

FINAL REPORT (DEVELOPMENT AWARD)

AWARD CODE and TITLE

2008/314.32 People development program: 2013 FRDC international travel bursaries

AWARD RECIPIENT: Jamin Forbes

ADDRESS:

New South Wales Department of Primary Industries
Narrandera Fisheries Centre
70 Buckingbong Road
Narrandera NSW 2700

DATE: 1st October 2013

ACTIVITY UNDERTAKEN

Attended the American Fisheries Society conference in Little Rock, Arkansas from 8-12 September, where results of NSW recreational fisheries research on Murray crayfish (*Euastacus armatus*) catch, harvest and effort were presented. Post conference, I travelled to Florida to meet with Dr Mike Allen from the University of Florida, and discussed strategies for incorporating angler catch, recreational fishing research and subsequent management. In addition, I travelled to North Carolina and met with Professor Ken Pollock of North Carolina State University who is a world expert on fisher creel surveys. We discussed several opportunities to implement Murray cod surveys in the Murray-Darling Basin

OUTCOMES ACHIEVED TO DATE

Conference outcomes (points relevant to Australian fisheries are in bold):

- Identified that web-based angler surveys using email address derived from fishing licenses can offer reasonable quality information with less effort and cost in comparison to traditional on-site or mail surveys.
- How do anglers spatially target fish in the USA? Assumption was that a portion of the fish population is safe from angling due to angler preferences and fish behavior; however, another study found that all fish were found to be equally vulnerable to angling. **My current study involves the spatial distribution of anglers along a select reach of the Murrumbidgee River and how distance from public access impacts fishing effort, catch and harvest or recreational fish species. I hypothesize that fishers located further distances away from public access lead to improved fishing opportunities due to less fishing pressure. In addition, fish located in closed areas (such as beneath weirs) may be less susceptible to angling until they move out of the protected area.**
- Hatchery practices for salmonids aim for >67% of the population to be wild fish with the remainder made up of hatchery bred fish (identified by mark detections). **This is applicable to Australian brown and rainbow trout as we have just commenced coded wire tagging of hatchery fish and can accurately gauge the proportion of hatchery v wild fish.**
- High catch and release rates for largemouth bass decrease the effectiveness of harvest regulations such as minimum legal limits, requiring physical removal of fish in some areas to reduce overcrowding. A slot limit was ineffective at changing the population structure due to the high instance of catch and release. **This could happen in certain Australian impoundments stocked with golden perch and Australian bass, particularly in regions with high catch and release rates.**
- US agencies are restoring habitat in impoundments as many of the dams are over 50 years old and the original structure has broken down. Artificial habitats are effective at improving recreational fishing opportunities in areas with little or no structure. **Many Australian impoundments are approximately 50 years old and have degrading fish habitat. Habitat enhancement could improve rec fishing opportunities in some instances.**

OUTCOMES ACHIEVED TO DATE (cont.)

- Largemouth bass are stocked in 35 US states. The stocking programs vary with success outcomes dependent on agency objectives. Many programs are not assessed for success. In order to assess survival of stocked fish, the presenter stressed the need to sample directly after stocking. **This immediate sampling of juvenile fish would be useful, however small Australian native fish are difficult to collect, which is a problem acknowledged by the US presenter in the largemouth bass example. A methodology to reliably collect juvenile fish such as Murray cod and golden perch from riverine environments would greatly improve stocking assessments in Australia.**
- The aim of many US stocking programs is to reduce or cease stocking events once a fishery has recovered. The need to evaluate stocking success is paramount to this goal, else stocking may continue without cause. **This is relevant to my current PhD research on stocking effectiveness of Murray cod and golden perch.**
- Different methods of stocking largemouth bass identified no difference in survival between fish released at boat ramps compared to those dispersed about the waterway. It was highlighted however that increased handling by the dispersal method increased mortality of those fish. **This may be applicable to Australian native fish dispersal as fishing clubs often want to disperse fish and hatcheries choose to release at easily accessible locations.**
- Catch at age models: Does sex matter? Most models do not differentiate male and female, despite sexual dimorphism. Harvest regulations can make one sex more likely to be harvested. ie slot limits can have the slower growing sex more vulnerable to harvest due spending longer time within the slot. **As such, sex does matter in harvest strategies, which could have implications for the proposed slot limit for Murray cod. This is directly applicable to my research on harvest regulations and minimum legal limits for this species.**
- Environmental DNA (eDNA) is sampling without seeing the fish, involving collection of water samples, DNA extraction and amplification to identify species present in that sample. eDNA has greater detection capability than normal sampling methods and eliminates gear bias. **This could be a tool used to search for invasive species, endangered or rare species in Australian inland waters.**
- Atlantic sturgeon are listed as endangered and their population status is unknown. Traditional sampling methods are harmful to the fish, so US researchers used side scan sonar to identify individual fish. **This method may be useful to studies of large Murray cod in waterways where they can be difficult to capture with traditional equipment.**

Summary of meeting with Dr Mike Allen, University of Florida

- Discussed proposed slot limit for Murray cod in NSW. **Dr Allen has worked on Murray cod before with VIC DPI and identified that a 60-80cm slot limit for this species would be beneficial.**
- Discussed creel survey methodologies for obtaining quality data with limited budgets. Dr Allen indicated that they use cameras to count fishing effort, and perform limited interviews to obtain catch rate information. **This would be a new technique for Australian fisheries and would require fewer staff on site to gain data, however cost of the cameras is a consideration.**
- Dr Allen is interested in identifying the spatial scale of anglers and how they target fish. **This could link in with my PhD creel survey data, in which we were able to identify where crayfishers targeted their effort and also where Murray crayfish were caught and harvested. This type of analysis could potentially identify areas of low fish abundance, demonstrative of potential localized decline, habitat degradation or other issue requiring intervention.**

OUTCOMES ACHIEVED TO DATE (cont.)

Summary of meeting with Professor Ken Pollock, North Carolina State University (all discussions were focused on new projects in Australia)

- Discussed my existing Murrumbidgee River creel survey design and analysis, to identify any problems that could be addressed prior to publication. Prof Pollock was comfortable with the design of the survey and its inherent bias reduction.
- Discussed a future creel survey design for Lake Mulwala and the use of aerial drones to collect fishing effort data. Drones would be a new and novel technique for collection of creel data. Prof Pollock believed it to have significant merit for effort counts due to the ability of the aircraft to fly low and slow, whilst collecting high resolution images for later interpretation. Detailed design of the proposed Mulwala creel survey involves aerial counts for effort (either manned or unmanned depending on cost) and using two clerks in a vehicle (one for boats, one for shore based fishers) who roam the popular fishing sites and boat ramps together to obtain catch rates from fisher interviews. Prof Pollock agreed that a gauge of fishery quality can be made from targeting a temporal strata that covers the summer. Ideally 1 December until the end of April. The number of days sampled per month (of weekend/weekday) will be dependent on budgetary considerations, but needs to be maximised to reduce variances. As this impoundment has many tournaments, it was discussed how the tournament fishers are catch and release, intensify effort and could have an effect on the fishery for days after the tournament is over. Tournament monitoring could be achieved by liaising with the operators of the event to get catch data, however, this data will have no record of undersized fish. A new survey could place creel clerks at weigh stations to quickly interview anglers as they measure fish to gauge the amount of smaller fish caught in addition to the fish over the minimum legal limit. Prof Pollock believed that tournament days and 'normal' sampling days will need to be kept separate, but reported together. Particularly as catch and release has a mortality component associated with it which can be combined with the observed creel survey harvest.
- Similar to Dr Allen, Prof Pollock is also interested in identifying the spatial scale of anglers and how they target fish.

Acknowledgments

NSW Department of Primary Industries
NSW Department of Primary Industries - Narrandera Fisheries Centre
NSW Department of Primary Industries - Recreational Fishing Trust
Charles Sturt University
Dr Mike Allen, University of Florida
Prof Ken Pollock, North Carolina State University

Background

The American Fisheries Society Annual meeting is the largest annual meeting worldwide which has a substantial recreational fishing component. Many topics presented were highly relevant to NSW recreational fisheries.

Current NSW recreational fishing research was presented to an international audience for comment and critique, enabling refinement of research outcomes.

The trip enabled me to learn about new techniques which can be applied to recreational fishing research programs in NSW. The department will gain important international research network opportunities for fisheries research.

I observed research activities and met with research staff that are world-leaders in their field on issues that have application in Australia. This may lead to collaborations and external funding opportunities.

Need

I presented results of Murray crayfish catch, effort and harvest from my recently completed angler creel survey to the American Fisheries Society at their annual conference. During the conference I attended numerous symposia where I gained exposure to experts in fisheries research and shared my knowledge and findings with other researchers. Following the conference, I met with Dr Mike Allen who is an expert on harvest regulations and population modelling, and has worked with Murray cod previously. I also met with Prof Ken Pollock, who is a global authority on fisher creel surveys.

My research is funded by the NSW recreational fishing trust and my current outcomes are directed toward improving the recreational fishery for Murray cod, golden perch and Murray crayfish in NSW. These outcomes include advising fishery managers of the catch, harvest and effort by recreational fishers in a representative reach of the Murrumbidgee River and also assessing size and age of maturity of Murray cod and golden perch. Comparison between riverine and impoundment fisheries is also undertaken. The effectiveness of stocking hatchery reared fish into rivers and impoundments is also being investigated.

These outcomes will enable assessment of current regulations and provide recommendations for future regulations to prevent fishery decline and ultimately improve recreational outcomes for anglers.

Objectives

1. To network with other researchers at an international conference

I liaised with researchers and higher degree students at the conference and developed relationships whereby future interactions and collaborations were discussed.

2. To learn from industry leaders and incorporate this new knowledge to NSW fisheries

Meeting with Mike Allen and Ken Pollock and discussing both my research and their own interests was invaluable to increasing my own knowledge of recreational fishing research. In particular I was able to discuss the implications of harvest restrictions and minimum legal limits for Murray cod and golden perch with Mike Allen, who has authored many papers on the subject and worked with fisheries all over the world.

In addition, Ken Pollock wrote the book *Angler Survey Methods and their Applications in Fisheries Management* which defines angler creel surveys. To spend a day discussing my previous survey and also future research I am planning was important to obtain informed opinion on what is planned as a novel method of conducting fishing effort estimations.

3. To present my findings at the international level

I presented the results of my 2012/13 Murrumbidgee River creel survey as it pertained to Murray crayfish. My talk was well attended and several questions were fielded at the time and further discussions ensued.

Methods

I attended the American Fisheries Society Conference in Little Rock, Arkansas from 8-12 September, where I presented results of NSW recreational fisheries research on Murray crayfish catch, harvest and effort. During the conference, I also attended symposia on environmental DNA, stocking and hatchery enhancement, habitat improvement, and harvest regulation assessment.

Post conference, I travelled to Florida to meet with Dr Mike Allen from the University of Florida, and discussed strategies for recreational fishing research. In addition, I travelled to North Carolina and met with Professor Ken Pollock of North Carolina State University who is a world expert on angler creel surveys.

Results/Discussion

New creel survey techniques

At the conference, I identified a potential new method of obtaining information from fishers using email addresses obtained from fishing license databases. Despite this being incomplete coverage of the population, data can be obtained relatively without the significant expense normally associated with creel surveys. In addition, during discussions with Prof Ken Pollock, we designed a novel angler creel survey to use on Lake Mulwala to assess the Murray cod recreational fishery. The use of drones to collect fishing effort and a combined shore and boat based harvest truncated to the warmer months, will allow collection of quality data, and keeping costs lower than a traditional on-site survey. Also, Dr Mike Allen indicated that he uses on-site cameras at access

points (such as boat ramps) rather than creel clerks to estimate fishing effort, which he has found to be a cost reduction.

Stocking success

At the conference, I attended many talks regarding stocking hatchery reared fish as this is an area of research I am currently involved. The release strategies for hatchery reared fish were interesting in that some US agencies go to extreme lengths about whether to stock a waterway and with how many fish. They also consider the dollar cost of stocking and whether it is viable to proceed with an enhancement. The ultimate goal of many US stocking programs is to reduce or cease stocking due to re-establishment of a self-supporting population. With stocking being a widespread practice in the US, significant research has been performed on its effectiveness and associated strategies for fish survival stemming from release strategies, to monitoring juvenile fish post introduction. I learnt the importance of considering a wide variety of factors (eg water level, water quality, predators, impact on wild fish, food availability, release site, fish handling) toward stocking success.

Harvest controls

Harvest regulations are another aspect of my current research. In particular, minimum legal limits and slot limits are of importance to the Murray cod recreational fishery in Australia. My meeting with Dr Allen discussed the proposed slot limit for this species. Dr Allen's previous work with VIC DPI identified that the fishery in that state would benefit from the new harvest restriction.

The largemouth bass recreational fishery in the USA has some similarities to Murray cod, golden perch and Australian bass fisheries in that these species in some areas have high instances of catch and release. Anglers seek larger fish and in the case of largemouth bass, the lack of angler harvest has seen overcrowding of this species to the point where length and condition are limited. Fishery managers have trialled the removal of harvest restrictions in affected areas in an attempt to decrease the number of fish and ultimately increase the number of large fish, but found no effect. This resulted in physical removal of adult largemouth bass, which resulted in fewer, but larger fish, which the anglers preferred. High rates of catch and release has implications for Australian fisheries whereby overstocking could see an abundance of small fish and few large, trophy fish. Assessment of stocking, particularly for impoundments, is important to get the correct balance of fish in correlation to the fluctuating carrying capacity of a given waterway.

The impact of slot limits (which are proposed for Murray cod) on the sexes, was identified by a presenter at the conference as significant. Slot limits can have the slower growing sex more vulnerable to harvest as it will spend more time within the slot and as such, gets greater exposure to harvest. I had not previously considered the impact of sexual dimorphism with the introduction of a slot for Murray cod, but will include this in my analysis.

During the conference I attended several talks on environmental DNA. eDNA is a relatively new monitoring tool used primarily to detect the presence or absence of a particular species. I previously knew little of this technique and now have an appreciation of how it works, its shortcomings, and its applicability in a wide variety of fisheries research applications. My background in biotechnology enabled me to understand the concepts of how the process works and I can see this becoming another

sampling method integrated with the more traditional electrofishing and netting procedures.

Benefits and Adoption

The knowledge gained from my US trip has given me new ideas to analyse my research and provide greater detail to fisheries management, so informed decisions can be made. Specifically, I will be able to provide better advice on fish stocking procedures and protocols, harvest restrictions and possible impacts of catch and release fishing. In addition, I have improved my skills in relation to angler creel surveys to obtain quality information at a lower cost, reduce bias, and improve analysis of existing data. Sustainability and improvement of recreational fisheries is the ultimate goal of my research, which directly benefits the fishing community and has indirect benefits to the non-fishing aspect of the population through increased spending on fishing stemming from greater recreational fishing opportunities.

Further Development

This was my first international conference, and I am only just starting to build international networks. I plan to build these relationships to develop joint collaborations and funding opportunities. In the shorter term, I have established key contacts with experts in fields directly relating to my research, which will assist to solve problems, gain different research perspectives and critique my work.