competitions were far more likely to frequently go fishing ($p < 0.001$). Of those who had participated in fewer than two competitions, 49% went fishing biannually or less. Males also tended to go fishing



more frequently and few only fished once a year. Around 80% of males, in contrast to 59% for women, went fishing at least once a month.

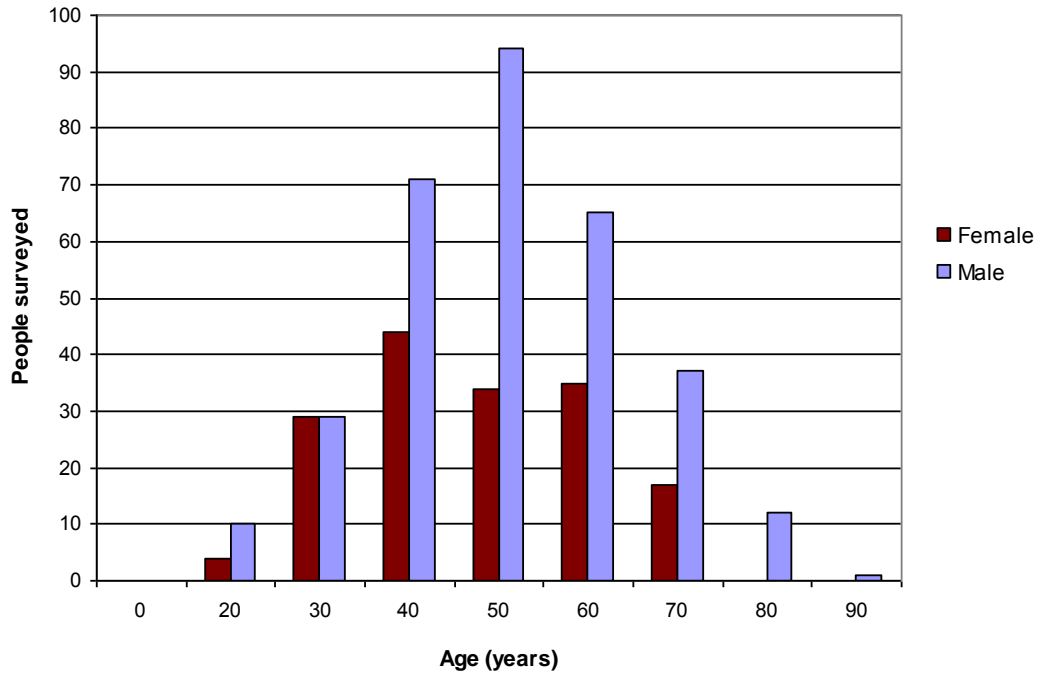


Figure 1. Combined age distribution of competitors at the six carp fishing competitions (n=499).

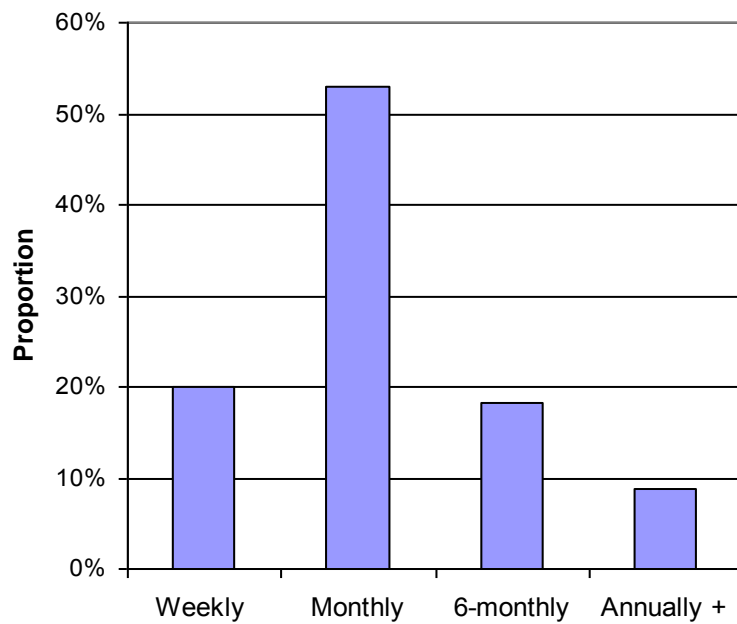
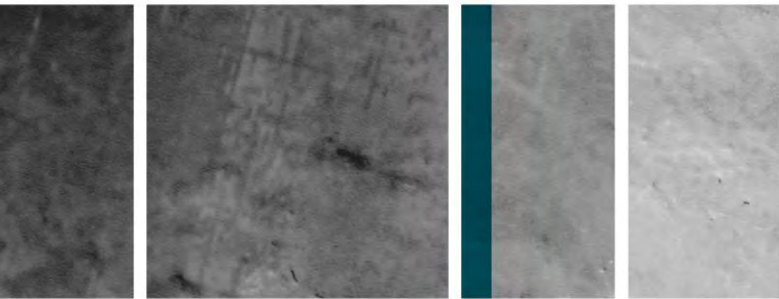


Figure 2. Frequency of fishing for survey participants (n=434).



A number of specific questions were added to the survey for the Dirranbandi 2008 competition to gain a better understanding of survey participants' carp fishing habits. The mean number of times that these survey participants had fished specifically for carp in 2007 was 3.9 ± 0.8 , with the figure rising to 5.6 ± 0.9 trips in 2008 ($n=70$). During these trips anglers caught an average of 3.9 ± 0.5 carp. When fishing for other species and specifically targeting native fish survey during this period, the Dirranbandi survey participants caught an average of 2.9 ± 0.2 carp as bycatch.

Only 14% of participants entered a competition by themselves. The rest entered as part of group which on average had 3.4 adults and 2.4 children.

3.2.1. Number of competitions entered in series

The number of competitions entered in the 2008 Regional Carp Busters Series varied significantly with several key participant demographics. Older survey respondents entered significantly more ($p=0.021$) events in the series compared to younger age groups. Males also attended significantly more ($p=0.005$) competitions than females. People who had entered many fishing competitions in the past were also significantly more ($p=0.021$) likely to enter a greater number of events in the series.

3.2.2. Knowledge of pest fish

It would appear that the level of knowledge on pest fish may have increased as a result of the 2008 Regional Carpbuster Series. A survey of 51 people at Goondiwindi in 2007 found that only 55% could readily tell the difference between carp and goldfish. At the final event of the series, 60 people were surveyed and the number correctly able to tell the difference rose to 70%.

3.2.3. Drivers behind participation

The most common reasons given for entering a carp fishing competition were to socialise, have a good time and remove carp from the river (Figure 3). This trend was consistent across all the competitions. Approximately half the respondents entered to help improve the state of the local waterways and native fish. Less than a third of anglers listed demonstrating their angling skill, being challenged as an angler or winning prizes as motivation for participating.

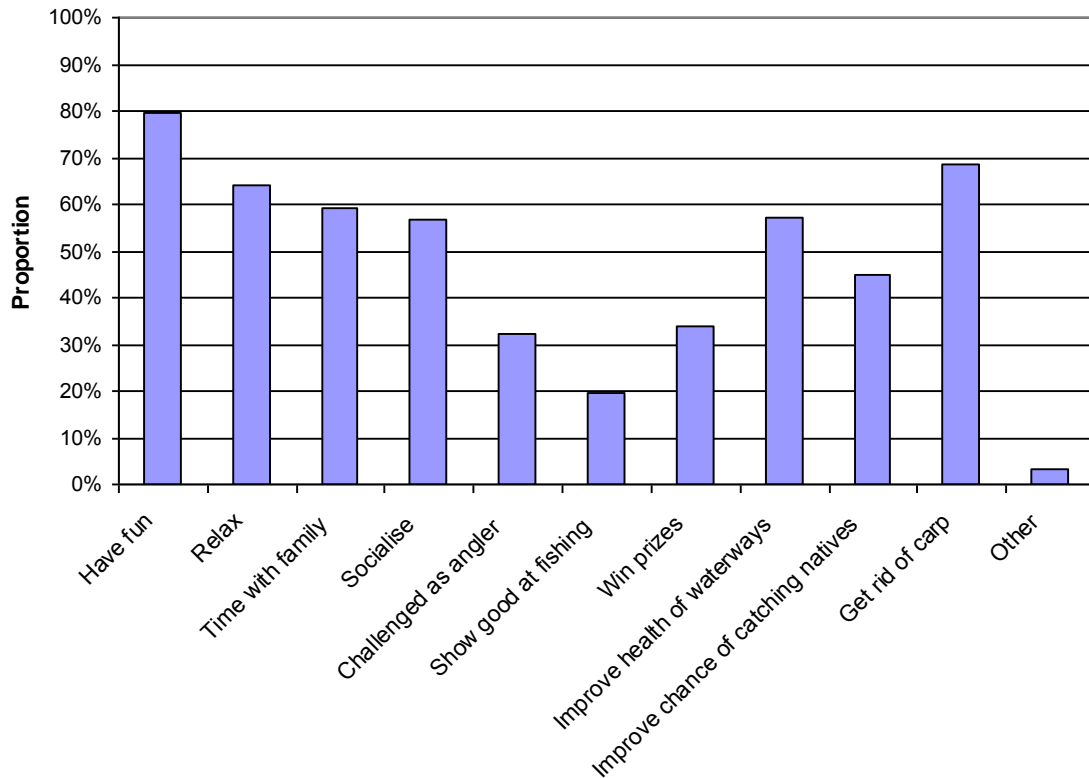
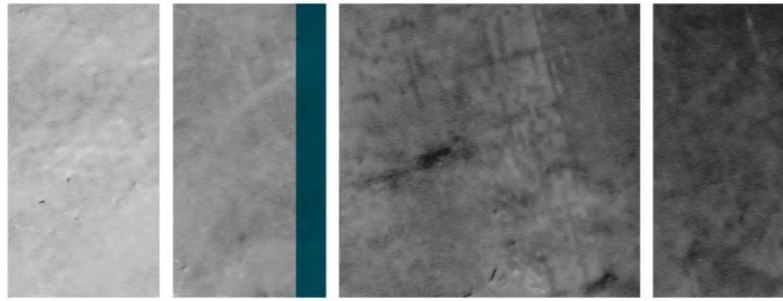


Figure 3. Reasons why people participated in the carp fishing competitions (n=439).

When asked to specify the single most important motivation for entering a carp competition, having fun (26%) and removing carp (21%) were the most frequent responses (Figure 4). Winning prizes was the key motivation for only a small number of entrants (4%) and demonstrating and challenging their fishing skills were the least frequently given responses (1%).

There were some differences in responses between competitions. Participants at Goondiwindi 2007 and 2008 and at Mungindi 2008 listed carp removal as their primary motivation for participating (Figure 4). In comparison, having fun was the most frequent response in the other events.

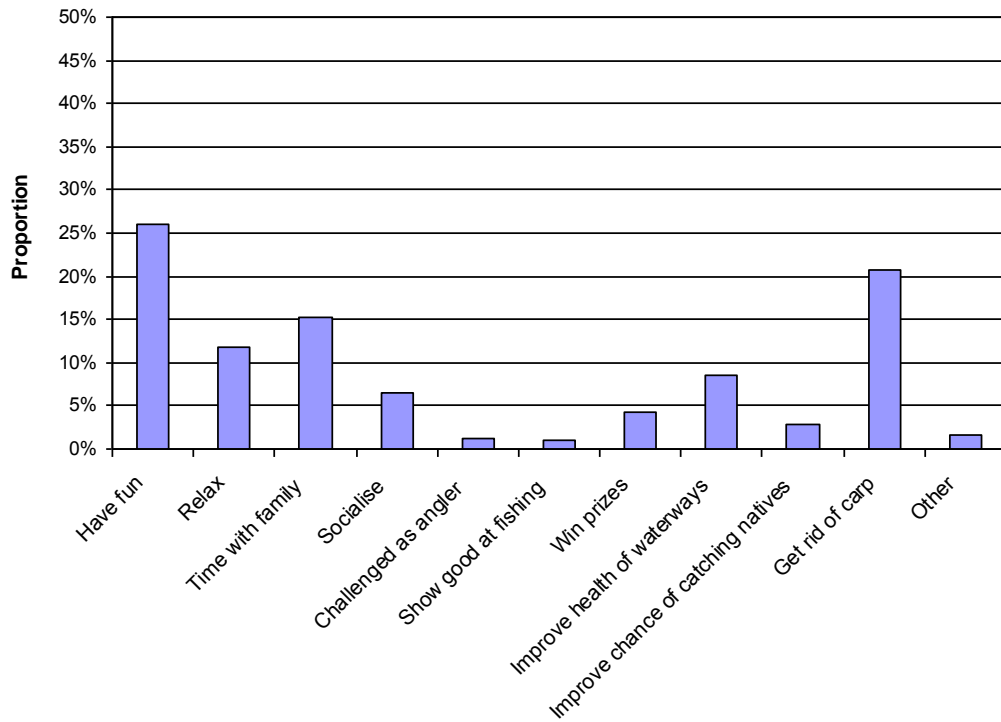
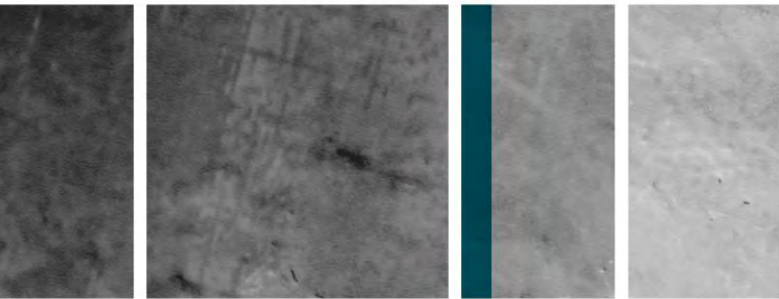


Figure 4. The primary motivation for participation in carp fishing competitions (n=465).

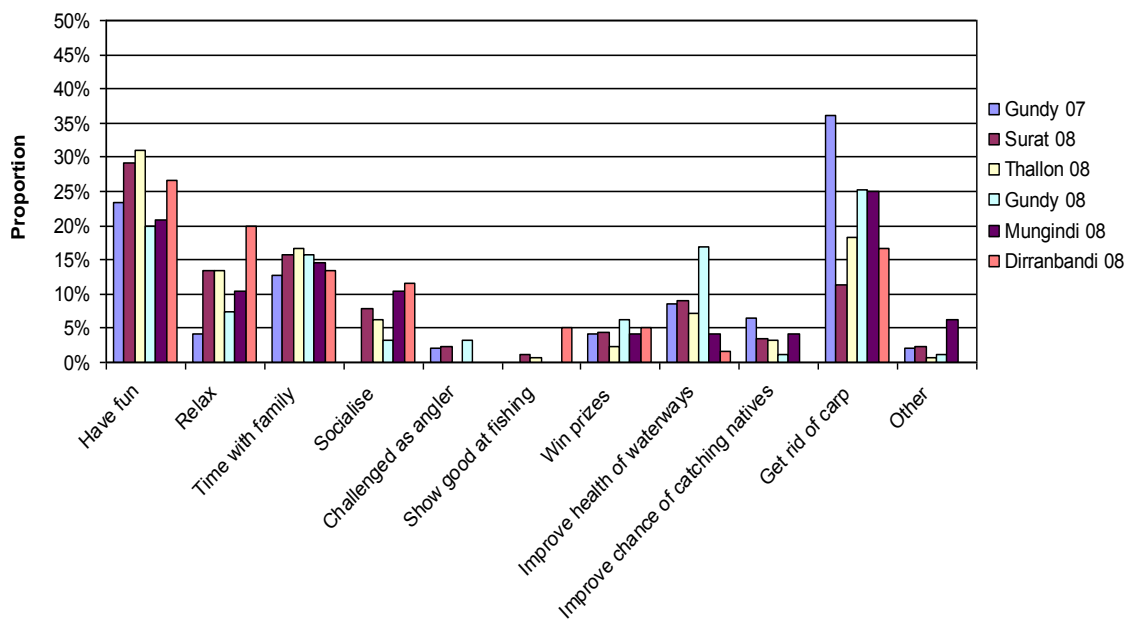
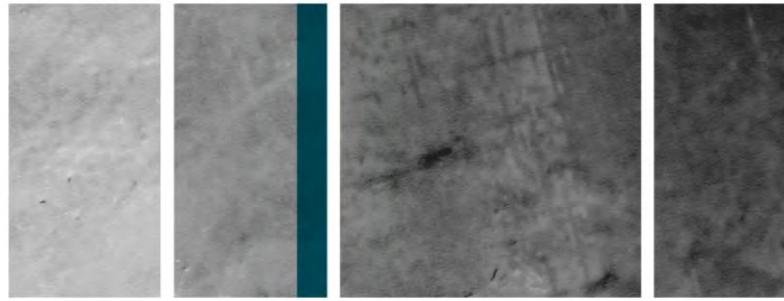


Figure 5. The primary reason for participation for entrants from six different carp fishing competitions (n=465).



The principal motivation for participation varied significantly with fishing club membership ($p=0.001$), age ($p<0.001$) and gender ($p=0.006$). When compared to non-fishing club members, club members were more likely to fish for relaxation (15% vs 9%) and less for fun (22% vs 29%). Club members also placed much more emphasis on improving the health of waterways (14% vs 8%) and removing carp (25% vs 17%). Non-club members were six times more likely to enter a competition to win a prize (6% vs 1%).

The most frequently given reason for participation by females was to have fun (32%). Males also gave this answer frequently (23%), but their most common response was to get rid of carp (25%). This was less frequently selected by women (13%). Females frequently listed spending time with their family (21%) as the primary driver behind participation. In contrast, only 12% of males responded in a similar manner.

The drivers behind participation also varied with age. Younger people entered to have fun, but older participants were there to relax. Spending time with the family was frequently listed by those aged between 21 and 50 years of age. This age bracket also contained the highest proportion of females. No survey respondents 18-20 years of age listed removing carp as their primary reason for participation. Conversely, this was the most frequent (28%) reason given by those over 50 years of age.

3.2.4. Participation in future competitions

The vast majority of people indicated they would participate in carp competitions again (Figure 6). No one indicated they would not participate again and only a few people were unsure (2%). The majority of people (67%) indicated that they would definitely compete again, and approximately half that number (31%) responded they probably would enter again.

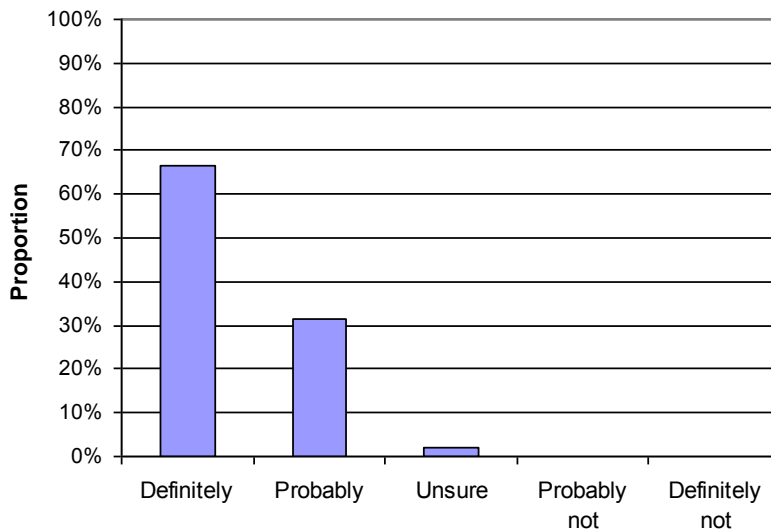
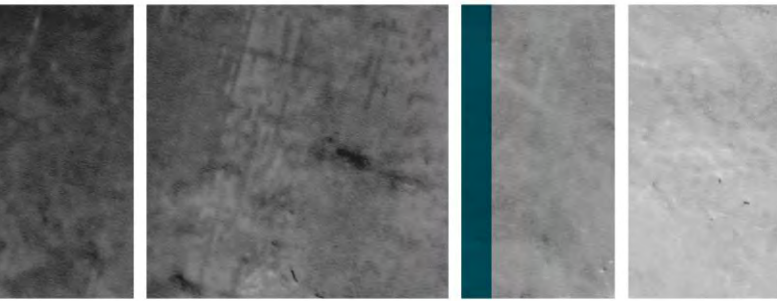


Figure 6. Likelihood of survey respondents to compete in a carp fishing competition again ($n=436$).



3.2.5. Fishing competition experience

More than three quarters of entrants had previously participated in a fishing competition (Figure 7). The mean number of competitions people had participated in varied between the six locations surveyed, and appears to be correlated with the duration that fishing competitions had been held in that location.

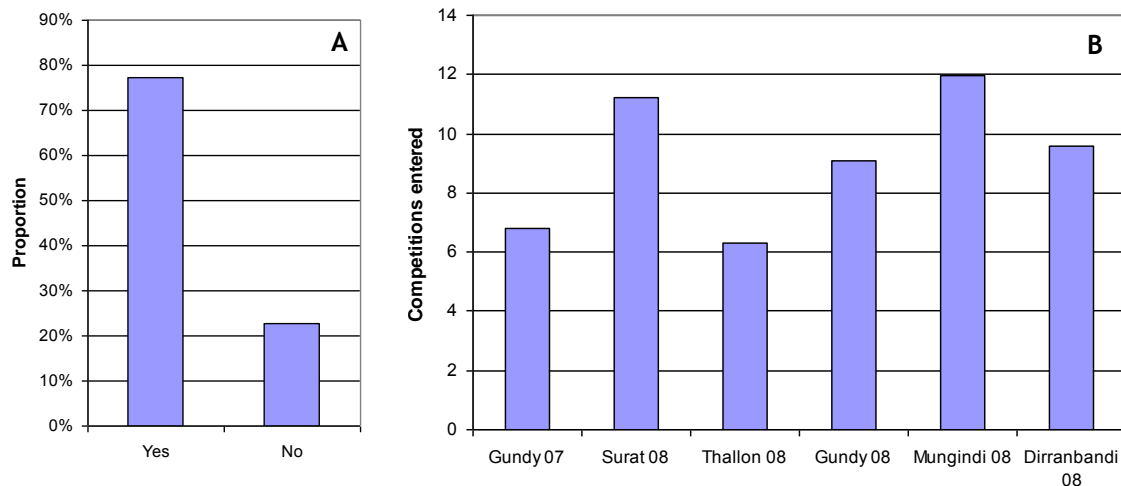


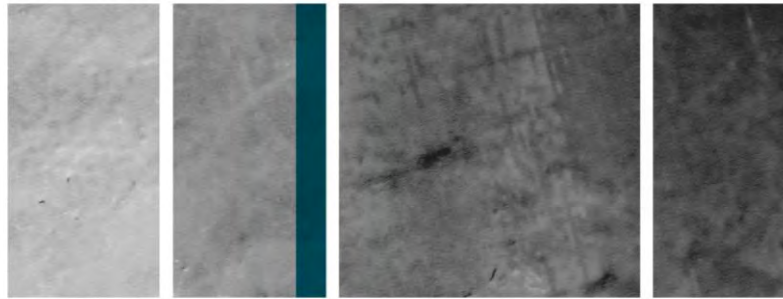
Figure 7. The proportion of anglers who had past competition experience (A) and the mean number of events they had entered (B) (n=379).

3.2.6. Improving competitions

Participants were asked what they would like to see changed or improved to make the carp competitions more enjoyable. The responses were quite event-specific and provided some useful feedback to individual event organisers. There were also some overarching trends in the comments. The most common request (17 out of 82 responses) was for the events to be held for a longer duration. This would provide more time and incentive for people travelling from further afield to get to the event, set up camp, register and fish. An increase in the quality and quantity of event signage, particularly regarding directions to registration, camping and fishing sites, was also commonly requested. One aspect of this is the need to provide maps of the designated fishing and camping areas for people not familiar with the competition site.

3.2.7. Competition advertising

A number of different methods were used to advertise upcoming carp fishing competitions. Participants were asked through which of these outlets they heard about the event. Word of mouth was by far the most common method (Figure 8). Many of the people entering the competitions were members of a local fishing club and found out via information and flyers sent to the club (37%). As the competition series progressed, the proportion of entrants listing their local fishing club as the key source of information increased. At Goondiwindi 2007, only 8% of entrants were informed by a fishing club. By the end of the series at Dirranbandi 2008,



74% of people learnt of the competition from their club. Approximately 20% of entrants learnt about the competitions through the media and posters. A large majority of these people had travelled to the event from out of town.

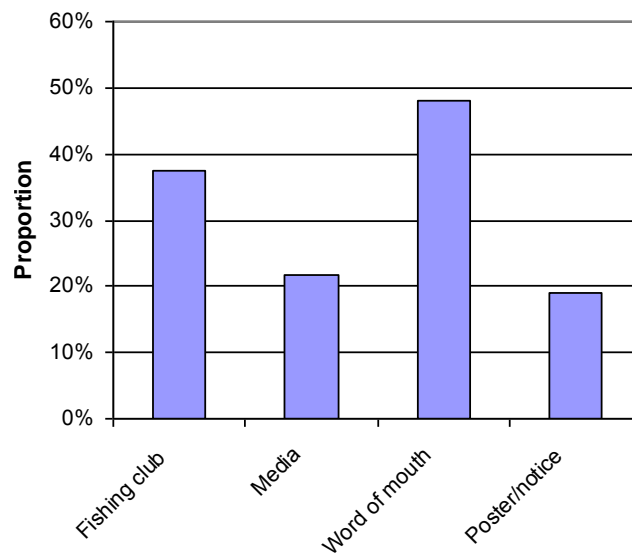


Figure 8. The principal method through which people found out about the carp competitions (n=508).

3.3. Perceived impacts of carp

3.3.1. The negative impacts

Participants were asked what they believed were the negative impacts of carp. The responses were consistent across the different competitions. Only 4% of respondents thought carp had no negative impacts (Figure 9). This group included several coarse fishing specialists who had traditionally targeted carp in England before migrating to Australia. The most frequently selected negative impact was that carp cause a decline in the number of native fish (84%). Almost as frequently selected was that they dirty the water, make it harder to catch native species and cause a decline in the abundance of aquatic vegetation. Half of those surveyed believed that carp tasted unpleasant to eat. A quarter thought that carp 'look out of place' in Australia waterways.

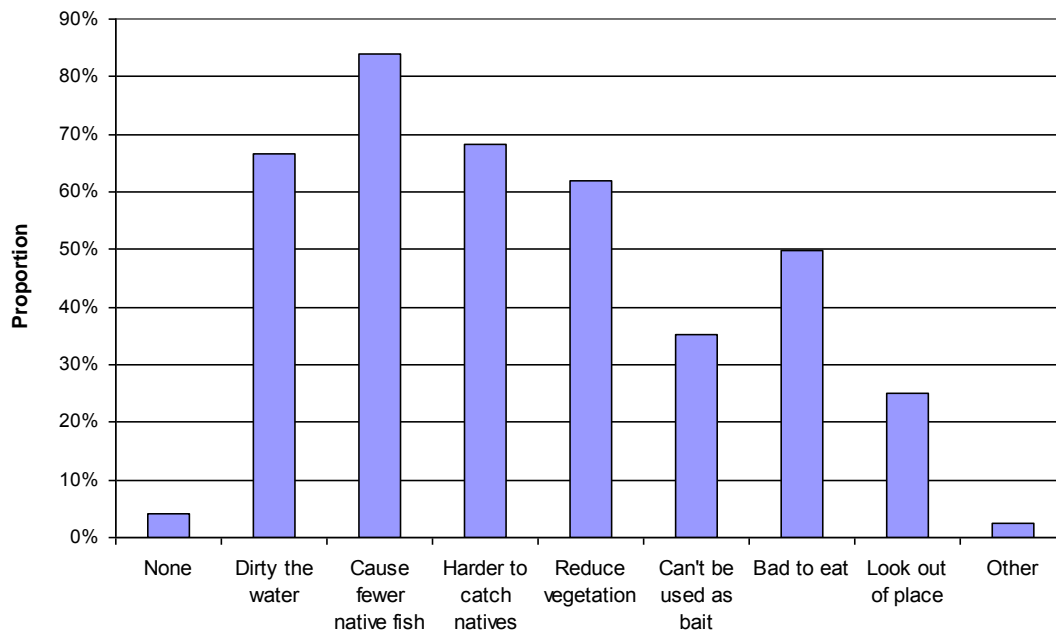
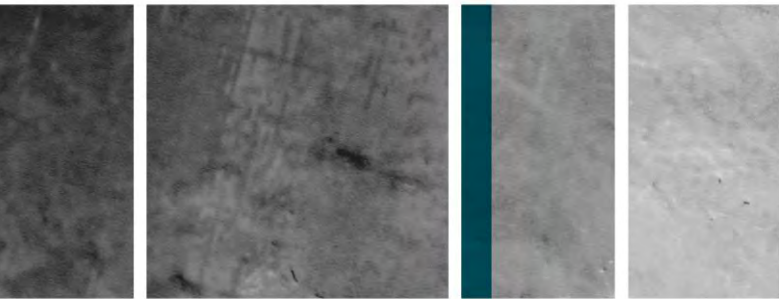


Figure 9. Negative impacts of carp in Australian waterways (n=422).

Participants were also asked to nominate what they believed to be the single worst impact of carp (Figure 10). More than half of the respondents listed carp reducing the abundance of native species (52%). Making it harder to catch native fish (17%), dirtying the water (13%) and reducing aquatic vegetation (11%) were other frequently nominated impacts.

The nominated worst impact of carp varied significantly with fishing club membership ($p=0.006$) and angler age ($p=0.048$). Angling club members more frequently thought carp reduced aquatic vegetation (14% vs 8%). Non-club members more frequently believed carp made it harder to catch native fish species (20% vs 12%).

Survey respondents between 21 and 35 years of age nominated the worst impact of carp as increasing turbidity only half as frequently as other age brackets. This age bracket also listed carp as being bad to eat at more than four times the frequency of other age groups.

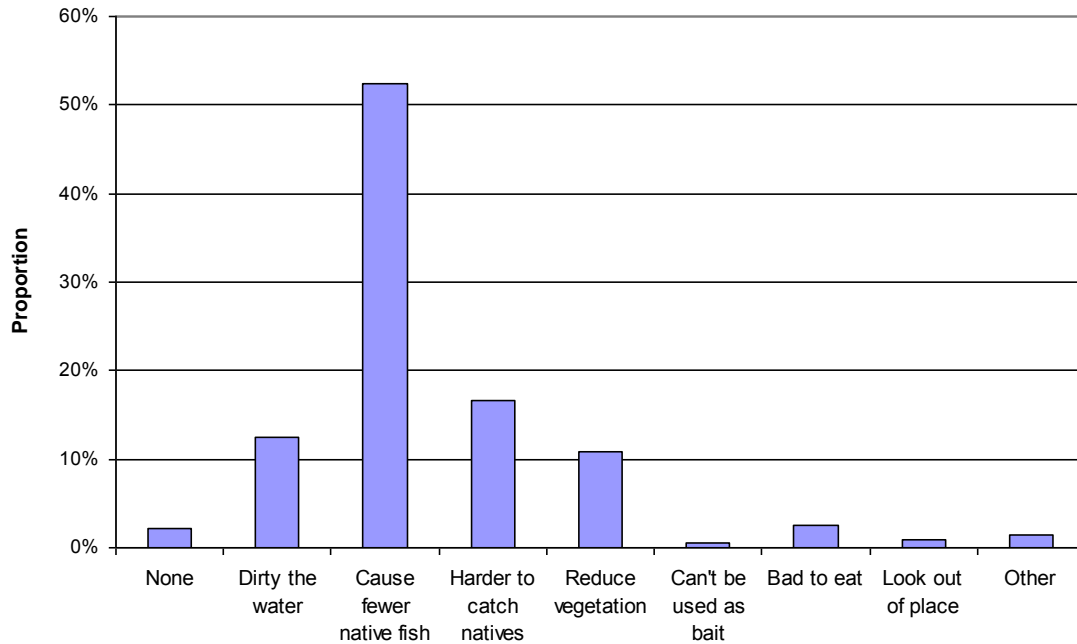
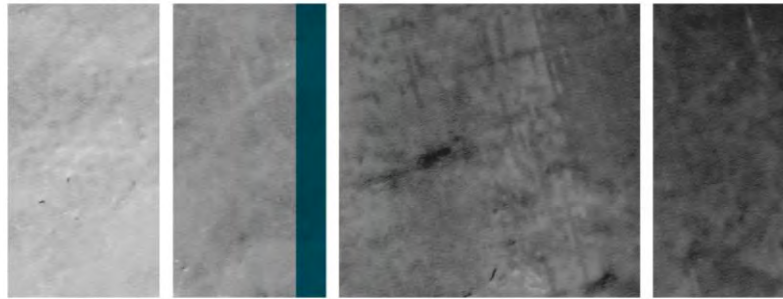


Figure 10. Survey responses on the single most negative impact of carp in Australian waterways (n=422).

3.3.2. The positive impacts

Participants were asked what they believed were positives of the presence of carp in Australian waterways. The survey responses were consistent across the competitions, although slightly more people believed carp had no positives at Goondiwindi 2007 (82%). The majority of people (62%) thought there were no benefits associated with the presence of carp (Figure 11). A number of people thought carp had some angling benefits:

- 26% said carp were a sporting fish to catch
- 18% thought they were a good species for children to catch
- 16% believed they provided an easy species to target.

Several people also commented that carp were good to eat.

Participants were also asked to nominate what they believed to be the best aspects of carp (Figure 12). The results were similar to the list of positives above. The majority of people again nominated carp as having no positive aspects (64%). A smaller proportion nominated their characteristics as a good angling species to be the species' most positive aspect.

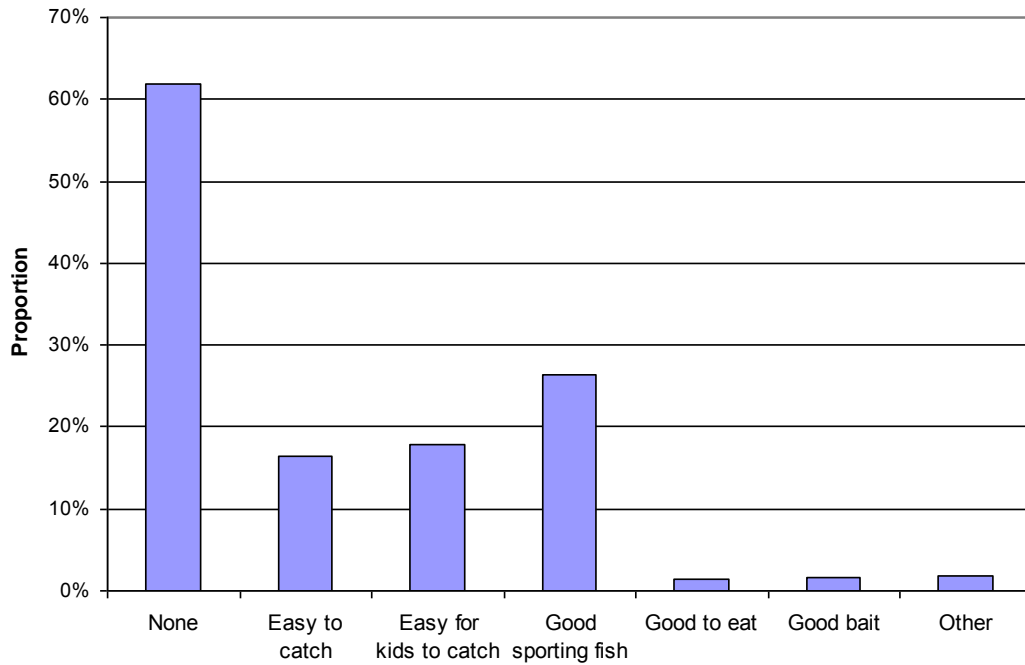
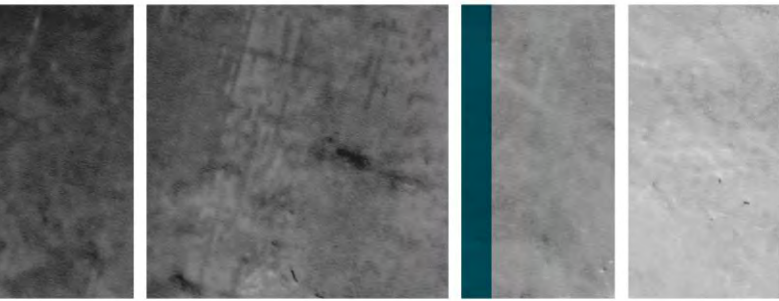


Figure 11. Positive impacts of carp in Australian waterways (n=477).

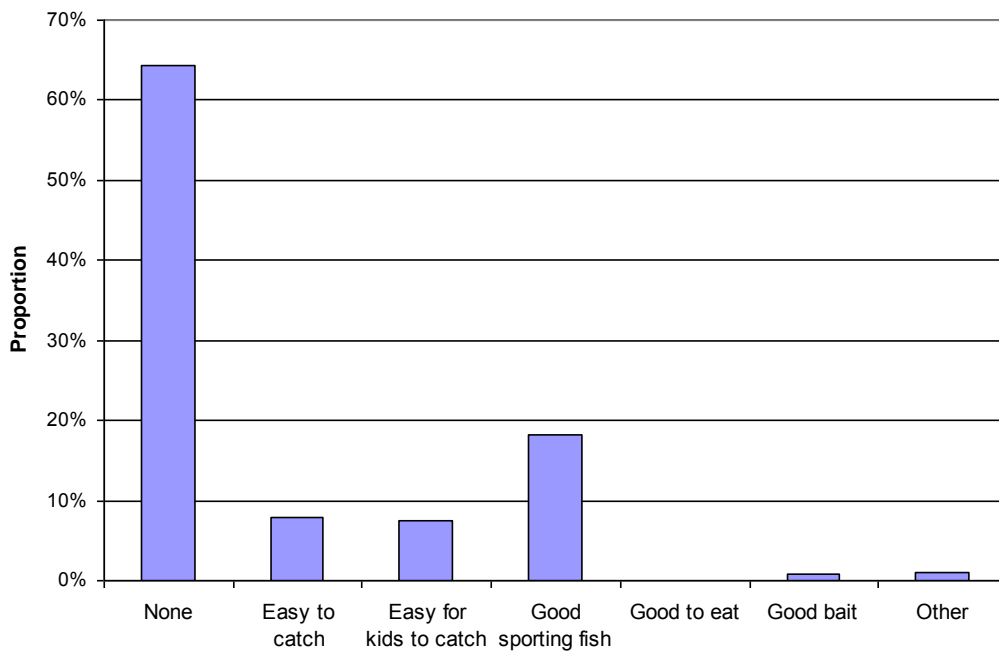
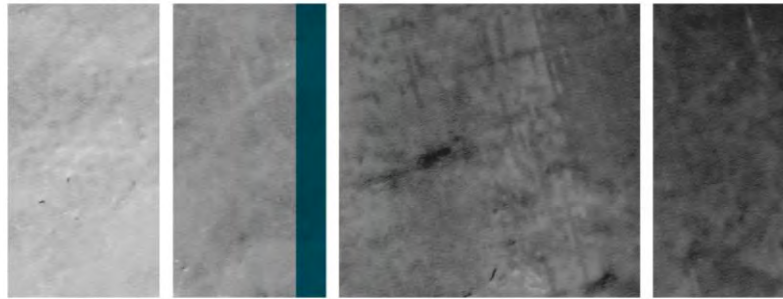


Figure 12. The 'best' aspects of carp in Australian waterways (n=477).



The 'best' aspect of carp did not vary much with angler demographics. The only significant variable was club membership ($p=0.049$). Fishing club members more frequently thought there were no positives to the presence of carp (71% vs 59%). Non-angling club members more frequently responded the best aspect was their prowess as a sporting fish (23% vs 12%).

3.3.3. Are carp a positive or negative thing?

Participants were asked to weigh up the positive and negatives of carp and rank them on a six-point scale. The greater part (84%) of those surveyed believed that the negatives outweighed the positives. In total, 53% thought that the negatives far outweighed any positive aspects. Only 4% said that on balance carp were a positive thing with a further 1% saying the negatives and the positives were equally balanced. The remainder of people were undecided (Figure 13).

The response of individuals differed significantly with participant's age ($p=0.015$). Younger respondents (<20 years) felt that the presence of carp was moderately bad, with their negative aspects outweighing any benefits. Older participants (20+ years) concurred with this, but to a greater degree, with the negative aspects far outweighing any benefits in carp's presence.

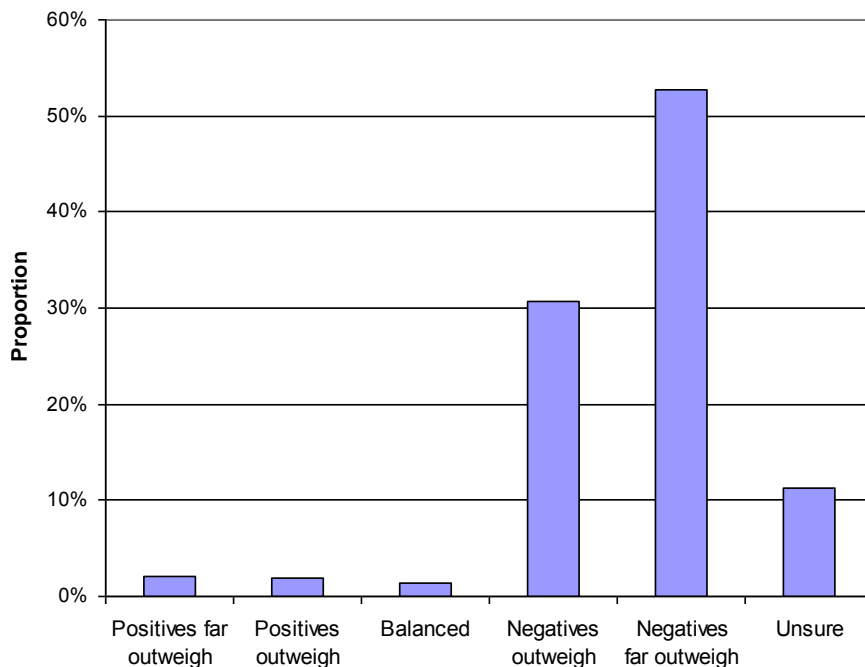
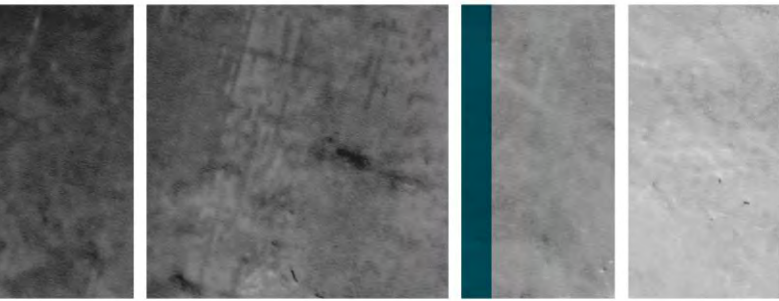


Figure 13. Survey responses on whether the positive or negative aspects of carp are greater ($n=486$).



3.3.4. Relative impacts of carp on river health

To better understand people's views on the impacts of carp relative to other processes potentially impacting the state of river health, participants were asked to rank the impacts of carp from most (10) to least (1) detrimental (Figure 14). The higher the mean rank the more concerned people were about the process' impacts. The processes were placed into one of four categories based on their mean rank:

- most important (6.1+)
- important (5.1-6.0)
- somewhat important (4.1-5.0)
- least important (<4.0).

Carp were deemed most important and to have by far the greatest impact on river health (Rank = 7.4). Processes viewed as important were:

- pollution (5.7)
- salinity (5.6)
- other pest fish (5.5).

Somewhat important processes included:

- clearing riparian vegetation (4.3)
- run-off from land clearing (4.3)

The least important processes were:

- pumping for irrigation (3.9)
- weeds (3.6)
- livestock trampling banks (3.6)
- dams and weirs (2.9).

The responses on the relative impacts on river health varied significantly for several impact-demographic combinations. Responses on the relative impacts of run-off from land clearing ($p=0.015$) and pumping for irrigation ($p=0.042$) both varied significantly with age. Younger participants listed the relative impacts of both these practices higher than older respondents did. The impact of livestock on river health was less frequently nominated with the number of competitions entered ($p=0.042$). Females also rated the impacts of clearing riparian vegetation to be less significant than males did ($p=0.024$).

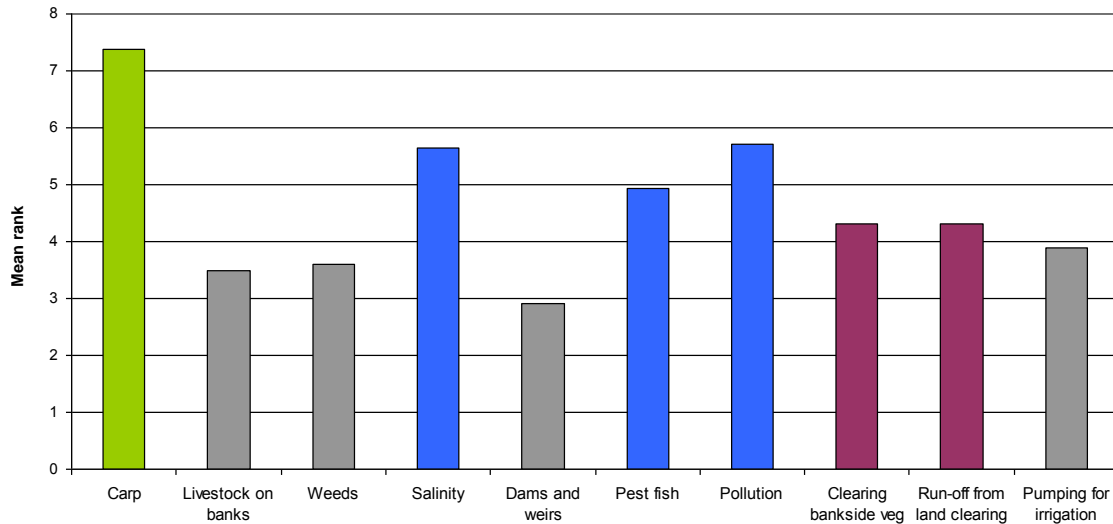
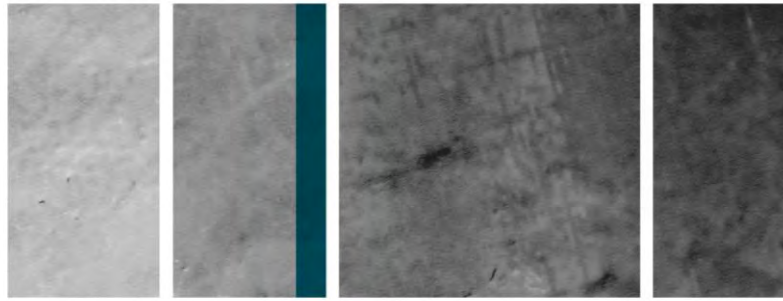


Figure 14. The relative importance of processes impacting river health. Higher mean ranks indicate greater concern by people about the impact (n=328). Category groupings: ■ most important; ■ important; ■ somewhat important; ■ least important.

3.3.5. Relative impacts of carp on native fish

To better understand people's views on the impacts of carp relative to other processes potentially impacting the status of native fish species, participants were again asked to rank the impacts from most (10) to least (1) detrimental (Figure 15). The processes were placed into one of four categories as above based on their mean rank. Carp were considered the most important and to have by far the greatest impact on native fish (Rank = 7.4). Processes viewed as important were:

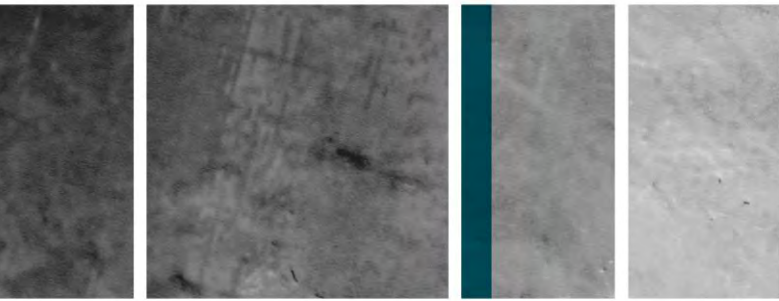
- other pest fish (5.7)
- removing riparian vegetation (5.6)
- pumping for irrigation (5.2).

Processes thought to be somewhat important were:

- weeds (4.3)
- livestock trampling banks (4.2).

The least important processes were:

- land clearing (3.9)
- climate change (3.7)
- dams and weirs (3.5).



Survey responses were quite similar across all demographics, except for the relative impact of weirs. Younger people ranked the impact of weirs on native fish to be significantly greater ($p=0.047$) compared to older participants.

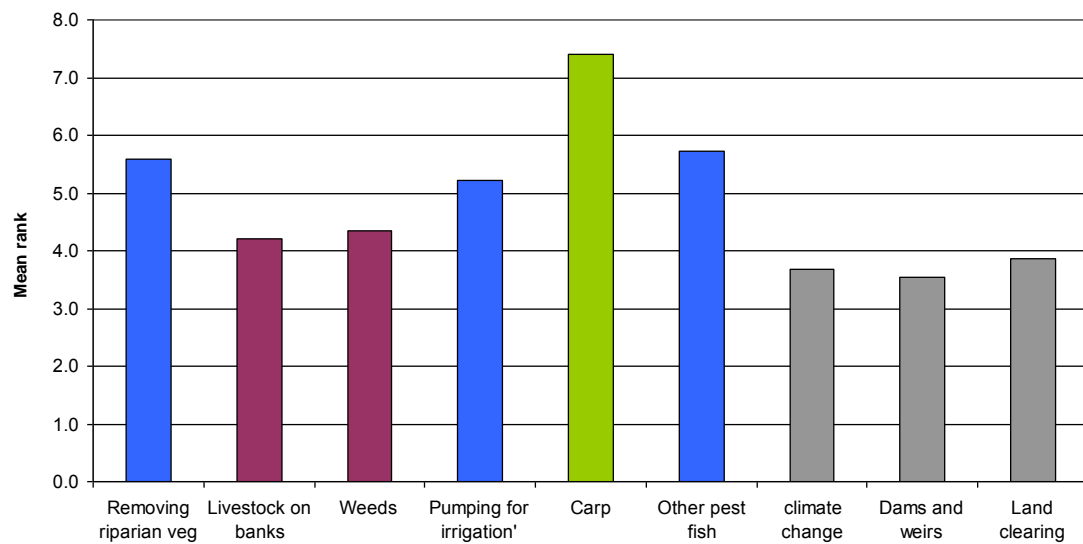
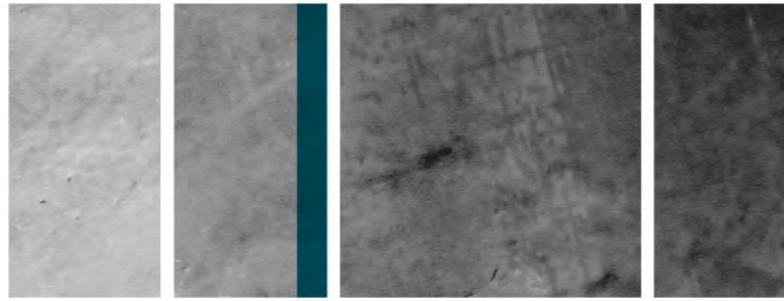


Figure 15. The relative importance of processes impacting the status of native fish. Higher mean ranks indicate greater concern by people about the impact ($n=319$). Category groupings: ■ most important; ■ important; ■ somewhat important; ■ least important.



4. Discussion

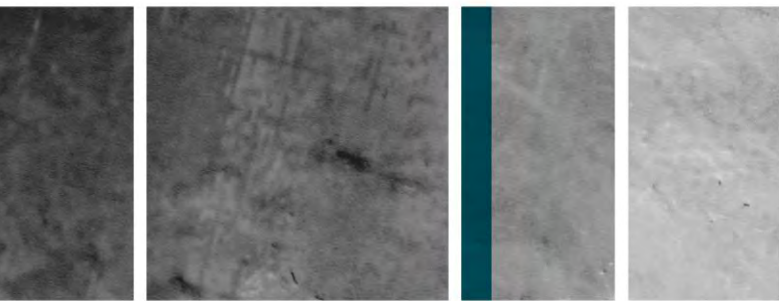
The demographics of the carp fishing competition participants captured a broad cross-section of the community. These events attracted participants with a wide range of angling experience, from keen anglers who fished weekly, to people who had never entered a competition before and fished less than once a year. Participation of the latter is particularly encouraging from a pest fish management perspective because it allows engagement and dialogue with a section of the community that may not be as well informed or aware of issues caused by pest fish. This engagement can help lead to increased participation, support and uptake of pest fish management initiatives.

Research on pest fish competitions is scarce and we found no previous data on the human dimensions of pest fish-outs, apart from comparisons between social aspects of general and tournament anglers. Although the sporting and challenging aspects of participating in angling competitions are often important to many competition anglers, the overall qualities that attract people to fishing are generally evident during these events (Falk et al 1989; Siemer and Brown 1994). The main reasons given for participating in carp fishing competitions were mostly activity-general (eg socialising and having fun), except for removing carp. Conversely, most activity-specific motivations were lowly ranked (eg winning prizes and demonstrating angler skill).

These results compare favourably with past studies on general angler motivation and satisfaction. Siemer and Brown (1994) reported the majority of anglers held stronger motivations related to spending time with people, appreciating nature and escaping from everyday routines. Similarly, non-catch aspects of the fishing experience played a major role in the self-reported motivations of German anglers (Arlinghaus 2006). Catch-oriented motivations were ranked far lower in these studies, except by tournament anglers who placed greater emphasis on the number and quality of fish caught.

Several key demographic variables significantly influenced respondent's answers. The key motivations for members of fishing clubs were to relax and help restore the health of the river system. Removing carp from local waterways was the only catch-oriented motivation to be given a high priority. Non-club members and those who fished less frequently placed greater emphasis on activity-general motivations and primarily entered events to have fun. Although tournament anglers were often more catch-oriented and placed greater emphasis on challenge and accomplishment, socialisation and escape were also important motivational factors (Siemer and Brown 1994). Such contention of multiple fishing satisfactions is consistent with previous studies (eg Hudgins 1984).

Gender also influenced participant's primary motivation for participation. Males more frequently entered competitions to have a good time. In contrast, females more frequently participated to spend time with their family (particularly those between 21 and 45 years of age). Females also formed a higher proportion of anglers who fished infrequently and entered as a group. Thus, some females in the age bracket typical of those with children appear to be entering competitions because the rest of their family are participating. This provides an opportunity for fisheries and NRM managers to communicate with a section of the community that may not have an in-depth understanding of the issues surrounding pest fish and that may

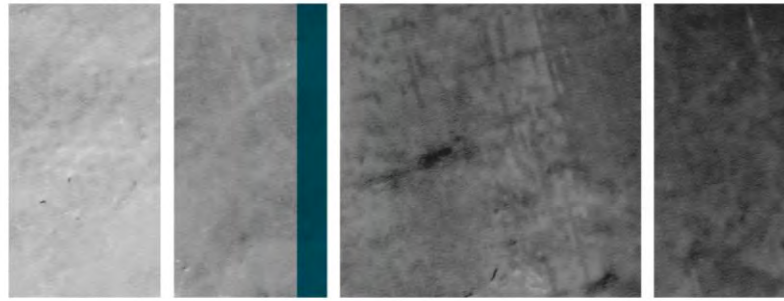


be missed by more conventional extension activities. Ensuring that these events maintain a family focus will assist continued participation from, and access to, this group.

Interestingly, among young anglers removing carp from the waterway was not a high priority. Few young people (18-20 years) nominated removing carp as their primary motivation for participation. In contrast, among older participants it was a frequent response with 28% of those older than 50 years listing it as their key motivation. Schramm and Gerard (2004) observed no relationship between angler age and the relative importance of different motivations for fishing among club anglers in the USA. The contrast between the results of these studies may be due to context in which participants view carp fishing competitions. As respondents increased in age, their motivations switched from having fun to relaxation. Together these results suggest younger participants may be more focused on the immediate benefits of having fun, and older anglers are more relaxed and consider the broader and longer-term benefits from removing carp from the local waterways.

There is a public perception that recreational angling can be used to help manage carp populations. In the Lachlan River Catchment, NSW, 22% of people thought recreational fishing could be used as a management tool, and 22% believed recreational angling was an effective control method (Wallis et al 2009). Recent research on reducing local carp population numbers via carp fishing competitions suggests that this form of management is unlikely to have any significant or sustained benefits (Norris et al 2010). Population reductions from angling were reported to be less than 1.8% from the competitions investigated. To produce a relatively stable, low population density in the Murray-Darling Basin, it has been estimated that the population reductions need to remove approximately 90% of the carp biomass (Thresher 1997). For long-term benefits to be realised, intense, sustained recreational angling would be required. Angling does not target all size classes of carp, and it is unlikely that angling pressure will ever be intense enough to achieve a 90% biomass reduction, except potentially in small, isolated waterways where removed fish are not replaced through immigration and reproductive output is low. Future research could explore competition anglers' perceptions of the impact they have on local carp populations and likely participation rates in carp fishing competitions if informed that the environmental benefits are minimal.

Competition participant satisfaction and the success of a fishing tournament can be measured by the percentage of anglers who would participate again (Falk et al 1989). Overall angler satisfaction often varies as a function of the degree of catch orientation (Fedler and Ditton 1986; Aas and Kaltenborn 1995; Calvert 2002; Arlinghaus 2006). Minimally catch-oriented anglers place more emphasis on the activity-general aspects of fishing (Fedler and Ditton 1986; Aas and Kaltenborn 1995) and often prefer more diverse outcomes from their fishing experiences (Fedler and Ditton 1986). Anglers typically have more control over activity-general aspects (ie who to fish with, where to go) and therefore seem to be able to satisfy activity-general motivations more easily (Arlinghaus 2006). Conversely, activity-specific elements (particularly catch-related) are far more difficult for anglers to control (Vaske et al 1982). Since activity-general aspects of fishing are generally easier to satisfy, activity-specific (particularly catch-dependent) aspects often ultimately determine angler satisfaction (Arlinghaus 2006).



Participants in the current study, despite a wide range of angling experience and enthusiasm, were highly satisfied with the experience received from the carp competitions. Nearly all (98%) stated they probably or definitely would compete again. Removing large numbers of carp from local waterways may have been a motivating factor in participation, but not a key determinant of satisfaction. The more serious anglers most likely treated carp fishing as a novel and relaxing activity, rather than a scenario in which to test or demonstrate their angling prowess. Consequently, catch was of low importance. Given the willingness to participate in future events, indicators or measures of satisfaction were more likely to be based on activity-general elements. Moreover, many of the competitions are held in better stretches of local waterways which are less disturbed. In regions with more pristine, less disturbed waterbodies, angler satisfaction has been found to be less catch-dependent and more activity-general (Finn and Loomis 2001). To encourage further participation in, and satisfaction with, carp competitions, we can hold a competition for a longer duration as most commonly requested, by opening by opening registrations on the Friday night, or running the competitions on long-weekends where possible.

Carp were widely recognised by survey participants to have detrimental impacts and considered one of the most significant factors affecting overall river health and the status of native fish species. These results are consistent with Wallis et al (2009) who reported 100% of people surveyed in the Lachlan River Catchment (NSW) believed carp had a detrimental impact. Discussions with the few people in the current study who believed carp had no negative impacts revealed most were migrants from countries where carp are considered native species and specifically fished for or consumed.

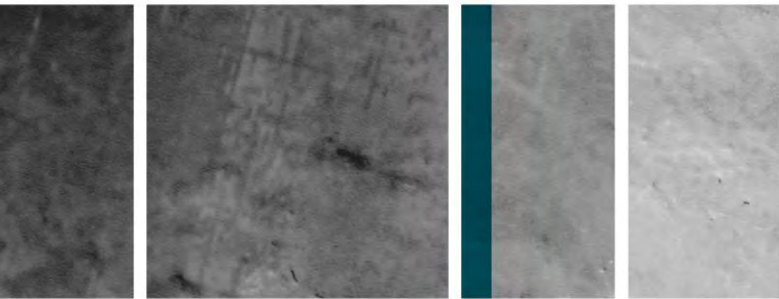
Members of fishing clubs rarely listed any benefits associated with the presence of carp. In comparison non-members believed that their sporting prowess, abundance and ease to catch were positive aspects. This difference may reflect the more specialised approach of club anglers who prefer to target specific species rather than fish for whatever is there. Non-specialised anglers appreciated the sport that could be gained from the availability, strength and size of carp.

The most detrimental impacts of carp in Queensland were perceived to be:

- a reduction in the abundance of native fish
- greater difficulty in catching native fish
- increasing turbidity
- reducing aquatic vegetation.

These findings mirror those surveyed in the Lachlan River Catchment, who additionally listed erosion as a major impact (Wallis et al 2009). In general, members of fishing clubs listed more specific carp impacts (eg increased turbidity) as their primary concern, but non-club members focused on the resultant outcome of these impacts (eg less native fish). This suggests that the members of fishing clubs may be more knowledgeable regarding the carp issue.

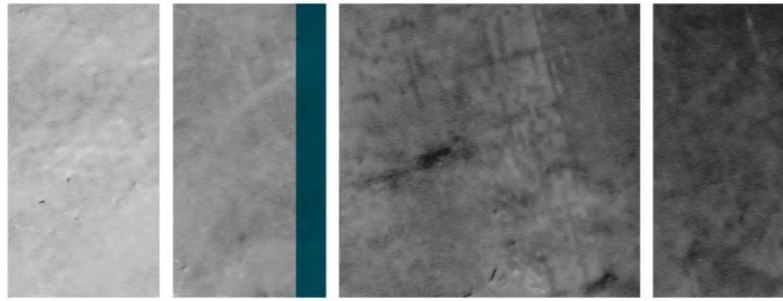
Participant age also influenced their perception of carp impacts. Younger participants (<20 years of age) believed the overall impact of carp was of a lesser degree than older respondents did. Younger people also ranked the impact of carp on turbidity much lower than

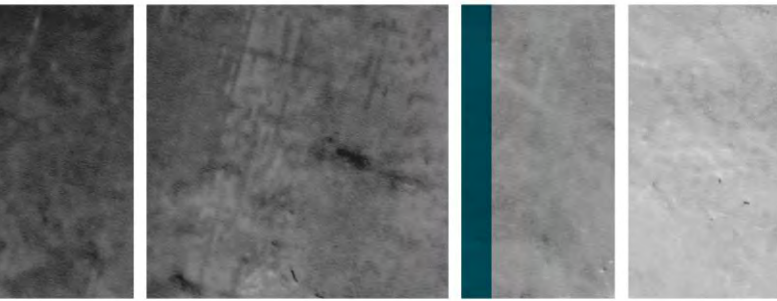


older generations. These age-based discrepancies may reflect participant exposure to waterways prior to, and post, carp invasion. Carp only became abundant in Queensland waterways in the mid 1970's (Koehn et al 2000). Older generations may remember what the local waterways were like prior to the invasion of carp and attribute the changes (ie increased turbidity) to the spread of the species. Younger participants may rarely or not ever have experienced clear flowing waters and high numbers of native species, thereby having limited baseline knowledge to compare to. These findings are supported by Fitzgerald et al (2007) who reviewed public attitudes towards invasive species in Australia and concluded that older people were generally more likely to regard an animal as a pest (and a more serious problem) than younger people.

Participants were asked to rank the impacts of carp relative to other potentially detrimental processes on overall river health and the status of native fish. Carp were consistently listed as the most significant factor. Clearing of riparian vegetation, pumping water for irrigation and the construction of dams and weirs which disrupt river continuity were all perceived to have relatively low impacts. Nonetheless, these processes can result in the same type of detrimental impacts as carp on river health and native fish species (Harris and Gehrke 1997; MDBC 2004). Clearing of riparian vegetation can lead to bank destabilisation, loss of habitat for native species (fish, birds and insects), sedimentation and increases in turbidity (Georges and Cottingham 2002). Pumping for irrigation and the construction of dams can limit the habitat, water quality and breeding cycles of native fish species (Blanch 2001; MDBC 2004). River degradation is generally caused by a complex combination of confounding factors. It is likely that these factors play a far greater role than carp in influencing river health and native fish numbers. Carp may just be occupying a vacant niche caused by other factors rather than being the primary cause of any changes (Koehn et al 2000). The impacts of carp are often easy for people to see or perceive, but the flow-on effects of other activities and processes are not so obvious. This may in part explain the public perception.

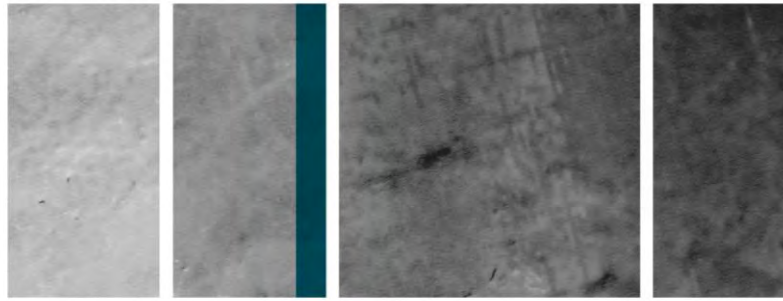
The family focus of carp fishing competitions attracted a range of people who may not ordinarily be involved in fishing or other fishing competitions. This provides an opportunity for fisheries and natural resource managers to communicate with a section of the community that may not have an in-depth understanding of the issues surrounding pest fish and that may be missed by more conventional extension activities. Ensuring that these events maintain a family focus will assist continued participation from, and access to, this group.



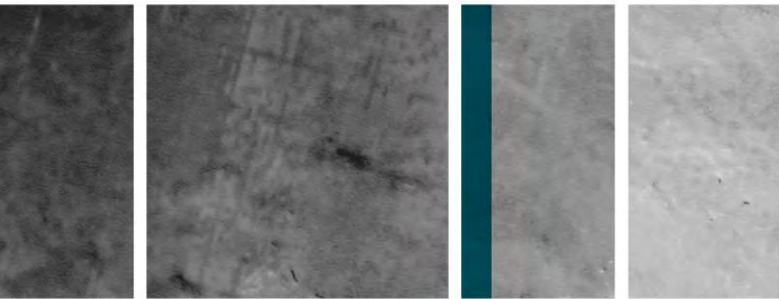


5. References

- Aas Ø and Kaltenborn BP (1995). Consumptive orientation of anglers in Engerdal, Norway. *Environmental Management* 19:751-761.
- Arlinghaus R (2006). On the apparently striking disconnect between motivation and satisfaction in recreational fishing: the case of catch orientation of German anglers, *North American Journal of Fisheries Management* 25:592-605.
- Blanch S (2001). *The Way Forward on Weirs*. Inland Rivers Network, Sydney, Australia.
- Brown P, Sivakumaran KP, Stoessesl D, Giles A, Green C and Walker T (2003). *Carp Population Biology in Victoria*. Marine and Freshwater Resources Institute, Department of Primary Industries, Snobs Creek, Australia.
- Burns RC, Graefe AR and Absher JD (2003). Alternate measurement approaches to recreational customer satisfaction: satisfaction-only versus gap scores. *Leisure Sciences* 25:363-380.
- Calvert B (2002). The importance of angler motivations for sports fishery management. In: TJ Pitcher and CE Hollingworth (Eds), *Recreational Fisheries: Ecological, Economic and Social Evaluation*, Blackwell Scientific Publications, Oxford, UK.
- Conover M (2002). *Resolving Human-Wildlife Conflicts: The Science of Wildlife Damage Management*, Lewis publishers, New York, USA.
- Decker DJ, Brown TL and Siemer WF (2001). *Human Dimensions of Wildlife Management in North America*. The Wildlife Society, Bethesda, Maryland, USA.
- Falk JM, Graefe AR and Ditton RB (1989). Patterns of participation and motivation among saltwater tournament anglers, *Fisheries* 14(4):10-17.
- Fedler AJ and Ditton RB (1986). A framework for understanding the consumptive orientation of recreational fisherman, *Environmental Management* 10:221-227.
- Finn KL and Loomis DK (2001). The importance of catch motives to recreational anglers: the effects of catch satiation and deprivation, *Human Dimensions of Wildlife* 6:173-187.
- Fisher MR (1997). Segmentation of the angler population by catch preference, participation and experience: a management-oriented application of recreational specialization, *North American Journal of Fisheries Management* 17:1-10.
- Fitzgerald G, Fitzgerald N and Davidson C (2007). *Public Attitudes Towards Invasive Animals and their Impacts*. Invasive Animals Cooperative Research Centre, Canberra, Australia.
- Georges A and Cottingham P (2002). *Biodiversity in Inland Waters - Priorities for its Protection and Management: Recommendations from the 2001 Fenner Conference on the Environment*. CRC for Freshwater Ecology, Canberra, Australia.
- Gilligan D and Rayner T (2007). *The Distribution, Spread, Ecological Impacts and Potential Control of Carp in the Upper Murray River*. NSW Department of Primary Industries, Sydney, Australia.
- Harris JH and Gehrke PC (1997). *Fish and Rivers in Stress: the New South Wales Rivers Survey*. NSW Fisheries and CRC Freshwater Ecology, Cronulla, Australia.
- Holland SM and Ditton RB (1992). Fishing trip satisfaction: a typology of anglers, *North American Journal of Fisheries Management* 12:28-33.



- Horn, C (2006) Involving communities in pest animal control. In Ballard, G (Ed.) *Social drivers of invasive animal control. Proceedings of the Invasive Animals CRC workshop on the social drivers of invasive animal control*. 26-17 July 2006 Adelaide, Invasive Animals Cooperative Research Centre, Canberra.
- Hudgins MD (1984). Structure of the angling experience, *Transactions of the American Fisheries Society* 113:750-759.
- Hume DH, Letcher AR and Morrison AK (1983). *Final Report. Carp Program No. 10*, Fisheries and Wildlife Division, Victorian Ministry for Conservation, Melbourne, Australia.
- Koehn J, Brumley A and Gherke P (2000). *Managing the Impacts of Carp*. Bureau of Rural Sciences, Canberra, Australia.
- Lintermans M (2004). Human-assisted dispersal of alien freshwater fish in Australia, *New Zealand Journal of Marine and Freshwater Research* 38:481-501.
- McCullagh P and Nelder JA (1989). *Generalized Linear Models* (2nd edition), Chapman and Hall, London, UK.
- MDBC (Murray-Darling Basin Commission) (2004). *Native Fish Strategy for the Murray-Darling Basin 2003-2013*. MDBC Publication No. 25/04, MDBC, Canberra, Australia.
- Miller KK (2009). Human dimensions of wildlife population management in Australasia: history, approaches and directions, *Wildlife Research* 36:48-56.
- Nimmo DG and Miller KL (2007). Ecological and human dimensions of management of feral horses in Australia: a review, *Wildlife Research* 34:408-417.
- Norris A, Hutchison M and Chilcott K (2012). *The Role of Fishing Competitions in Pest Fish Management*. PestSmart Publication, Invasive Animals Cooperative Research Centre, Canberra, Australia.
- Reid DD and Harris J (1997). Estimation of the total abundance: the calibration experiments. In: JH Harris and P Gherke (Eds), *Fish and Rivers in Stress - the NSW Rivers Survey*. NSW Fisheries, Narrandera, Australia.
- Schramm HL and Gerard PD (2004). Temporal changes in fishing motivation among fishing club anglers in the United States, *Fisheries Management and Ecology* 11:313-321.
- Siemer WF and Brown TL (1994). Motivations and satisfactions of Lake Ontario boating salmonid anglers, *Journal of Great Lakes Research* 20(2):457-470.
- Sinclair ARE, Frywell JM and Caughley G (2006). *Wildlife Ecology, Conservation, and Management* (2nd edition), Blackwell Publishing, Oxford, UK.
- Snedecor GW and Cochran WG (1980). *Statistical Methods* (7th edition), Iowa State University Press, Ames, USA.
- Thresher RE (1997). Physical removal as an option for control of feral carp populations In: J Roberts and R Tilzey (Eds), *Controlling carp: Exploring options for Australia*. 22-24 October 1996, Albury. CSIRO and Murray-Darling Basin Commission. Pp 58-73.
- Vaske JJ, Donnelly MP, Herberlein TA and Shelby B (1982). Differences in reported satisfaction ratings by consumptive and non-consumptive recreationists, *Journal of Leisure Research* 14:195-206.



Appendix A

Competitor Feedback Survey

Competition:.....

Name:

Please note:

Participation in this survey is voluntary. Your responses are confidential and will be used by the competition organisers, Queensland Fisheries and the Invasive Animals Cooperative Research Centre to improve future fishing competitions.

You must be over 18 years of age to participate in this survey.

Q1. Are you: Male Female

Q2. In which year were you born? 19 ____

Q3. Are you a member of a fishing club? Yes No

Q4. How often do you go fishing?

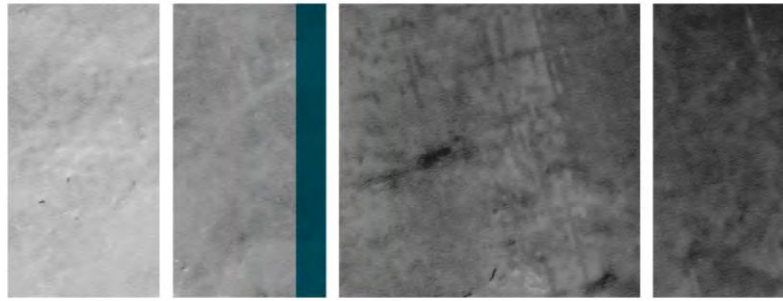
Weekly Monthly Six monthly Annually or less

Q5. Why did you choose to take part in this fishing competition?

Please tick all that apply to you

- A. To have fun
- B. To relax
- C. To spend time with my family
- D. To socialise
- E. To be challenged as an angler
- F. To show other people I'm good at fishing
- G. To win a prize
- H. To improve the health of local waterways
- I. To improve my chance of catching native fish in the future
- J. To get rid of carp
- K. Other. Please describe: _____

Q6. Which one of these (A to K, above) was your main reason for competing? _____



Q7. If this competition was held again next year, would you compete in it again?

- Definitely would
- Probably would
- I'm unsure
- Probably would not
- Definitely would not

Q8. Have you previously taken part in a fishing competition?

- Yes. About how many fishing competitions have you previously entered? _____
- No. Please go to Question 6.

Q9. Compared to the other fishing competitions you've entered, was this one 'Better', 'Much the Same' or 'Worse' for each of the following aspects?

<i>Aspect of competition</i>	Better	Same	Worse	I'm unsure
The amount fun you had	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Entry cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your chance to catch fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Your chance to relax	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Quality of the prizes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Number of prizes on offer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effort required to enter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ease of getting a good fishing spot	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How 'well organised' it was	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

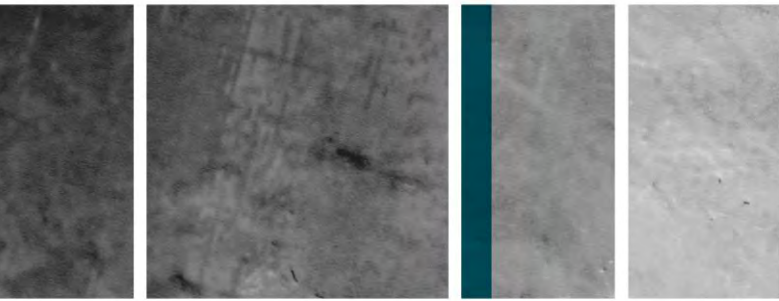
Q10. How do you think the organisers could make this competition better?

Q11. How did you learn about this competition?

- Via my fishing club
- Media
- Word of mouth
- Poster/notice

Q12. Did you come to this competition: Alone As part of a group

If as a group many adults _____ kids_____



Q13. Which of the following would you say are negatives associated with carp, in QLD?

- A. None. I don't think there are negatives associated with carp in QLD's waterways
- B. Carp dirty the water
- C. Carp cause there to be fewer native fish
- D. Carp make it harder to catch native fish
- E. Carp cause there to be less aquatic vegetation
- F. Carp can't be used for bait
- G. Carp are bad to eat
- H. Carp look out of place
- I. Other. Please describe: _____

Q14. From the choices above (A to I), what is the worst thing about carp in QLD? _____

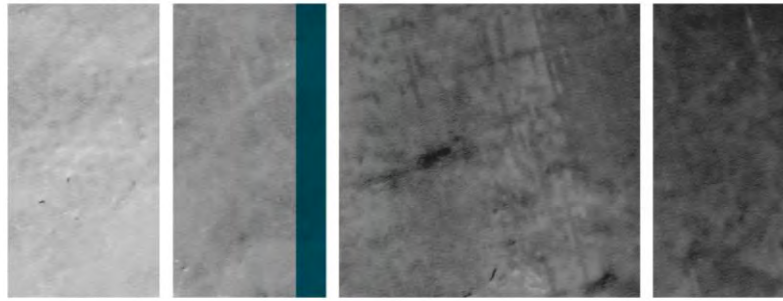
Q15. Which of the following would you say are positives associated with carp, in QLD?

- A. None. I don't think there are positives associated with carp in QLD's waterways
- B. Carp are easy to catch
- C. Carp are easy for children to catch
- D. Carp are a good sporting fish
- E. Carp are good to eat
- F. Carp are good bait
- G. Other. Please describe: _____

Q16. From the choices above (A to G), what is the best thing about carp in QLD? _____

Q17. Thinking about carp, in QLD's waterways, how do their positive and negative aspects compare?

- Positives far outweigh the negatives
- Positives outweigh the negatives
- Positives and negatives are balanced
- Negatives outweigh the positives
- Negatives far outweigh the positives
- I am unsure



Q18. The following lists contain things that have the potential to have negative impacts on native fish and river health in QLD. Rank them from worst to least (1 = least, 9/10 = worst) with regard to the relative level of their impact.

Each rank can only be used once so each item on the list must have a different rank

<u>Impacts on native fish</u>	<i>Rank (1-9)</i>
Clearing bank-side vegetation	_____
Livestock on banks	_____
Weeds	_____
Pumping for irrigation	_____
Carp	_____
Other pest fish	_____
Climate change	_____
Dams	_____
Land clearing	_____
Other. _____	_____

<u>Impacts on total river health</u>	<i>Rank (1-10)</i>
Carp	_____
Livestock on banks	_____
Weeds	_____
Salinity	_____
Dams	_____
Other pest fish	_____
Pollution	_____
Clearing bank-side vegetation	_____
Dirty run-off from land clearing	_____
Pumping for irrigation	_____
Other. _____	_____

Thank you for your time and we hope you enjoyed the competition.

