

# **The ecohydrology and restoration of an enclosed estuarine wetland**

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## Abstract

Many coastal floodplain wetlands on the eastern Australian coast have undergone anthropogenic changes to achieve flood mitigation and agricultural land reclamation benefits. Most of these wetlands have suffered degradation of their environments and biota populations, altered hydrological conditions and formation of acid sulfate soils because of these changes. This has resulted in the growth of restoration programs using tidal re-inundation to rejuvenate the wetland without causing salinity intrusion onto surrounding agricultural land.

The Yarrahapinni Wetland, on the New South Wales north coast, has undergone a program of incremental openings to the controlling floodgate system, and the changes to the hydrology and ecology have been monitored. By adopting an ecohydrological approach, this study used an understanding of the hydrological processes within the changing wetland to develop a scientific understanding of the behavioural patterns of the fish and crustacean populations of the system.

Changes to the hydrological connectivity across the floodgate system were quantified based on areas of the various floodgate openings and compared with the tidal flow and range. It was found that a 25% opening level is sufficient to restore sufficient tidal influence on the hydrology of the system for extensive rehabilitative. The correlation between the salinity of the wetland and effects of flooding events was examined, and the water level of the controlling freshwater reservoir was found to be a more effective indicator of salinity than rainfall data.

A mathematical model of the salinity of water available externally to the floodgate system for re-inundation was developed and the controlling freshwater reservoir was also found to be a more accurate indicator than rainfall data.

The changes to the fish and crustacean abundances in close proximity to the inside of the floodgate system were compared before and after the first small incremental opening. It was found that 12 of the 26 species of fish and crustacean sampled in the

external reference creeks were not present within the wetland in significant abundances before the floodgate-opening trial began. After a small magnitude of hydrological connectivity was introduced to the wetland, 10 of these species had reappeared.

An analysis of fish and crustacean abundance distribution throughout the wetland revealed that the species involved belong to three distinct groups: those that stay in the more saline sections, those that move to the more brackish regions and those who have distributed equally throughout the system.

## **Certification**

*I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.*

*I certify that any help received in preparing this thesis, and all sources used have been acknowledged in this thesis.*

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Signature

# Table of Contents

<b>Acknowledgements</b> .....	<b>ii</b>
<b>Abstract</b> .....	<b>iii</b>
<b>Certification</b> .....	<b>v</b>
<b>Table of Contents</b> .....	<b>vi</b>
<b>List of Tables</b> .....	<b>x</b>
<b>List of Figures</b> .....	<b>xii</b>
<b>List of Abbreviations</b> .....	<b>xix</b>
<b>CHAPTER 1 Introduction</b> .....	<b>21</b>
1.1 The Need for This Research .....	21
1.2 Aims and Objectives .....	23
1.3 Precis.....	23
<b>CHAPTER 2 Thesis Literature Survey</b> .....	<b>26</b>
2.1 Ecohydrology .....	26
2.2 Hydrological Connectivity.....	29
2.3 Wetlands.....	32
2.3.1 Acid Sulfate Soils.....	37
2.4 Wetland Restoration .....	40
2.4.1 Australian East Coast Wetland Restoration .....	42
2.5 Fisheries Research .....	45
2.5.1 Fish Sampling Methods .....	45
2.5.2 School Prawn ( <i>Metapenaeus Macleayi</i> ).....	48
2.6 Conclusions .....	49
<b>CHAPTER 3 The Study Area and Its History</b> .....	<b>51</b>
3.1 Introduction .....	51
3.2 Macleay Valley Catchment Area.....	51
3.3 Macleay Estuary—Geomorphology.....	53

3.4 Flood Mitigation on the Macleay River .....	61
3.5 Yarrahapinni Wetland.....	62
3.5.1 Phragmites Australis.....	72
3.5.2 Wetland Administration .....	76
3.6 Andersons Inlet.....	77
3.7 Rainfall .....	80
3.8 Summary.....	83
<b>CHAPTER 4 Changes to the Hydrological Connectivity and Their Effects on the</b>	
<b>Hydrology of a Wetland.....</b>	<b>85</b>
4.1 Introduction.....	85
4.2 Study Area: History of Hydrological Connectivity Changes.....	88
4.2.1 Stage 0: Pre-Flood Mitigation—The Natural State.....	90
4.2.2 Stage 1: After Flood Mitigation: 1970 to December 2007 .....	91
4.2.3 Stage 2: Start of Trial Openings 4 December 2007 to 5 February 2010.....	100
4.2.4 Stage 3: 5 February 2010 to 24 July 2011 .....	103
4.2.5 Stage 4: 24 July 2011 to the Present .....	103
4.3 Data Analysis: Theoretical Context.....	104
4.4 Data Sources and Methods .....	106
4.5 Results.....	110
4.5.1 Phragmites Australis.....	110
4.5.2 Quality and Quantity of Water External to the Floodgates .....	121
4.5.3 Hydrological Connectivity at the Floodgates.....	121
4.5.4. Influence of the Upstream Freshwater Wetland Section .....	130
4.6 Summary and Discussion.....	139
<b>CHAPTER 5 A Hydrological Predictive Model of the Salinity of the Water Entering</b>	
<b>an Enclosed Wetland during Restoration of Connectivity .....</b>	<b>143</b>
5.1 Introduction.....	143
5.2 Study Area.....	144
5.2.1 Tides.....	148

5.2.2 Rainfall .....	148
5.3 Methods.....	150
5.3.1 Data Loggers .....	151
5.3.2 Salinity Profiles .....	152
5.3.3 Recorded Data .....	152
5.3.4 Statistical Analysis .....	153
5.4 Results.....	153
5.4.1 Salinity Predictive Model.....	158
5.5 Discussion .....	162
5.6 Conclusion .....	163
<b>CHAPTER 6 Changes to Fish Assemblages during Restoration of the Connectivity</b>	
<b>to a Wetland .....</b>	<b>166</b>
6.1 Introduction.....	166
6.2 Study Area.....	169
6.3 Data and Methods .....	171
6.3.1 Data Collection .....	171
6.3.2 Fish Sampling Methods .....	172
6.3.3 Water Quality .....	174
6.3.4 Data Analysis .....	174
6.4 Results.....	175
6.5 Discussion .....	191
6.6 Conclusions.....	195
<b>CHAPTER 7 Patterns of Spatial Distribution of Fish and Prawns in a Regenerating</b>	
<b>Wetland .....</b>	<b>196</b>
7.1 Introduction.....	196
7.2 Methods and Study Area .....	197
7.3 Results.....	201
7.3.1 Seine Netting .....	201
7.3.2 Fyke Netting.....	204



7.4 Background and Results for Individual Species .....	208
7.4.1 <i>Acanthopagrus australis</i> .....	208
7.4.2 <i>Afurcagobius tamarensis</i> .....	209
7.4.3 <i>Ambassis</i> spp. ....	210
7.4.4 <i>Gambusia holbrooki</i> .....	212
7.4.5 <i>Hyperseleotris compressa</i> .....	213
7.4.6 <i>Philypnodon grandiceps</i> .....	215
7.4.7 <i>Pseudogobius olorum</i> .....	216
7.4.8 <i>Redigobius macrostoma</i> .....	217
7.4.9 <i>Gobiopterus semivestitis</i> .....	218
7.4.10 <i>Mugil cephalus</i> .....	219
7.4.11 <i>Pomatomus saltatrix</i> .....	219
7.4.12 <i>Metapenaeus macleayi</i> .....	220
7.5 Summary.....	224
7.6 Discussion .....	229
<b>CHAPTER 8 Discussion and Conclusions.....</b>	<b>231</b>
<b>References .....</b>	<b>236</b>
<b>Appendices .....</b>	<b>274</b>
Appendix A Total Fish and Crustacean Abundances for the Four Sampling Sites, Before and After Connectivity .....	274
Appendix B Comparisons of Rainfall and Water Level for Collombatti Creek .....	275
Appendix C Unfiltered Readings for Salinity Recovery as Portrayed in Figure 5.5 ..	276

## List of Tables

Table 2.1: Examples of connectivity in the science laws.....	31
Table 4.1: Tidal prisms at various stations within the Macleay River (MHL 2004) .....	94
Table 4.2: Comparisons of tidal ranges for the ocean, Macleay River, Macleay Arm and Andersons Inlet for 16 April 2003 (MHL2004) .....	97
Table 4.3: Approximate connectivity for the various opening configurations .....	106
Table 4.4: Coordinates of data loggers.....	109
Table 4.5: Maximum incoming flow rates compared with percentage hydrological connectivity at the floodgates.....	127
Table 4.6: Highest levels of recorded ion contents .....	138
Table 5.1: Recovery times after recovery starts and after rainfall events for various levels of salinity .....	160
Table 5.2: Dates of recovery periods and first point in Figure 5.6.....	162
Table 6.1: Fish sampling dates.....	172
Table 6.2: BIO-ENV comparisons of Spearman rank correlation factors for taxa abundances for all sampled sites compared with four environmental variables.....	175
Table 6.3: Taxa abundances classified according to habitat migration categories.....	176
Table 6.4: BIO-ENV comparisons of Spearman rank correlation factors for categorised taxa abundances compared with environmental variables for all sampled sites.....	177
Table 6.5: BIO-ENV Correlations for sample sites R1 and R2 .....	178
Table 6.6: BIO-ENV Spearman correlation factors for individual taxa species for Site R2 .....	179
Table 6.7: BIO-ENV Spearman correlation factors for sampling site MG, with and without the connectivity variable .....	180
Table 6.8: Mean and standard deviation comparisons for environmental variables for wetland site MG before and after restored connectivity.....	180

Table 6.9: Species contributions to abundance similarities between Sites MG and R2 .....	184
Table 6.10: Group abundances before and after connectivity .....	186
Table 6.11: BIO-ENV correlations of group species abundances and environmental variables.....	187
Table 6.12: Summary of comparison of fish sampling methods.....	190
Table 7.1: Coordinates for the fish and crustacean sites .....	200
Table 7.2: The total abundances and catch per unit effort for the seine hauling during 2008 and 2011.....	202
Table 7.3: Abundances for seine net sampling within the upper freshwater region ..	203
Table 7.4: Fyke net Abundances at the five sampling sites.....	204
Table 7.5: Species within each group and the group correlation coefficient .....	225
Table 7.6: Percentages of the total group abundances for each Site (Group D) .....	227

## List of Figures

Figure 2.1: Number of scientific articles published on the subject of ecohydrology for five-year periods, from a Web of Science <sup>SM</sup> survey .....	27
Figure 2.2: Methodological trends and hydrological variables used in journal articles titled ecohydrology (King & Caylor 2011) .....	28
Figure 2.3: The role of connectivity in some laws of physical change .....	30
Figure 2.4: Ecological functions and socioeconomic benefits of a wetland (Turner et al. 2003) .....	34
Figure 2.5: Iron floc outbreak in the Yarrahapinni Wetland (Source: Author, February 2008) .....	39
Figure 2.6: Tidal buffering chemical reaction (Indraratna et al. 2002) .....	43
Figure 2.7: A schematic diagram of a precast concrete culvert fitted with one drop board (NSW Fisheries 2002) .....	44
Figure 2.8: Life cycle of <i>Metapenaeus macleayi</i> (Montgomery 2010) .....	48
Figure 3.1: Macleay River catchment area (DECC 2009) .....	52
Figure 3.2: Macleay River estuary (Kempsey Shire Council 2010) .....	54
Figure 3.3: Lower Macleay River estuary network (NPWS) .....	56
Figure 3.4: Schematic of the Macleay estuary in the mid-Holocene (from Cohen 2005) .....	58
Figure 3.5: Surface geology of the lower Macleay River area (Shortland Wetlands Centre 1997, Roy 1984) .....	60
Figure 3.6: Levy bank in the vicinity of Middle Island (NPWS) .....	63
Figure 3.7: Floodgate structure (NPWS) .....	64
Figure 3.8: Major flood mitigation structures on the Yarrahapinni Wetland (NPWS) ..	65
Figure 3.9: Acid sulfate scald area in the Yarrahapinni Wetland (NPWS) .....	66
Figure 3.10: Aerial photographs of the wetland before and after enclosure .....	67
Figure 3.11: Vegetation and water area of Yarrahapinni Wetland prior to 1969 (NPWS) .....	68
Figure 3.12: Altered Yarrahapinni Wetland (NPWS) .....	69

Figure 3.13: 2009 LIDAR image of elevations and minor drainage of the wetland (NPWS).....	71
Figure 3.14: Partial blockage by common reed ( <i>Phragmites australis</i> ) .....	73
Figure 3.15: Start of total blockage of <i>Phragmites australis</i> .....	74
Figure 3.16: 2007 positions of <i>Phragmites australis</i> blockages (modified from LPI 2002).....	75
Figure 3.17: Schematic views of an Armon float controlled floodgate opening (NSW Department of Industry and Investment) .....	77
Figure 3.18: Andersons Inlet (LPI 2002) (scale 1 km grid) .....	78
Figure 3.19: Tidal plane comparisons for the ocean, South West Rocks and outside the Yarrahapinni floodgates in Andersons Inlet (MHL 2004).....	80
Figure 3.20: Map of the Yarrahapinni Wetland catchment .....	81
Figure 3.21: Locations of Bureau of Meteorology stations (KSC 2010) (C) Collombatti, (E) Eungai, (F) Fishermans Reach.....	82
Figure 3.22: Rainfall figures for 2009–2011 for Collombatti (C), Eungai (E) and Fishermans Reach (F).....	83
Figure 4.1: A schematic wetland hydrology model for the Yarrahapinni Wetland.....	87
Figure 4.2: Study area site location (NPWLS) .....	89
Figure 4.3: Aerial photograph of Yarrahapinni Wetland (1967) showing the area of interest highlighted in Figure 4.2 .....	91
Figure 4.4: Aerial photograph (1976) of the same region after flood mitigation work.....	92
Figure 4.5: Inside view of the floodgate structure November 2007.....	93
Figure 4.6: Schematic diagram of the connectivity of saline ocean water at the various positions in the Macleay River in terms of the tidal prisms .....	95
Figure 4.7: Comparison of tidal ranges in the ocean, Macleay River and Andersons Inlet (MHL 2004).....	96
Figure 4.8: Comparison of the water level within the wetland with the tidal levels outside the floodgates for a period of rising water levels (MHL 2001) .....	98

Figure 4.9: Comparison of the water level within the wetland with the tidal levels outside the floodgates for a period of falling water levels (MHL 2001) .....	99
Figure 4.10: Water levels at Site M1 for a 14-day period commencing 19 December 2004 (MHL 2004) .....	100
Figure 4.11: Dimensions and position of each gate and the smaller opening .....	101
Figure 4.12: Float-operated floodgate manufactured by Armon Engineering, Kempsey, upper: gate position at low tide, lower: gate position at high tide (Kroon et al. 2004) (note: gates shown have opening at a lower level than those fitted).....	102
Figure 4.13: Status of floodgate openings for Stage 4 .....	103
Figure 4.14: Schematic representation of hydrological connectivity through an anthropogenic obstruction.....	105
Figure 4.15: Positions of recording sites for data loggers .....	108
Figure 4.16: 2007 positions of <i>Phragmites australis</i> blockages (modified from LPI 2002).....	111
Figure 4.17: Blockage X on 25 November 2007 .....	112
Figure 4.18: (a) <i>Phragmites</i> blockage at Y, November 2008 (note position of PVC pipe for water level data logger), (b) position of blockage Y, November 2012, with the same (discoloured) PVC pipe .....	113
Figure 4.19: Start of the total blockage, November 2008.....	114
Figure 4.20: Positions of depth profiles (Glamore et al. 2011) .....	116
Figure 4.21: The depth profiles for the positions shown in Figure 4.20 (Glamore et al. 2011) .....	118
Figure 4.22: Schematic representation of the areas of the three distinct zones.....	120
Figure 4.23: (a) Schematic drawing of floodgate openings, (b) water levels at Site M1 for a 14-day period commencing 16 January 2010.....	122
Figure 4.24: (a) Schematic diagram of floodgate openings, (b) water levels at Site M1 for a 14-day period commencing 26 June 2010.....	123
Figure 4.25: (a) Schematic diagram of floodgate openings, (b) water levels at Site M1 for a 21-day period commencing 23 August 2011.....	124

Figure 4.26: Change in tidal range and mean water levels for four stages (mean water level for Stage 1 approx. -0.3 AHD; MHL2004) .....	125
Figure 4.27: Tidal ranges for the four stages compared with connectivity .....	126
Figure 4.28: Comparison of hydrological connectivity and maximum flow rates within the wetland .....	127
Figure 4.29: Tidal ranges during the four stages at recording station M5.....	128
Figure 4.30: Salinity of wetland compared with distance from floodgates, 12 May 2008 .....	129
Figure 4.31: Salinity compared with distance upstream from floodgates 11 November 2012 .....	130
Figure 4.32: Comparison of water level height and rainfall for the freshwater region.....	131
Figure 4.33: Water level heights from the MHL logger in the freshwater region.....	133
Figure 4.34: Hourly salinity readings from the data logger at M1 for the same period as Figure 4.35 .....	133
Figure 4.35: Hourly salinity recorded at M1 for a 31-day period 2012.....	134
Figure 4.36: Logarithmic relationship between wetland salinity and time of recovery .....	135
Figure 4.37: Logarithmic relationship between freshwater water levels and time of recovery of salinity .....	135
Figure 4.38: Freshwater discharge curves for Stages 2 and 4.....	136
Figure 4.39: Comparison of pH and Salinity, April–September 1996 (MHL 2001).....	137
Figure 4.40: Comparison of pH and salinity, 2008–2012 .....	137
Figure 5.1: Study domain (NSW Department of Natural Resources 2009).....	145
Figure 5.2: Andersons Inlet (LPI 2002) (scale 1 km gridlines).....	146
Figure 5.3: (a) Longitudinal isohaline diagrams of salinity in the lower half of Andersons Inlet, (b) isohaline diagrams of salinity in the upper half of Andersons Inlet.....	155
Figure 5.4: Longitudinal salinity distribution curves for Andersons Inlet, (b) Hau estuary, Vietnam (Nuygen & Savenije 2006, Fig. 7c) .....	157

Figure 5.5: Comparison of salinity–recovery time results with predicted model curve .....	<b>Error! Bookmark not defined.</b>
Figure 5.6: Predicted model curve compared with results from other flooding events .....	<b>Error! Bookmark not defined.</b>
Figure 6.1: Study area and reference creeks (adapted from NPWS (2009)).....	170
Figure 6.2: Fish and water sampling regime for reference creeks.....	173
Figure 6.3: Cluster analysis of the percentage similarities of taxa abundances for the Sites R2 and MG, before and after connectivity .....	181
Figure 6.4: nMDS ordination of abundances for Sites R2 and MG .....	182
Figure 6.5: PRIMER cluster dendrogram of abundance results for Gibbs et al. (1999), Kroon et al. (2004) and Boys et al. (2011) for the Yarrahapinni floodgate area (MG) .....	183
Figure 6.6: nMDS ordination of abundance results for Gibbs et al. (1999), Kroon et al. (2004) and Boys et al. (2011) for the Yarrahapinni floodgate area (MG).....	183
Figure 6.7: Cluster dendrogram of fish abundance for site MG, before and after connectivity .....	185
Figure 6.8: Bivariate analysis of individual species abundance fluctuations before and after the connectivity introduction after sample number 10 .....	188
Figure 6.9: Bivariate analysis of species <i>Amb. spp.</i> abundances before and after the introduction of connectivity .....	189
Figure 6.10: Reactions of <i>Philypnodon</i> species to connectivity .....	190
Figure 6.11: Cluster dendrogram of the similarities of the six seine hauls for site (MG), seine no. 23 .....	191
Figure 7.1 Example of the structure of a fyke net (Fipecc 2013) .....	198
Figure 7.2: Positions for the sites for fish and crustacean sampling.....	199
Figure 7.3: Downstream photograph of the freshwater section of Borirgalla Creek taken from Whalen’s Bridge (NPWS) .....	201
Figure 7.4: Cluster dendrogram of fish and crustacean species for seine netting in 2008 and 2010 .....	203



Figure 7.5: Total abundances for each sampling event compared with the distance from the floodgates.....	205
Figure 7.6: Cluster dendrogram of total abundances for Sites 1 to 4.....	206
Figure 7.7: Cluster dendrogram showing similarities between Sites 1–5.....	206
Figure 7.8: An nMDS ordination of similarities of abundances between sites.....	207
Figure 7.9: Abundance of <i>Acanthopagrus australis</i> compared with distance from the floodgate .....	209
Figure 7.10: Abundances of <i>Afurcagobius tamarensis</i> compared with the distance from the floodgate .....	210
Figure 7.11: Abundances of <i>Ambassis</i> spp. compared with distance from the floodgates.....	212
Figure 7.12: Abundances of <i>Gambusia holbrooki</i> compared with distance from the floodgates.....	213
Figure 7.13: Abundances of <i>Hyperseleotris compressa</i> compared with distance from the floodgates.....	214
Figure 7.14: Abundances for <i>Philypnodon grandiceps</i> compared with distance from the floodgate .....	216
Figure 7.15: Abundances for <i>Pseudogobius olorum</i> compared with the distance from the floodgate .....	217
Figure 7.16: Abundances of <i>Redigobius macrostoma</i> compared with the distance from the floodgates.....	218
Figure 7.17: Total abundances of <i>Metapenaeus macleayi</i> compared with the distance from the floodgates .....	221
Figure 7.18: Prawn abundances compared with distance for Sites 1, 2, 3 and 5 .....	222
Figure 7.19: The median carapace length of <i>Metapenaeus macleayi</i> samples compared with date of capture.....	223
Figure 7.20: The median carapace length of <i>Metapenaeus macleayi</i> samples compared with the distance from the floodgates .....	224
Figure 7.21: Group total abundances compared with distance from floodgates (a) Group A, (b) Group B, (c) Group C.....	226

Figure 7.22: Significant group abundances at each sampling site ..... 228

## List of Abbreviations

AHD	Australian Height Datum
BOM	Bureau of Meteorology
BP	Before Present
BRUVS	Baited Remote Underwater Video Stations
CL	Carapace length
CPUE	Catch per unit effort
DECC	Department of Environment and Climate Change
DI&I	Department of Industry and Investment
Fe <sup>2+</sup>	Ferrous iron ions
FeS	Iron monosulfides
FeS <sub>2</sub>	Iron pyrite
KSC	Kempsey Shire Council
LIDAR	Light Detection and Ranging
LPI	Land and Property Information
MBO	Monosulfidic black ooze
MHL	Manly Hydraulics Laboratory
MSL	Mean sea level
nMDS	Non-metric multidimensional scaling
NPWS	National Parks and Wildlife Service

NSW	New South Wales
PPT	Points per thousand
SO <sub>4</sub> <sup>2-</sup>	Sulfate ions
SWC	Shortland Wetlands Centre
UNSW	University of New South Wales