
MACQUARIE PERCH UNDER PRESSURE: PREDATION RISK TO AN ENDANGERED FISH POPULATION



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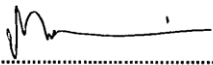
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STATEMENT OF CONTRIBUTION

Chapters 3, 4 and 5 of this thesis have been prepared for publication in peer-reviewed journals, and therefore several other people have contributed to the work and they deserve special acknowledgement. These include:


Dr Brendan Ebner (Australian Rivers Institute, Griffith University), who provided guidance and supervision for all aspects of the PhD Study and assisted in the preparation of manuscripts.

Associate Professor Mark Lintermans (Institute for Applied Ecology, University of Canberra), who provided guidance and supervision for all aspects of the PhD Study and assisted in the preparation of manuscripts.

Professor Richard Norris (Institute for Applied Ecology, University of Canberra), who provided guidance and supervision for all aspects of the PhD Study and assisted in the preparation of manuscripts.

These people will be included as authors on publications resulting from this thesis. However regardless of their contribution, the work within is my own and I have received no assistance other than which is stated above.

As primary supervisor I agree with the above statement.



Professor Richard H. Norris



Date

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ABSTRACT

The extinction of freshwater fish species poses a threat to the health of freshwater ecosystems and must be prevented. Habitat loss is largely responsible for the decline of many of Australia's freshwater fish species, resulting in small and often isolated populations that are vulnerable to stochastic processes. Macquarie perch, *Macquaria australasica* (Percichthyidae), is one such species, and is now listed nationally as endangered. Cotter Reservoir in the Australian Capital Territory (ACT) is home to one of the last self-sustaining populations of Macquarie perch. The success of the Macquarie perch population at Cotter Reservoir has been largely attributed to the abundance of structural habitat around the perimeter of the reservoir, which established primarily in response to long-term stable water levels. This habitat is thought to mitigate predation by cormorants which are known to prey on adult Macquarie perch, a vulnerable component of the population. However, habitat availability in the reservoir will soon change when it is enlarged from 4 to 78 GL and regularly drawn down for water supply. It was the aim of this thesis to guide effective conservation measures to protect Macquarie perch from cormorant predation in the enlarged Cotter Reservoir by:

1. Determining spatial and temporal trends in cormorant predation risk to Macquarie perch in Cotter Reservoir.
2. Investigate trends in the spatial ecology and habitat use of Macquarie perch over the course of a year to develop an understanding of refuge and spatial requirements.

Predator abundance, predator-prey overlap, prey behaviour and habitat characteristics, were considered key parameters for achieving the objectives of this thesis. Adult Macquarie perch were radio-tracked at Cotter Reservoir every two weeks from April 2008 to June 2009. During this period a 2 m drawdown occurred for one month in each season to mimic structural habitat availability in the enlarged reservoir. Cormorants were counted from February 2008 to June 2009 and their activity and location within the reservoir were recorded. Habitat was mapped using aerial photographs taken during a 5 m drawdown. Macquarie perch, cormorant and habitat data was analysed in ArcGIS to investigate spatial and temporal relationships.

Predation risk to Macquarie perch was greatest in the shallow upstream section of Cotter Reservoir during spring and summer, when predator-prey overlap and predator abundance were highest. This corresponded with a shift by the Macquarie perch population into the upstream section of the reservoir during its spawning period. A decline in predator-prey overlap at the fish microhabitat scale suggests that the use of structural habitat by adult Macquarie perch in the current reservoir mitigates predation. A 2 m drawdown resulted in the loss of all emergent macrophytes and 55% of structural woody habitat. During drawdown fish did not aggregate in remaining structures or increase their use of depth as refuge, resulting in increased vulnerability to predation. The addition of constructed habitats in the upstream section of the enlarged reservoir is essential to ensure that Macquarie perch are able to make a spawning run into the river and access upstream foraging habitat without increased risk of cormorant predation.

Adult Macquarie perch established larger home-ranges than previously reported for percichthyids in rivers and demonstrated a spatial awareness of Cotter Reservoir. The population distribution shifted temporally, with upstream shifts in spring and summer and downstream shifts in response to drawdown. Smaller fish inhabited deeper habitats (>15 m) while larger fish inhabited shallower habitats (<15 m), potentially in response to a trade-off between avian predation risk and food availability. This information contributes significantly to understanding the resource requirements of Macquarie perch and provides valuable baseline data for investigating the effects of reservoir enlargement.

The present thesis provides a valuable approach for developing an understanding of predator-prey interactions, particularly when dealing with small populations in the field. Investigation of predator-prey overlap allowed the identification of when and where predation risk is greatest, which cannot be obtained from conventional consumption estimates. Information about spatial and temporal trends in predation risk is critical for

implementing effective conservation measures to protect small prey populations threatened by predation.

TABLE OF CONTENTS

Chapter 1:	General introduction: the need for conservation of freshwater fish.....	1
1.1	Background.....	2
1.1.1	Conservation biology	2
1.1.2	The decline of freshwater fish.....	4
1.1.3	Macquarie perch and the Cotter Reservoir.....	7
1.2	Thesis aims	10
1.3	Thesis structure and specific research questions	10
Chapter 2:	Literature review: Predation risk.....	13
2.1	Investigating predator-prey interactions	14
2.2	Parameters for investigating trends in predation risk.....	16
2.2.1	Predator-prey spatial overlap.....	16
2.2.2	Predator abundance	18
2.2.3	Prey behaviour	19
2.2.4	Habitat characteristics	21
2.3	Decision framework for assessing predation risk	22
Chapter 3:	Knowing the enemy: understanding trends in predator abundance and predator-prey overlap for assessing predation risk to threatened fish populations.	26
3.1	Introduction.....	27
3.2	Methods.....	30
3.2.1	Study area.....	30
3.2.2	Study species	33
3.2.3	Cormorant observations	34
3.2.4	Predator-prey distribution overlap.....	35
3.3	Results	38
3.3.1	Predator abundance.....	38
3.3.2	Predator-prey overlap.....	39
3.4	Discussion.....	51
3.4.1	Predator abundance.....	51

3.4.2	Overlap of predator-prey distribution.....	54
3.4.3	Conclusion	56
Chapter 4:	Diurnal habitat of an endangered fish species in an upland reservoir.....	57
4.1	Introduction.....	58
4.2	Methods	60
4.2.1	Study site	60
4.2.2	Habitat mapping.....	61
4.2.3	Radio-telemetry.....	61
4.2.4	Analysis.....	62
4.3	Results	65
4.3.1	Habitat availability	65
4.3.2	Habitat preferences and body size.....	65
4.3.1	Drawdown effects on habitat selection	66
4.3.1	Habitat selection and spatial scale.....	67
4.3.2	Seasonal changes in habitat selection.....	67
4.4	Discussion.....	80
4.4.1	Habitat preferences and body size.....	80
4.4.2	Drawdown effects on habitat selection	81
4.4.3	Habitat selection and spatial scale.....	83
4.4.4	Seasonal changes in habitat selection.....	85
4.4.5	Conclusion	86
Chapter 5:	Home-range behaviour and population distribution of an endangered fish species in an upland reservoir	88
5.1	Introduction.....	89
5.2	Materials and methods	92
5.2.1	Study area.....	92
5.2.2	Radio-tracking.....	92
5.2.1	Data analysis.....	93
5.3	Results	97

5.3.1	Home-range behaviour	97
5.3.2	Distribution	98
5.4	Discussion.....	108
5.4.1	Home-range behaviour	108
5.4.2	Population distribution.....	111
5.4.3	Conclusion	114
Chapter 6:	Synopsis: Summary and implications	116
6.1	Summary.....	117
6.2	conservation of Macquarie perch in Cotter Reservoir	118
6.3	Reality of estimating predator-prey interactions	119
6.4	The significance of spatial and temporal overlap of predator and prey in assessing predation risk	120
6.5	The significance of the current study for small populations	123
6.6	Conclusion	123
References	125
Appendix 1	159

LIST OF FIGURES

FIG. 2.1 Schematics showing a) the complexity of factors that affect predator-prey interactions, b) common parameters used for making consumptive estimates of predator-prey interactions, c) common parameters used for making non-consumptive estimates of predator-prey interactions and d) parameters selected for estimating predation risk in the current study.	23
FIG. 2.2 A framework for assessing predation risk to threatened prey populations.	24
FIG. 2.3 An assessment of predation risk to Macquarie perch by cormorants at Cotter Reservoir based on current knowledge. This assessment identifies that there is not yet sufficient information to determine the level of predation risk.	25
FIG. 3.1 Location of study sites, Cotter Reservoir and Lake Burley Griffin, in the Australian Capital Territory.	32
FIG. 3.2 Location of vantage points where cormorant observations were made at Cotter Reservoir. ...	37
FIG. 3.3 Mean seasonal abundance (\pm S.E.) of (■) Great cormorants, (□) Little pied cormorants and (▣) Little black cormorants at a) Cotter Reservoir and b) Lake Burley Griffin.	41
FIG. 3.4 Mean monthly Great cormorant abundance (●) (\pm S.E.) at Cotter Reservoir. Each months deviation from average rainfall (■) is plotted to show any relationship between cormorant abundance and rainfall conditions.	43
FIG. 3.5 Mean monthly Little pied cormorant abundance (●) (\pm S.E.) and Little black cormorant abundance (□) (\pm S.E.) at Cotter Reservoir. Each months deviation from average rainfall (■) is plotted to show any relationship between cormorant abundance and rainfall conditions.	43
FIG. 3.6 Monthly Great cormorant abundance (●) at Lake Burley Griffin 1989–1993. Each months deviation from average rainfall (■) is plotted to show any relationship between cormorant abundance and rainfall conditions. Data provided by ACT Parks and Conservation Service (Rutzou and Lintermans unpubl. data).	44
FIG. 3.7 Monthly Little pied cormorant abundance (●) and Little black cormorant abundance (□) at Lake Burley Griffin 1989–1993. Each months deviation from average rainfall (■) is plotted to show any relationship between cormorant abundance and rainfall conditions. Data provided by ACT Parks and Conservation Service (Rutzou and Lintermans unpubl. data).	45
FIG. 3.8 Foraging areas of a) all cormorant species (Great, Little pied and Little black) and b) Great cormorants only at Cotter Reservoir estimated using 50% (■), 70% (▣) and 95% (□) kernel distributions and c) depth profile of Cotter Reservoir showing <5 m (▩), 5–10 m (▨) and >10 m (□).	46
FIG. 3.9 Overlap between foraging locations of all cormorant species (Great, Little pied and Little black) estimated using 50% (■), 70% (▣) and 95% (□) kernel distributions with adult	

Macquarie perch locations (○) in a) spring, b) summer, c) autumn and d) winter*. Note* because few foraging cormorants were recorded in winter kernel estimates of cormorant range for this season were based on all cormorant sightings.	48
FIG. 3.10 Percentage of overlap in the distribution of adult Macquarie perch and 50% (■), 70% (▣) and 95% (□) kernel estimates of cormorant foraging range in Cotter Reservoir. *Winter overlap was calculated from all cormorant observations because of the low number of observations of cormorants foraging.	50
FIG. 4.1 Location of the study site, Cotter Reservoir, in the Australian Capital Territory.....	64
FIG. 4.2 Habitat characteristics of Cotter Reservoir; a) depth profile showing 0–5 m depth (□), 5–10 m depth (▣), 10–15 m depth (■), > 15 m depth (■); b) structural habitat availability including emergent macrophytes (■), structural woody habitat (■), rocky shorelines (■) and artificial structure (■). Bathymetry data from Ebner and Lintermans (2007) and Ecowise Environmental.	69
FIG. 4.3 Spatial association between adult Macquarie perch of two size classes and habitat type in Cotter Reservoir at 5, 10, 25, 50 and 100 m scales when the reservoir was full (■) and at 2 m drawdown (■). Relative contact values greater than 0 indicate a positive association, and values less than 0 indicate a negative association. * Represents an association that is significantly different from random (p<0.05).....	70
FIG. 4.4 The percentage of adult Macquarie perch that have contact with each habitat type at the 10 m scale. Bars represent size classes of fish <350 mm TL (■) and 350 mm TL (■) when the reservoir is full, and <350 mm TL (■) and >350 mm TL (■) when the reservoir is drawn down by 2 m.	72
FIG. 4.5 The percentage of adult Macquarie perch that have no contact with structural habitat at 5, 10, 25, 50 and 100 m scales. Bars represent size classes of fish <350 mm TL (■) and 350 mm TL (■) when the reservoir is full, and <350 mm TL (■) and >350 mm TL (■) when the reservoir is drawn down by 2 m.....	73
FIG. 4.6 Association of two size classes of adult Macquarie perch with depth categories in the Cotter Reservoir at 5, 10, 25, 50 and 100 m scales when the reservoir was full (■) and at 2 m drawdown (□). Relative contact values greater than 0 indicate a positive association, and values less than 0 indicate a negative association. * Represents an association that is significantly different from random (p<0.05).	75
FIG. 4.7 Percentage of area within a 10 m radius of fish locations covered by a) structural woody habitat, b) emergent macrophytes and c) constructed habitat during each season for adult Macquarie perch <350 mm TL (■) and >350 mm TL (□). ** Represents significantly more use of that habitat than any other season (p<0.05). Bars linked with * are significantly different from each other in regards to use of that specific habitat type.	77

FIG. 4.8 Percentage of adult Macquarie perch in the size classes a) <350 mm TL and b) >350 mm TL that have contact with each habitat type at the 10 m scale during autumn (■), winter (▣), spring (▤) and summer (▥).	78
FIG. 4.9 Percentage of area of a) depths 0–5 m and b) depths >15 m within a 10 m radius of adult Macquarie perch of the size classes <350 mm TL (■) and >350 mm TL (□) during each season. Bars linked with *are significantly different (p<0.05). ** Represents significant difference from all other seasons for that fish size class.	79
FIG. 5.1 Map showing a) the location of Cotter Reservoir in the Australian Capital Territory and b) the location of emergent macrophytes (■), structural woody habitat (■), 0–5 m depth (□), 5–10 m depth (□), 10–15 m depth (■), 15–20 m depth (■), and >20 m depth (■) within Cotter Reservoir. Map b) derived from Chapter 4, Ebner and Lintermans (2007) and data supplied by Ecowise Environmental.	95
FIG. 5.2 Water Levels in Cotter Reservoir throughout the length of the study. Indicates a sampling event.....	96
FIG. 5.3 Mean estimates of a) home-range (± S.E.), b) core-range (± S.E.) and c) the number of core-ranges (± S.E.) of adult Macquarie perch in Cotter Reservoir. Estimates are based on the total sample of fish (■), a sample of 13 fish located 24 times (▣) and a sample of 5 fish located 27 times (▤). * Denotes a sample of 29 fish and ** a sample of 18 fish.	100
FIG. 5.4 Home-range (□) and core-range (■) areas of individual adult Macquarie perch located 24 times in Cotter Reservoir. An individual identifier is located at the top left corner of each map.	101
FIG. 5.5 Patterns of core-range use (●) of adult Macquarie perch located 24 times or more in relation to water level (–) and season (–) from autumn 2008 to autumn 2009. Blank spaces indicate times when fish were outside core-range areas during that radio-tracking event. Core area ID 1 indicates the most upstream core-range while the most downstream core-range has the highest core area ID.	104
FIG. 5.6 Distribution of adult Macquarie perch in Cotter Reservoir based on a) sample of 13 fish located 24 times, b) all fish > 350 mm, c) all fish < 350 mm in relation to water level. The figure shows mean populations centres for each tracking event when the reservoir was full (▲), drawdown 2 m (●) and drawdown 5 m (■). The standard deviation ellipse is shown for the population when the reservoir was full (□), drawdown 2 m (▣) and drawdown 5 m (▤).	105
FIG. 5.7 Distribution of the mean population centre (▲) when the reservoir is full based on a) the sample of 13 fish located 24 times, b) all fish > 350 mm and c) all fish < 350 mm. Groupings are a) i = October –December 2008, ii = April–July 2008 and January and February 2009 and iii = March 2009; b) i = October 2008 – early January 2009, February and May 2009, ii = April–July 2009 and	

late January 2009, iii = March 2009; c) i = late October and early December 2009, ii = late November and late December.....	106
FIG. 5.8 Standard deviation (based on direction distribution ellipse) from the mean centre of the group of Macquarie perch based on the sample of 13 fish located 24 times (◆) and all fish > 350 mm (■) in comparison with water level (- -).	107
FIG. 6.1 Framework of questions for guiding investigation into predation risk to small prey populations.	122

LIST OF TABLES

TABLE 3.1 Comparison of seasonal cormorant abundances at Lake Burley Griffin and Cotter Reservoir.	
* Indicates a significant difference. ^ Indicates analysis was not conducted as sample size was too low.	42
TABLE 4.1 Mean habitat composition (% ±S.E.) at the 10 m scale for two size classes of Macquarie perch and two water levels.	74
TABLE 4.2. Mean depth composition (% ±S.E.) within a 10 m radius for adult Macquarie perch >350 mm TL and <350 mm TL in Cotter Reservoir at full water level and 2 m drawdown.	76