The Life History and Ecology of Bluefish, *Girella cyanea*, at Lord Howe Island

Melanie A Lewis

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Thesis submitted in fulfilment of the requirements for the Degree of Master of Science (Research)

Picture source: NSW Department of Primary Industries
Certificate of Authorship & Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that this thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in this thesis.

Melanie A Lewis

3rd April 2012
Girella cyanea is a conspicuous member of the reef-fish community in the Lord Howe Island Marine Park (LHIMP), but very little is known about its life history. Rareness of this species on mainland Australian coasts in recent years has initiated a fishing ban across the state of New South Wales, however recreational fishing is still permitted on LHI. Effective management and conservation of this population requires increased information on life history and demographics. Management currently in place for this species is limited. A bag limit of 5 fish person$^{-1}$ day$^{-1}$ is imposed in habitat protection zones across the Marine Park. It is difficult to measure the effectiveness of this strategy, however, without the knowledge of the resource requirements of the species and how these may change throughout the course of life. This study aimed to describe distribution, diet and growth in G. cyanea to provide important information for best-practice management of the LHI population.

An extensive literature search was conducted for published life history, ecology and management data on Girellidae, revealing relatively scarce information for the family. A pilot study assessed the utility of a roaming survey method towing a GPS-receiver behind an observer on snorkel/SCUBA. This new method proved effective and was used for size-based assessments of habitat-use at nearshore and offshore locations around the LHI archipelago. Densities of G. cyanea were highest in complex rocky intertidal and rocky-reef areas. Dietary analyses helped explain this distribution, with gut contents showing intertidal green algal species (i.e. Ulva and Enteromorpha) are important food resources for post-settlement fish.

An ontogenetic dietary shift was found, with fish < 40 mm standard length ($L_s$) found in intertidal habitat having a mainly carnivorous diet and a digestive system without pyloric caeca. In contrast, pyloric caeca were well-developed in fish > 40 mm $L_s$ and diets exhibited increased ingestion of algae.

Age-at-size using otoliths and von Bertalanffy parameters revealed G. cyanea is fast-growing and long-lived (up to 41 yrs). It is likely the transition to sexual maturity occurs between 2 and 5 years of age or 200 mm $L_s$. Size-based observations place fish of this life stage within complex rock habitats at depths < 5 m. Future management policies should ensure adequate (representative) areas of rocky intertidal habitat are within sanctuary zoning to protect G. cyanea at this important life stage.
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*So what did I learn from this process?* In the words of American writer Poul Anderson:

> "I am yet to see any problem, however complicated, which when you look at it the right way did not become still more complicated."
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Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE PAGE</td>
<td>I</td>
</tr>
<tr>
<td>CERTIFICATE OF AUTHORSHIP &amp; ORIGINALITY</td>
<td>II</td>
</tr>
<tr>
<td>THESIS ABSTRACT</td>
<td>III</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>IV</td>
</tr>
<tr>
<td>PERMISSIONS, PERMITS AND FUNDING</td>
<td>VI</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>XI</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>XII</td>
</tr>
<tr>
<td>ABBREVIATIONS</td>
<td>XIV</td>
</tr>
</tbody>
</table>

CHAPTER 1 - GENERAL INTRODUCTION ................................................. 1

1.1 STUDYING THE ECOLOGY AND LIFE HISTORY OF FISHES .......................... 1
1.2 LIFE HISTORY AND ECOLOGY OF THE BLUEFISH, *Girella cyanea*, Macleay 1881 2
1.3 PROJECT AIMS                                                          3
1.4 *Girella cyanea* AT LORD HOWE ISLAND                                   4
1.5 THESIS STRUCTURE                                                      11
   (1) *What resources do G. cyanea require/use?* ................................ 12
   (2) *What life history traits do G. cyanea exhibit?* .......................... 12
   (3) *Do the life history and demographic attributes of G. cyanea display ontogenetic change?* 13

CHAPTER 2 - LITERATURE REVIEW .................................................... 14

2.1 REVIEWING WHAT WE KNOW ABOUT THE FAMILY GIRELLIDAE ........................ 14
2.2 TAXONOMY                                                              15
2.3 GEOGRAPHIC RANGE                                                      15

FIGURE 2.1 WORLDWIDE ANTITROPICAL DISTRIBUTION OF GIRELLIDAE. ADAPTED FROM YAGISHITA & NAKABO (2003) 18

2.4 HABITAT                                                              19
2.5 BIOLOGY AND BEHAVIOUR ......................................................... 19
   Diet                                                                   19
   Reproduction                                                           22
   Age and growth                                                         22

2.6 FISHERIES AND POPULATIONS                                            23
   The Americas                                                           23
   Australasia                                                            24
   Japanese archipelago                                                  25

2.7 BIBLIOGRAPHY (CH. 2 ONLY)                                             26

CHAPTER 3 - METHOD DEVELOPMENT ................................................... 34

3.1 PREFACE                                                              34
Preliminary Study A: Optimisation of underwater visual survey methods for patchily distributed fish

3.2 INTRODUCTION .................................................................................................................. 35
3.3 MATERIALS AND METHODS .......................................................................................... 36
3.5 DISCUSSION ....................................................................................................................... 39

Preliminary Study B: Determining the accuracy and precision of underwater estimates of fish lengths

3.6 INTRODUCTION .................................................................................................................. 47
3.7 MATERIALS AND METHODS .......................................................................................... 48
3.8 RESULTS .............................................................................................................................. 49
3.9 DISCUSSION ....................................................................................................................... 49

CHAPTER 4 - PUTTING BLUEFISH (GIRELLIDAE: GIRELLA CYANE'A) ON THE MAP: PATTERNS OF ABUNDANCE AND POPULATION SIZE STRUCTURE USING THE ROAMING TRANSECT SURVEY METHOD

4.1 INTRODUCTION .................................................................................................................. 54
4.2 MATERIALS AND METHODS .......................................................................................... 54
Study site ....................................................................................................................................... 54
Nearshore sampling ....................................................................................................................... 55
Offshore sampling .......................................................................................................................... 57
Data analyses ................................................................................................................................. 57

4.3 RESULTS .............................................................................................................................. 59
Habitat partitioning ....................................................................................................................... 59
Depth stratification ......................................................................................................................... 63
Environmental factors .................................................................................................................. 63
LHIMP zones ................................................................................................................................. 63

4.4 DISCUSSION ....................................................................................................................... 67
Distribution of juveniles to adults, from complex intertidal to rocky-reef ....................................... 67

CHAPTER 5 - HERBIVORY, PSEUDO-HERBIVORY OR OMNIVORY? THE HIGHLY VARIABLE DIET OF THE BLUEFISH (GIRELLIDAE: GIRELLA CYANE'A) AT LORD HOWE ISLAND

5.1 INTRODUCTION .................................................................................................................. 71
5.2 MATERIALS AND METHODS .......................................................................................... 72
Sample collections ......................................................................................................................... 72
Fish dissection and measurements .............................................................................................. 73
Dietary examination ...................................................................................................................... 75
Diet composition and data analyses ............................................................................................ 76

5.3 RESULTS .............................................................................................................................. 77
Appendix 1: Archived collections of G. cyanea ................................. 151
Appendix 2: Dissemination of research results ......................................... 152
List of Tables

TABLE 2.1 LIST OF CURRENT SPECIES RECOGNISED IN GIRELLA ................................................................. 16

TABLE 2.2 DIETS OF ADULT GIRELLA AND KYPHOSUS SPECIES. ADAPTED FROM CLEMENTS & CHOAT (1997) .................. 21

TABLE 3.1 DEFINING CHARACTERISTICS OF HABITAT CATEGORIES USED IN RTS AT NORTH BAY, LHI. .......................... 38

TABLE 3.2 DEPENDENT SAMPLES T-TEST OF DENSITY (NUMBER OF FISH CALCULATED 100m⁻²) AND ABUNDANCE (NUMBER OF FISH COUNTED PER 3MIN RTS) IN EACH HABITAT WHERE FISH WERE OBSERVED ................................................................. 42

TABLE 4.1 DESCRIPTION OF HABITATS ASSESSED FOR G. CYANEA DISTRIBUTIONS AT LOCATIONS NEARSHORE ON THE MAIN ISLAND OF LHI (RK, AZ, CD, DR, SA, SG), AND AT OFFSHORE ISLETS AND DIVE SITES (DI) .......................................................... 58

TABLE 4.2 DETAILS OF TOTAL SAMPLING EFFORT AND G. CYANEA ABUNDANCE ACROSS HABITAT CATEGORIES SURVEYED AT LOCATIONS ACROSS THE LHI ARCHIPELAGO ........................................................................ 60

TABLE 5.1 FOOD ITEMS IN THE DIET OF SAMPLED G. CYANEA ........................................................................... 82

TABLE 5.2 DEGREE OF DIETARY SPECIALIZATION WITHIN SIZE CLASSES ............................................................... 85

TABLE 5.3 DISCRIMINATORY FOOD ITEMS CONTRIBUTING TO DISSIMILARITY IN PAIRWISE COMPARISONS OF SIZE CLASSES ... 86

TABLE 6.1 MEAN AGE OF SIZE CLASSES ........................................................................................................ 107

TABLE 6.2 GROWTH PARAMETERS DERIVED FROM THE VON BERTALANFFY GROWTH MODEL AND POPULATION CHARACTERISTICS .................................................................................. 110
# List of Figures

**FIGURE 1.1** MAP OF THE GLOBAL DISTRIBUTION OF *G. CYANEA* ................................................................. 5

**FIGURE 1.2** THE LORD HOWE ISLAND ARCHIPELAGO ..................................................................................... 6

**FIGURE 1.3** LOCATION OF LORD HOWE ISLAND WITHIN THE SOUTH-WEST PACIFIC OCEAN, AND EXPANDED TO SHOW THE LHI ARCHIPELAGO .................................................................................. 7

**FIGURE 1.4** OCEANIC CURRENTS OF THE SOUTH-WEST PACIFIC OCEAN. FROM: SCHIEL ET AL. (1986) ............. 9

**FIGURE 2.1** WORLDWIDE ANTITROPICAL DISTRIBUTION OF GIRELLIDAE. ADAPTED FROM YAGISHITA & NAKABO (2003) .... 18

**FIGURE 3.1** SCHEMATIC OF THE ROAMING TRANSECT SURVEY (RTS) TECHNIQUE SHOWING SWATHE DIMENSIONS AND FIELD OF VIEW OF THE OBSERVER ........................................................................... 37

**FIGURE 3.2** DISTANCE COVERED DURING A THREE-MINUTE RTS PER HABITAT AT NORTH BAY, LHI ....................... 40

**FIGURE 3.3** DISTANCE *(o)* VERSUS SPEED *(s)* OF EACH RTS CONDUCTED OVER A THREE MINUTE INTERVAL ........... 41

**FIGURE 3.4** DENSITY (NUMBER OF FISH CALCULATED PER 100M$^3$) AND ABUNDANCE (NUMBER OF FISH COUNTED PER THREE MINUTE RTS) FOR EACH HABITAT THAT *G. CYANEA* WERE OBSERVED .................................................................................... 43

**FIGURE 3.5** A: ACCURACY OF MODEL FISH SIZE ESTIMATIONS IN THE FIELD. B: SIZE CLASS CATEGORIES USED TO ASSIGN FISH LENGTH ESTIMATES AD HOC. .............................................................................. 50

**FIGURE 3.6** PRECISION OF MODEL SIZE ESTIMATIONS IN THE FIELD ...................................................................... 51

**FIGURE 4.1** SAMPLING LOCATIONS WITHIN THE LHI ARCHIPELAGO .................................................................. 56

**FIGURE 4.2** MEAN DENSITIES (± S.E.M) OF *G. CYANEA* IN NEARSHORE HABITATS, RECORDED FROM RTS SWIMS POOLED ACROSS LOCATIONS .................................................................................. 62

**FIGURE 4.4** DEPTH DISTRIBUTIONS OF *G. CYANEA* ......................................................................................... 64

**FIGURE 4.5** OCCURRENCE OF FOUR ENVIRONMENTAL FACTORS ASSOCIATED WITH *G. CYANEA* SIGHTINGS ................................................................................................................................. 65
Figure 4.6 Segregation of RTS-observed G. cyanea across LHI Marine Park zones. ................................. 66

Figure 5.1 Sampling locations of G. cyanea at Lord Howe Island ...................................................... 74

Figure 5.2 The relationship of length and weight in G. cyanea .......................................................... 79

Figure 5.3 Schematic drawings of the digestive tract of G. cyanea ...................................................... 80
Figure 5.4 The relationship between the length of digestive tract and two measures of body size .......... 81

Figure 5.5 Volume of major food groups in digestive tract and relative gut length per size class ............ 87

Figure 5.6 Gut length standardised for body mass, expressed as Zihler's index (ZI) .............................. 89

Figure 5.7 Seasonal frequency of the most common dietary items in plant (Ulva spp.) and animal (Euphausid sp.) categories found in gut contents. Total animal tissue is also displayed......................... 90

Figure 6.1 Transversely sectioned sagittal otolith of a four year old G. cyanea, showing a dense central opaque region (F) and a subsequent alternating sequence of opaque and translucent banding. 101

Figure 6.2 Linear growth of otoliths in relation to opaque bands (presumed age in yrs) in Girella cyanea. 106

Figure 6.3 Temporal patterns of reproductive development across size classes (A), ages (B) and months (C). ......................................................................................................................... 110

Figure 7.1 Diagrammatic representation of horizontal (habitat) and vertical (depth) partitioning in G. cyanea through ontogeny ...................................................................................................... 122
Abbreviations

ANOVA  Analysis of Variance
DPI    Department of Primary Industries
EAC    East Australian Current
EAUC   East Auckland Current
GLM    General Linear Model
HPZ    Habitat Protection Zone (some fishing permitted, see p. 10)
LHI    Lord Howe Island
LHIMP  Lord Howe Island Marine Park
$L_T$  Fish total body length (rostrum to caudal fin tip)
$L_F$  Fish body length (rostrum to fork)
$L_S$  Fish standard body length (rostrum to last vertebrae)
MHWM   Mean high water mark
MLL    Minimum Legal Length
MPA    Marine Park Authority
NSW    New South Wales
QLD    Queensland
RTS    Roaming Transect Survey
SZ     Sanctuary Zone (no-take reserve)
UNESCO United Nations Educational, Scientific and Cultural Organisation
UTS    University of Technology, Sydney
UVC    Underwater Visual Census
VBGM   von Bertalanffy Growth Model