CONSERVATION OF THE IRRAWADDY DOLPHIN, *ORCAELLA BREVIROSTRIS* (OWEN IN GRAY, 1866) IN THE MEKONG RIVER: BIOLOGICAL AND SOCIAL CONSIDERATIONS INFLUENCING MANAGEMENT

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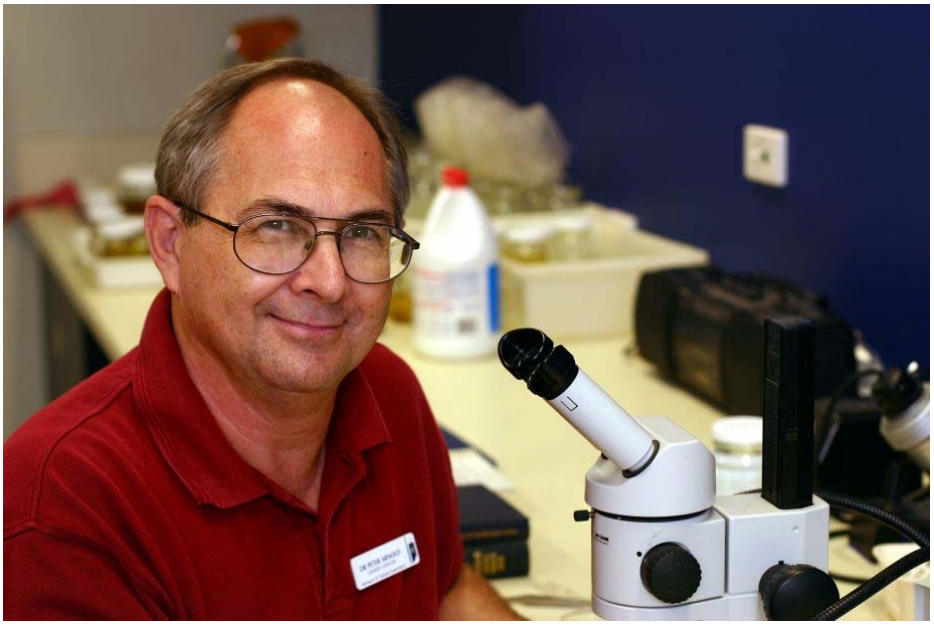
This thesis is dedicated to the memory of:

Dr. Peter William Arnold

(14 May 1949 – 07 March 2006)

A treasured friend, colleague and mentor,

whom I miss dearly



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The Australian Snubfin dolphin, *Orcaella heinsohni*

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ABSTRACT

The goal of my study was to *contribute to the effective conservation of the Irrawaddy dolphin population that inhabits the lower Mekong River*. To achieve my goal, I developed objectives based on a conceptual framework of conservation principles and strategies that guide management of endangered species. The results of my study provide significant new information relevant to the taxonomic status of *Orcaella* and ecology and conservation of the Irrawaddy dolphin population inhabiting the Mekong River, with broader application to other freshwater dolphin populations.

Previously, the genus *Orcaella* was considered to consist of only one species, the Irrawaddy dolphin (*Orcaella brevirostris*). However, two colleagues and I discovered that what were previously considered Irrawaddy dolphins occurring in Australian/Papua New Guinean waters are instead a separate species, which we named the Australian snubfin dolphin (*Orcaella heinsohni*).

Freshwater Irrawaddy dolphin populations and their habitats are highly susceptible to anthropogenic threats. As a result of small population sizes, strict habitat preferences, apparent high site fidelity, slow maturation rate, long calving intervals and most importantly, their close proximity to human activities in freshwater ecosystems, Irrawaddy dolphins are highly susceptible to anthropogenic impacts. Most freshwater populations of Irrawaddy dolphins are small and declining; nevertheless, there has been a notable lack of on-the-ground conservation measures to conserve these populations. Flora and fauna along the river, as well as local subsistence communities, are facing threats similar to those faced by freshwater Irrawaddy dolphins. Irrawaddy dolphins should therefore be considered an effective flagship species for freshwater biodiversity conservation.

My study area encompassed the lower Mekong River of southern Laos, Cambodia and Vietnam and focused on the population of freshwater Irrawaddy dolphins that inhabit this river system. The natural environment of the lower Mekong River had previously been shielded from major development by war and political upheaval. However, all the lower Mekong countries are now developing quickly, and are experiencing significant human population growth. Based on conservation lessons learned from other countries, community involvement in habitat and species conservation is imperative for conservation efforts to be successful. Preservation of habitat is essential, not only to the conservation of endangered species, but also to the survival

of subsistence rural human communities, and other flora and fauna that rely on the river ecosystem.

I conducted 497 interviews with local villagers throughout the lower Mekong River to investigate local perceptions and knowledge relevant to dolphin conservation. Information from these interviews suggests a major decline in dolphin occurrence and abundance throughout most of the river. Reports affirm that dolphins previously occurred regularly south of Kratie Township to the Vietnamese Delta, but they are now virtually never sighted there. Interviewees identified the Kratie to Khone Falls river segment as the most important habitat remaining for dolphins in the lower Mekong River. Local communities hold very positive attitudes towards Irrawaddy dolphins. These attitudes significantly assist with securing local cooperation for management strategies. My study confirms that interviews with local people can provide detailed information about changes in species' distribution and abundance over time, as well as about local perceptions towards riverine flora and fauna. Such information may take scientists many decades to obtain.

The absolute abundance of Irrawaddy dolphins in the Mekong River was estimated using capture-recapture analysis of photo-identified individuals, line-transect, and direct count methodologies. I compared these three survey methodologies to ascertain the most appropriate survey technique for accurate and precise long-term monitoring. Ninety-nine dolphins were individually identified during my study period, with 83% of the population estimated to be photographically-identifiable. A closed population model was used for capture-recapture analysis. I estimated that a minimum of 127 dolphins (range: 108-146), inhabited the Mekong River, as of April 2005. With the highest level of precision obtained from capture-recapture abundance estimates (CV=0.07), I estimated that with a CV of 0.07, it would take six years to detect a 5% per annum decline, and only two years to detect a 20% per annum decline.

A total of 13,200 km of boat surveys were undertaken throughout the lower Mekong River to provide estimates of abundance to compare with capture-recapture estimates. Dolphins were sighted only in the Kratie to Khone Falls river section – no dolphins were sighted south of Kratie Township. The largest number of dolphins sighted during upriver direct count surveys was 68 (range: 54-88), in May 2001. The largest number of dolphins sighted during downriver pool counts was 69 (range: 57-84), in May 2003. Direct counts were deemed an imprecise and inaccurate survey method, and not recommended for future monitoring purposes. Line-transect analyses estimated 161 dolphins (range: 89-289) inhabited the Mekong River, as of April 2005. Based on a combination of photo-identification and line-transect methodologies, I estimated that the total Irrawaddy dolphin population in the Mekong River was between 127–161 individuals

(range: 89-289), as of April 2005. Comparisons of survey techniques indicate photo-identification is the preferred methodology for population monitoring because of its efficiency and precision. Irrespective of the differences between survey methodologies, the total number of Irrawaddy dolphins inhabiting the Mekong River is very small and the population is now facing a very uncertain future.

Individual Irrawaddy dolphins exhibit extremely high site fidelity. By analysing ranging patterns for the 15 most frequently sighted photo-identified individuals, I estimated a mean area ranged of only 16.0 km^2 in the dry season (range = 0.7–73.0 km^2) and 42.0 km^2 in the wet-season (range 0.9–99.0 km^2).

Average group sizes during the dry and wet seasons were 6.8 dolphins $\pm$ s.e. 0.20 (range=1-19, n=405) and 5.7 dolphins $\pm$ s.e. 0.41 (range=1-34, n=107), respectively. School dynamics and social structure were investigated using photo-identified individuals. Analysis of association patterns revealed that individuals were seen with a particular companion significantly more often than would be expected by chance. The relationship between the lagged association rates and time lag suggests a 'constant companions model' *i.e.*, the population is highly structured with the majority of individuals having preferred, long-term associates. Association analyses indicated four, somewhat discrete, sub-populations. From a management standpoint, my research suggests that it is critical that conservation efforts are now focused on the four sub-populations and associated critical habitats.

My study provides the first reliable estimates of mortality rates for the Irrawaddy dolphin population in the Mekong River and potential causes for these mortalities. Fifty-four dolphin carcasses were recovered and/or confirmed between January 2001 and April 2005. Forty-three percent of all carcasses recovered were newborns and only two newborns were known to have survived longer than six months. The cause of the high number of newborn deaths is unknown. Entanglement in gillnets and direct deaths through destructive fishing practices (e.g., dynamite fishing) are known causes of anthropogenic mortality. Other potential indirect causes of dolphin mortality include: contaminants, boat harassment and noise, boat collision, reduced fish stocks, and inbreeding depression. The Irrawaddy dolphin population appears to be declining at a yearly rate of at least 4.8%. The most conservative allowable Potential Biological Removal (PBR) from anthropogenic mortality is less than one individual/year. Anthropogenic mortality must therefore be reduced to zero as a primary management goal, if the population has any chance of survival in the river.

I initiated an integrated conservation development project named Dolphins for Development, which aimed to provide tangible benefits to the community in exchange for their cooperation with conservation efforts. Project components included: (1) rural development and diversification of livelihoods; (2) community-based ecotourism; (3) education and awareness raising; and (4) strengthening stakeholder relationships. Various project limitations were encountered, nevertheless, observable measures of success were evident. To conserve endangered species in developing countries, some incentive must be provided to local communities. 'Community-conscious conservation' is a term that I developed to describe multidisciplinary, on-the-ground conservation programs that work towards involving communities with conservation of endangered species and habitats. Further efforts are also required to integrate local conservation efforts with regional and national conservation priorities and decision-making.

Based on the preliminary results obtained (*i.e.*, before comprehensive analyses of most data), I developed a conservation and management strategy for the Irrawaddy dolphin population in the Mekong River, which was adopted as national policy in Cambodia in January 2005. The five management goals of this strategy are to: (1) reduce threats and mortality rates; (2) increase local education and awareness; (3) effectively manage dolphin-watching tourism; (4) continue research and monitoring; and (5) clarify regional and national management responsibilities. Based on a comprehensive analysis of my data and acknowledgement of biological and social considerations affecting conservation, I developed recommendations built on my original MDCP strategy. These recommendations acknowledge that the Irrawaddy dolphin population that inhabits the Mekong River is very small, declining, and is in urgent need of effective management. The recommendations identify the high priority activities urgently required to contribute towards the dolphins' immediate and long-term conservation.

TABLE OF CONTENTS

1. INTRODUCTION 1-2

1.1. THE IRRAWADDY DOLPHIN 1-2
1.2. STUDY AREA 1-4
1.3. ENDANGERED SPECIES CONSERVATION 1-6
1.4. THE IMPORTANCE OF BIOLOGICAL STUDIES IN SPECIES CONSERVATION 1-7
1.5. THE IMPORTANCE OF COMBINING BIOLOGICAL AND SOCIAL STUDIES 1-8
1.5.1. Stakeholder Involvement 1-9
1.5.2. Political Considerations 1-10
1.6. MOUNTAIN GORILLA CONSERVATION – AN 'ON-THE-GROUND' EXAMPLE 1-11
1.7. BAIJI CONSERVATION – AN EXAMPLE OF UNSUCCESSFUL CONSERVATION 1-12
1.8. EFFECTIVE PLANNING FOR ENDANGERED SPECIES CONSERVATION 1-13
1.8.1. Principles of Conservation Management 1-13
1.8.2. Conservation Process 1-14
1.9. GOALS, AIMS AND OBJECTIVES OF MY RESEARCH 1-19
1.10. THESIS FRAMEWORK AND OUTLINE 1-20
1.10.1. Conceptual Framework 1-20
1.10.2. Thesis Outline 1-21

2. FRESHWATER DOLPHIN POPULATIONS AT RISK: IRRAWADDY DOLPHINS (*ORCAELLA BREVIROSTRIS*) AS A CASE STUDY 2-26

2.1. INTRODUCTION 2-27
2.1.1. Irrawaddy Dolphin Distribution 2-29
2.1.2. Global Status 2-30
2.2. REVIEW OF FRESHWATER IRRAWADDY DOLPHIN POPULATIONS 2-30
2.2.1. Chilka Lake (India) 2-31
2.2.2. Songkhla Lake (Thailand) 2-31
2.2.3. Ayeyarwady River (Myanmar) 2-32
2.2.4. Mahakam River (Indonesia) 2-32
2.2.5. Mekong River (southern Laos, Cambodia and Vietnam) 2-33
2.3. NATURAL SUSCEPTIBILITY TO ANTHROPOGENIC IMPACTS 2-36
2.3.1. Risks Associated with Small Populations 2-36
2.3.2. Habitat Preferences 2-38
2.3.3. Survival and Life History 2-39
2.4. EVIDENCE OF POPULATION DECLINES 2-40
2.5. THREATENING PROCESSES 2-40
2.5.1. Direct Take 2-42
2.5.2. Live- Capture for Display 2-42
2.5.3. Dolphin-Watching Tourism 2-43
2.5.4. Fisheries-Related Impacts 2-44
2.5.5. Habitat Degradation 2-45
2.6. SOCIO-ECONOMIC STATUS AND LOCAL PERCEPTIONS OF VILLAGERS 2-46
2.7. CONSERVATION, MANAGEMENT AND THREAT MITIGATION 2-47
2.7.1. Cultural Protection 2-47
2.7.2. Awareness Raising Programs and Community Involvement 2-48
2.7.3. Net-Compensation Packages 2-48
2.7.4. Integrated Conservation Development Projects 2-49
2.7.5. Dolphin-Watching Tourism 2-50
2.7.6. Protected Areas 2-51
2.7.7. Legislation 2-51
2.8. THE VALUE OF FRESHWATER DOLPHINS AS A FLAGSHIP SPECIES 2-51
2.9. CONCLUSIONS 2-57

3. THE MEKONG RIVER IN PERIL: A HISTORY OF THE LOWER MEKONG RIVER AND THE IMPORTANCE OF HABITAT PRESERVATION TO SPECIES CONSERVATION.....3-59

3.1. INTRODUCTION.....3-60
3.2. GEOLOGICAL HISTORY OF AREA.....3-61
3.3. COUNTRIES OF THE LOWER MEKONG RIVER.....3-63
3.4. DESCRIPTION OF THE LOWER MEKONG RIVER SECTION.....3-66
3.4.1. Climate.....3-66
3.4.2. Khone Falls.....3-66
3.4.3. Khone Falls to Kratie Township River Section.....3-67
3.4.4. Deep Pools.....3-67
3.4.5. Kratie Township to Phnom Penh River Stretch.....3-68
3.4.6. Tonle Sap Great Lake.....3-69
3.4.7. Lower Cambodian Mekong River and Vietnamese Delta.....3-70
3.5. FISH AND FISHERIES.....3-70
3.6. NON-FISH FAUNA AND FLORA.....3-72
3.7. THREATS TO THE MEKONG RIVER.....3-73
3.7.1. Direct Impacts from Within the Fisheries Sector.....3-73
3.7.2. Direct Impacts from Outside the Fisheries Sector.....3-74
3.8. INSTITUTIONAL, LEGAL AND POLICY FRAMEWORKS.....3-75
3.9. IMPORTANCE OF COMMUNITY-BASED CO-MANAGEMENT SYSTEMS.....3-77
3.10. IMPORTANCE OF HABITAT PRESERVATION TO SPECIES CONSERVATION.....3-78
3.11. CONCLUSIONS.....3-82

4. EVALUATING THE CONSERVATION STATUS OF IRRAWADDY DOLPHINS IN THE MEKONG RIVER USING LOCAL KNOWLEDGE.....4-84

4.1. INTRODUCTION.....4-85
4.2. BACKGROUND SCIENTIFIC KNOWLEDGE OF IRRAWADDY DOLPHINS IN THE MEKONG RIVER.....4-87
4.3. SURVEY AREA AND TIMING.....4-90
4.4. INTERVIEW METHODOLOGY.....4-91
4.4.1. Questionnaire Development.....4-92
4.4.2. Methodology.....4-92
4.5. RESULTS.....4-96
4.5.1. Demographics of Respondents.....4-96
4.5.2. Local Knowledge of Historical Distribution of Dolphins.....4-98
4.5.3. Local Perceptions of Dolphin Status and Conservation.....4-104
4.6. DISCUSSION.....4-108
4.6.1. Limitations of Methodology.....4-108
4.6.2. Historical Dolphin Distribution and Population Change.....4-109
4.6.3. Local Perceptions of Dolphins and Conservation.....4-112
4.7. CONCLUSIONS.....4-115

5. ESTIMATING ABUNDANCE AND ASSESSING TRENDS OF IRRAWADDY DOLPHIN NUMBERS IN THE MEKONG RIVER, BASED ON CAPTURE-RECAPTURE ANALYSIS OF PHOTO-IDENTIFIED INDIVIDUALS.....5-117

5.1. INTRODUCTION.....5-118
5.2. STUDY AREA.....5-120
5.3. MATERIALS AND METHODS.....5-121
5.3.1. Data Collection.....5-121
5.3.2. Identification from Photographs.....5-124
5.3.3. Capture-Recapture Assumptions.....5-126
5.3.4. Data Selection.....5-126
5.3.5. Estimating the Proportion of Animals with Long-lasting Marks.....5-129
5.3.6. Estimating Total Population Size.....5-130
5.3.7. Estimating the Number of Newborns/Calves and Dead Animals.....5-131
5.3.8. Study Constraints.....5-133
5.4. ANALYSIS OF STATISTICAL POWER OF MONITORING PROGRAMS.....5-134

5.5. RESULTS 5-134
5.5.1. Number of Dolphins with Long-Lasting Marks 5-137
5.5.2. Proportion of Dolphins with Long Lasting Marks 5-139
5.5.3. Model Selection and Population Size 5-139
5.5.4. Number of Calves and Dead Animals 5-139
5.5.5. Total Population Size 5-142
5.6. EFFECTIVENESS OF MONITORING PROGRAMS 5-142
5.7. DISCUSSION 5-144
5.7.1. Estimates of Population Size 5-144
5.7.2. Risk of Small Populations 5-145
5.7.3. Survival, Mortality Rates and Population Trends 5-146
5.7.4. Management Implications 5-146
5.8. CONCLUSIONS 5-148

6. POPULATION SIZE ESTIMATES OF FRESHWATER IRRAWADDY DOLPHINS IN THE MEKONG RIVER, BASED ON DIRECT COUNTS AND DISTANCE SAMPLING TECHNIQUES 6-151

6.1. INTRODUCTION 6-152
6.2. STUDY AREA 6-153
6.3. BOAT SURVEY METHODS 6-154
6.3.1. Direct Count Surveys 6-154
6.3.2. Line-transect Distance Sampling 6-155
6.3.3. Timing of Surveys 6-158
6.3.4. General Search Effort 6-158
6.3.5. Data Recorded 6-159
6.3.6. Sighting Data Recorded 6-161
6.3.7. Reducing the Potential for Double Counting for Direct Counts 6-163
6.3.8. Independent Observations 6-164
6.3.9. Distance Estimation 6-164
6.3.10. Line-Transect Data Analyses 6-167
6.4. LAND-BASED OBSERVATIONS 6-167
6.4.1. Dolphins Missed/Group Size Observations 6-168
6.4.2. Observing Surface and Dive Times 6-168
6.5. ANALYSIS OF STATISTICAL POWER OF MONITORING PROGRAMS 6-168
6.6. STUDY CONSTRAINTS 6-169
6.7. RESULTS 6-169
6.7.1. Direct Counts 6-170
6.7.2. Line-Transect Surveys in the Kratie to Khone Falls River Section 6-173
6.7.3. Line-Transect Surveys Below Kratie 6-177
6.8. LAND-BASED OBSERVATIONS 6-178
6.8.1. Proportion of Dolphins Missed by the Boat-based Observer Team 6-178
6.8.2. Group Size Estimates 6-178
6.8.3. Land-based Observations to Estimate Sighting Probability 6-179
6.9. POWER TO DETECT TRENDS 6-179
6.10. DISCUSSION 6-181
6.10.1. Importance of Kratie to Khone Falls River Section 6-181
6.10.2. Direct Count Considerations 6-181
6.10.3. Line Transect Considerations 6-182
6.10.4. Methodological Considerations 6-183
6.11. CONCLUSIONS 6-186
6.12. BOAT SURVEY RECOMMENDATIONS 6-188

7. DISTRIBUTION AND RANGING PATTERNS OF IRRAWADDY DOLPHINS INHABITING THE MEKONG RIVER 7-190

7.1. INTRODUCTION 7-191
7.2. STUDY AREA AND METHODS 7-192
7.2.1. Distribution 7-192
7.2.2. Ranging Patterns 7-192
7.3. RESULTS 7-194
7.3.1. Distribution of Dolphin Sightings 7-194
7.3.2. Environmental Characteristics of Sighting Locations 7-197
7.3.3. Deep Pool Characteristics 7-199
7.3.4. Ranging Patterns 7-200
7.4. DISCUSSION 7-210
7.4.1. Distribution and Habitat Preferences 7-210
7.4.2. Ranging Patterns 7-211
7.5. CONCLUSIONS 7-212

8. SCHOOL DYNAMICS AND SOCIAL STRUCTURE OF IRRAWADDY DOLPHINS INHABITING THE MEKONG RIVER 8-214

8.1. INTRODUCTION 8-215
8.2. MATERIALS AND METHODS 8-217
8.2.1. Photo-Identification of Individuals 8-217
8.2.2. Group Size 8-217
8.2.3. Association Analyses 8-218
8.2.4. Temporal Patterns of Analyses 8-221
8.3. RESULTS 8-222
8.3.1. Group Size 8-222
8.3.2. Dry Season Association Patterns 8-224
8.3.3. Wet Season Association Patterns 8-231
8.3.4. Dry Season Temporal Patterns of Analyses 8-234
8.4. DISCUSSION 8-235
8.4.1. A Stable Social Structure and its Potentially Influencing Factors 8-235
8.4.2. Research and Management Implications 8-240
8.5. CONCLUSIONS 8-241
8.6. SOCIAL STRUCTURE RESEARCH RECOMMENDATIONS 8-242

9. MORTALITY RATES AND CAUSES AFFECTING SURVIVAL OF THE IRRAWADDY DOLPHIN POPULATION INHABITING THE MEKONG RIVER 9-244

9.1. INTRODUCTION 9-245
9.2. STUDY AREA 9-246
9.3. METHODOLOGY 9-246
9.3.1. Carcass Reporting and Collection 9-246
9.3.2. Information Gathered from Carcasses 9-249
9.3.3. Location of Deaths 9-252
9.3.4. Cause of Death 9-252
9.4. ESTIMATES OF MORTALITY LIMIT 9-252
9.5. RESULTS 9-254
9.5.1. Mortality Rates, Seasonality and Age/Sex Composition 9-254
9.5.2. Location of Dolphin Deaths 9-258
9.5.3. Cause of Death 9-260
9.6. ESTIMATES OF SUSTAINABLE ANTHROPOGENIC MORTALITY 9-262
9.7. DISCUSSION 9-262
9.7.1. Newborn Mortalities and Survival Rates 9-262
9.7.2. Location of Deaths 9-264
9.7.3. Causes of Death 9-264
9.7.4. Potential Causes of Dolphin Death 9-267

9.8. ESTIMATES OF MORTALITY LIMIT 9-269
9.8.1. Considerations Regarding Implementing Management Actions..... 9-270
9.9. CONCLUSIONS 9-271
9.10. RECOMMENDATIONS FOR MORTALITY STUDY AND MITIGATION 9-273

10. ENCOURAGING COMMUNITY SUPPORT FOR IRRAWADDY DOLPHIN CONSERVATION: RURAL DEVELOPMENT, LIVELIHOOD DIVERSIFICATION AND TOURISM 10-275

10.1. INTRODUCTION 10-276
10.1.1. Conservation Strategies 10-276
10.1.2. Project Evaluation 10-279
10.1.3. Freshwater Conservation Strategies 10-281
10.2. 'DOLPHINS FOR DEVELOPMENT': A CONSERVATION INITIATIVE IN CAMBODIA 10-282
10.2.1. Project Background 10-282
10.2.2. Project Location 10-283
10.2.3. Dolphin-watching Tourism 10-284
10.2.4. Project Initiation and Methods 10-285
10.2.5. Dolphins for Development Project 10-287
10.2.6. Project Evaluation 10-295
10.3. DISCUSSION 10-295
10.3.1. The Potential for Conservation Success Using Integrated Conservation Development Projects 10-296
10.3.2. Community-based Tourism Initiatives 10-299
10.3.3. Community Conscious Conservation 10-302
10.4. CONCLUSIONS 10-305

11. CONSERVATION AND MANAGEMENT OF THE IRRAWADDY DOLPHIN POPULATION THAT INHABITS THE MEKONG RIVER 11-307

11.1. INTRODUCTION 11-308
11.2. MAJOR RESULTS OF THE STUDY 11-309
11.2.1. Objective 1. Determine the current status and biodiversity importance of freshwater Irrawaddy dolphin populations (Chapter 2). 11-309
11.2.2. Objective 2. Provide information on the study area and justification for why habitat conservation should be a major priority (Chapter 3). 11-310
11.2.3. Objective 3. Investigate the historical status of the population and reasons for any population change using local knowledge (Chapter 4). 11-310
11.2.4. Objective 4a. Obtain estimates of total population size (Chapters 5 and 6). 11-311
11.2.5. Objective 4b. Obtain baseline data on ranging patterns and habitat use (Chapter 7). .. 11-312
11.2.6. Objective 4c. Obtain data on school dynamics and social structure (Chapter 8). 11-312
11.2.7. Objective 4d. Obtain data on mortality rates and causes (Chapter 9). 11-312
11.2.8. Objective 5. Investigate social considerations influencing conservation strategies and trial a Dolphins for Development conservation initiative (Chapter 10). 11-313
11.2.9. Objective 6. Provide recommendations for the effective conservation of Irrawaddy dolphins and their riverine habitat in Cambodia (Chapter 11). 11-314
11.3. SETTING CONSERVATION GOALS AND PRIORITIES 11-315
11.3.1. Recommendations for Future Research 11-317
11.3.2. Recommendations for Future Management 11-320
11.3.3. ON-THE-GROUND IMPLEMENTATION OF RECOMMENDATIONS 11-321
11.4. MEASURING SUCCESS, REVIEW AND ADAPTATION 11-324
11.5. CONCLUSIONS 11-325
11.6. RECOMMENDATIONS FOR FRESHWATER DOLPHIN CONSERVATION 11-329
Objective 1. Determine the current status and biodiversity importance of freshwater Irrawaddy dolphin populations (Chapter 2). 11-331
Objective 2. Provide information on the study area and justification for why habitat conservation should be a major priority (Chapter 3). 11-332

Objective 3. Investigate the historical status of the population and reasons for any population change using local knowledge (Chapter 4). *11-333*
Objective 4a. Obtain estimates of total population size (Chapters 5 and 6). *11-334*
Objective 4a continued. Obtain estimates of total population size (Chapters 5 and 6). *11-335*
Objective 4b. Obtain baseline data on ranging patterns and habitat use (Chapter 7). *11-336*
Objective 4c. Obtain data on school dynamics and social structure (Chapter 8). *11-336*
Objective 5. Investigate social considerations influencing conservation strategies and trial a Dolphins for Development conservation initiative (Chapter 10). *11-338*

12. LITERATURE CITED **12-340**

13. APPENDIX **373**

APPENDIX I. Beasley et al. 2005 373
APPENDIX II. Beasley et al. 2002 375
APPENDIX III. Land-based Observations 377
APPENDIX IV. MDCP Mekong Dolphin Conservation Strategy 386
APPENDIX V. Cambodian DoF Mekong Dolphin Conservation Strategy 389
APPENDIX VI. *Orcaella* Life History Information 391
APPENDIX VII. Mekong Dolphin Stranding and Mortality Summary 403
APPENDIX VIII. Biological and Social Research Recommendations 405
APPENDIX IX. Management Recommendations 412

LIST OF TABLES

CHAPTER 2

Table 2.1. A summary of previous attempts to estimate abundance of freshwater Irrawaddy dolphin populations. 2-35

Table 2.2. Comparisons of previous and current freshwater Irrawaddy dolphin abundance estimates and historical distribution. Many of the previous estimates are anecdotal reports, or best guesses, as a result of a lack of detailed study. 2-41

Table 2.3. Various awareness-raising conservation initiatives implemented to conserve freshwater Irrawaddy dolphin populations 2-48

Table 2.4. Known, proposed, or recommended protected areas for freshwater Irrawaddy dolphins 2-52

Table 2.5. Legislation relevant to freshwater populations of Irrawaddy dolphins 2-53

CHAPTER 3

Table 3.1. The 2003 Human Development Index and Human Poverty Index statistics for Laos, Cambodia and Vietnam, compared with Australia (UNDP 2004) 3-65

Table 3.2. International agreements that pertain directly, or indirectly, to conservation and management of the lower Mekong River. 3-76

CHAPTER 4

Table 4.1. Summary of the differences between developed and developing countries with respect to the conditions under which surveys are designed and deployed. The identified differences are arranged in ascending order of importance to undertaking a questionnaire survey regarding natural resource management issues. The third column describes the methods by which I addressed these concerns in my study. The last column summarises the potential for problems to occur during data collection/analyses based on my final questionnaire design. 4-94

Table 4.2. The average age (including standard deviation) and average length of time interviewees had resided, or worked, in the area (including standard deviation) where they were interviewed, based on interview surveys conducted throughout the lower Mekong River. 4-97

Table 4.3. A summary of the number (and percent) of respondents to interview surveys who had previously sighted Irrawaddy dolphins in various sections of the Mekong River and Tonle Sap Lake (Area), during the wet and dry seasons. Most respondents sighted Irrawaddy dolphins during the dry season in the Kratie to Khone Falls river section and Tonle Sap River and Tonle Sap Lake. During the wet season, Irrawaddy dolphins were sighted most frequently south of Kratie, into the Vietnamese Delta. 4-101

Table 4.4. Summary of the reported trends in current dolphin abundance along the Mekong River, compared to when the respondent was a child based on interview surveys. Cambodia is separated into three regions: Kratie to Khone Falls, Kratie south to the Vietnamese/Cambodian border, and Tonle Sap River and Lake. These regions can be seen on Figure 4.4. 4-102

Table 4.5. The number (% total) of respondents during interview surveys with various beliefs about the closest relative of Irrawaddy dolphins in the Mekong River. 4-105

CHAPTER 5

Table 5.1. The assumptions of mark-recapture and consequences of the methods used in this study to address them. 5-127

Table 5.2. The number of excellent quality photographs in each year from 2004-2005 and the associated proportion of individuals identifiable in the total population 5-139

Table 5.3. Population estimates of Irrawaddy dolphins in the Mekong River, using a closed population model. 5-140

Table 5.4. Known Irrawaddy dolphin minimum birth and mortality rates in the Mekong River from January 2003–April 2005. 5-141

Table 5.5. The effect of different annual rates of population change on the number of years required to detect population trends with yearly survey intervals (t = 1), for Irrawaddy dolphins in the Mekong River. Data variability is specified at CV = 0.07, which corresponds to the highest level of precision obtained for the abundance estimates. The probability of Type I and Type II errors was set at the 0.05 level. Power analysis based on Gerodette (1987). 5-144

CHAPTER 6

Table 6.1. Summary of surveys conducted to assess the freshwater Irrawaddy dolphin population size in the Ayeyarwady and Mahakam Rivers in Asia. 6-156

Table 6.2. A summary table of the assumptions of line-transect methodology, the effect of failure to address the assumption adequately, the methods used in this study to address potential violations and the potential in this study for assumptions to be violated. 6-157
Table 6.3. Summary of direct count and line-transect methodologies used to estimate Irrawaddy dolphin population size in the Mekong River 6-165
Table 6.4. A summary table of the constraints involved in boat and land-based surveys for Irrawaddy dolphins in the Mekong River. Each constraint has an associated indication on the potential for it to be problematic to data analyses. 6-169
Table 6.5. Summary of boat survey type, duration and number of Irrawaddy dolphin groups sighted during boat surveys in the Mekong River. 6-170
Table 6.6. A summary of the upriver direct count surveys conducted to estimate population size of the Irrawaddy dolphin population that inhabits the Mekong River. The summary includes the dates of each survey, total effort conducted (in both distance and time) and the number of individual dolphins sighted based on 'best', 'low' and 'high' estimates[1]. 6-170
Table 6.7. A summary of the downriver direct count surveys conducted to estimate population size of the Irrawaddy dolphin population that inhabits the Mekong River. The summary includes the dates of each survey, total effort conducted (distance and time) and the number of individual dolphins sighted based on 'best', 'low' and 'high' estimates[1]. 6-171
Table 6.8. Summary of on-effort and combined independent observer sightings during surveys conducted in January and April 2004 and April 2005. Two dolphin groups were sighted only by the independent observer team only in April 2004, representing 22% of sightings for that survey period. These data indicate that boat-based observers had the potential to miss at least 22% of dolphins in the survey area. 6-173
Table 6.9. Summary of the combined line-transect and upriver direct count boat surveys conducted in the Kratie to Khone Falls section of the Mekong River. The summary provides information on survey duration and effort, with corresponding minimum population size estimates of Irrawaddy dolphins. 6-173
Table 6.10. Habitat type and availability in the Kratie to Khone Falls river section. Dolphins are most commonly sighted in deep pool areas during the dry season which comprise only 26.4% of available habitat in the Kratie to Khone Falls river section. 6-175
Table 6.11. Estimates of Irrawaddy dolphin abundance from line-transect surveys within deep pool habitats in Kratie to Khone Falls river section. The Model Fit was the model chosen by the program DISTANCE, resulting from the lowest AIC value. All data were truncated using 5% of outliers *. 6-177
Table 6.12. Summary of line-transect duration and effort south of Kratie Township to the Vietnamese Delta. 6-177
Table 6.13. Number of dolphin groups sighted by land- and boat-based observer teams. Land-based observations were undertaken over two years of the study period. The boat-based observers did not miss any dolphin groups that were sighted by land-based observers in critical dolphin habitats. A total of 16 dolphin groups were sighted by land-based observers and 17 dolphins groups sighted by the boat-based observers. 6-178
Table 6.14 . Effect of different annual rates of population change on the number of years required to detect population trends with yearly survey intervals (t=1). Data variability is specified at CV = 0.30, which corresponds to the highest level of precision obtained for the line-transect abundance estimates from this study. 6-180
Table 6.15. A comparison of the different surveys methods used to estimate total population size of Irrawaddy dolphins inhabiting the Mekong River. 6-185

CHAPTER 8

Table 8.1. Irrawaddy dolphin group size in the five primary areas in the Mekong River during the dry and wet seasons. 8-224
Table 8.2. An examination of differences in Irrawaddy dolphin group size in the Mekong River between primary areas during the dry season. Highly significant differences in group size between primary areas are indicated by two stars (**), significant differences are indicated by one star (*) and areas showing no significant differences are indicated by 'ns'. 8-224
Table 8.3. Results of permutation tests for preferred companionship of Irrawaddy dolphins inhabiting the Mekong River based on the 2003-2005 dry season data-set, following the Bejder *et al*. (1998) procedure. The highly significant P value (P<0.001) indicates that individuals showed a preference in their associations. 8-231

CHAPTER 9

Table 9.1. Total confirmed and unconfirmed dolphin mortalities in the Mekong River from January 2001 to April 2005. 9-255
Table 9.2. Summary table of inorganic mercury residues in Irrawaddy dolphin liver and blubber tissue from the Mekong River, plus comparative data for other cetacean species from Japan, China and the Mediterranean [1]....9-261
Table 9.3. The allowable Potential Biological Removal of Irrawaddy dolphins from the Mekong River from anthropogenic mortality 9-262
Table 9.4. A comparison of newborn mortality rates in the Mekong River with other well-studied cetacean populations. 9-263

CHAPTER 10

Table 10.1. A summary of the potential constraints to development and implementation of Integrated Conservation Development Projects (ICDPs), with a corresponding list of potential solutions to these constraints. 10-280
Table 10.2. Summary of the objectives and outputs for the rural development and livelihood diversification component of the Dolphins for Development' project at Kampi Village, Kratie Province. 10-289
Table 10.3. Summary of the objectives and outputs for the community-based tourism project component of the Dolphins for Development project, initiated at Kampi Village, Kratie Province. 10-291
Table 10.4. Summary of the objectives and outputs for the awareness raising and education component of the Dolphins for Development project, initiated at Kampi Village, Kratie Province. 10-293
Table 10.5. Summary of the objectives and outputs for the stakeholder relationship strengthening component of the Dolphins for Development project, initiated at Kampi Village, Kratie Province. 10-294
Table 10.6. Characteristics of successful ICDPs and comparison with the Cambodian Dolphins for Development ICDP. 10-298
Table 10.7. Summary of the dolphin-watching tourism at Kampi Pool and my perceived levels of community empowerment resulting from the Mekong River Dolphins for Development project. . 10-300
Table 10.8. Summary of the limitations encountered in the community-based tourism project at Kampi Village and the potential solutions that could be implemented. 10-301
Table 10.9. Local and national conservation programs required and the necessary components of each programme. 10-304

CHAPTER 11

Table 11.1. Summary of the main research and conservation implications of Chapter 1: Objective 1 - to determine the current status and importance of freshwater Irrawaddy dolphin populations. 11-331
Table 11.2. Summary of the main research and conservation implications of Chapter 3: Objective 2 – to provide information on the study area and justify why habitat conservation should be a major priority. 11-332
Table 11.3. Summary of the main research and conservation implications of Chapter 4: Objective 3 – to investigate the historical status of the Irrawaddy dolphin population in the Mekong River and reasons for any population change using local knowledge. 11-333
Table 11.4. Summary of the main research and conservation implications of Chapters 5: Objective 4a – to obtain estimates of total population size of Irrawaddy dolphins in the Mekong River, using capture-recapture of photo-identified individuals. 11-334
Table 11.5. Summary of the main research and conservation implications of Chapter 6: Objective 4a – to obtain estimates of total population size of Irrawaddy dolphins in the Mekong River, using direct count and line-transect methodologies. 11-335
Table 11.6. Summary of the main research and conservation implications of Chapter 8: Objective 4c – investigate Irrawaddy dolphin school dynamics and social structure in the Mekong River. 11-336
Table 11.7. Summary of the main research and conservation implications of Chapter 8: Objective 4d - investigate mortality rates and causes affecting survival of Irrawaddy dolphins in the Mekong River. 11-337
Table 11.8. Summary of the main research and conservation implications of Chapter 10: Objective 5 – to investigate social considerations influencing conservation strategies and trial a Dolphins for Development conservation initiative. 11-338

LIST OF FIGURES

CHAPTER 1

Figure 1.1. Location map of southern Laos, Cambodia and Vietnam, showing the research area where my study was undertaken. 1-5

Figure 1.2. Location map of the lower Mekong River study area. The study area begins at the Laos/Cambodian border and extends south to the Vietnamese Delta (including Tonle Sap Lake). The light blue shading shows the floodplain area of Tonle Sap Lake. Map created by Matti Kummu (MRCS/WUP-FIN Lower Mekong Modeling Project) and reproduced with his permission. 1-6

Figure 1.3. The seven components of an overall process for conserving biodiversity, as described by Margoluis and Salafsky (1998), pg 319. 1-15

Figure 1.4. A conceptual framework of my thesis, as adapted from Groves (2003). My primary goal is to contribute to the effective conservation of the Irrawaddy dolphin population inhabiting the Mekong River, by considering both biological and social factors (shown by the black and white boxes respectively) of relevance to conservation and management. 1-21

CHAPTER 2

Figure 2.1. An Irrawaddy dolphin photographed from the Mekong River, Cambodia. This image shows the characteristic slaty grey uniform colouration, rounded head and small rounded dorsal fin. Irrawaddy dolphins in the Mekong River rarely leap completely out of the water (as shown in this picture) and normally surface inconspicuously, with little of their body showing. Photograph by Yim Sak Sang. 2-28

Figure 2.2. Partial distributions of the Irrawaddy dolphin (black) and Australian snubfin dolphin (red). The species-level separation between the Irrawaddy and Australian Snubfin dolphin stocks appears to occur on either side of the deep-water straits of Indonesia. 2-29

Figure 2.3. Locations of the five freshwater Irrawaddy dolphin populations, shown in red: Chilka and Songkhla Lakes (shown by red dots) and the Mahakam, Mekong and Ayeyarwady Rivers (shown by red lines). 2-30

Figure 2.4. Irrawaddy dolphins live-captured from coastal Thai waters and held for public display at Oasis Sea World, Chantaburi Province, Thailand, near the Thai/Cambodian border. 2-43

Figure 2.5. An example of the dolphin-watching boats now used at Chiteal Pool to observe dolphins. The area is very small (1 km^2) and this photograph shows the main habitat for the dolphins. 2-44

Figure 2.6. An Irrawaddy dolphin captured by a large mesh gillnet in the Mekong River, Cambodia in February 2001. The indentations from the net can be viewed just behind the flippers and neck region (indicated by the arrow). 2-45

Figure 2.7. One of the many wells that were constructed by the Cambodian Rural Development Team to provide access to freshwater, in rural villages adjacent to critical dolphin habitats. Photograph by Brendan Boucher. 2-50

Figure 2.8. A Mekong River giant stingray (*Himantura chaophraya*) that was captured by a large hook in Kampi Pool in January 2004. Conservation efforts directed at the *Critically Endangered* Irrawaddy dolphin population would also benefit other fauna and flora in the river system. 2-56

CHAPTER 3

Figure 3.1. The Mekong River from its origin in Tibet to the South China Sea (left). The inset on the right shows the study area of the lower Mekong River section. A large expanse of waterfalls, named Khone Falls, is situated across the Laos/Cambodian border. These falls prevent dolphin movement north. My surveys cover nearly the entire known historical distribution of dolphins in the Mekong River, apart from the Sekong River of southern Laos. Both maps were produced by Matti Kummu (MRCS/WUP-FIN Lower Mekong Modelling Project) and reproduced with his permission. 3-62

Figure 3.2. The Mekong River narrowing to the bottom of Khone Falls (left). The right photo is of a representative section of Khone Falls, showing the extensive small waterfall system 3-67

Figure 3.3. Chiteal Pool situated on the Laos/Cambodian border is one of hundreds of deep pool areas in the Mekong River. Dolphins preferentially use only 10-12 deep pool areas in the upper Cambodian Mekong River (including Chiteal Pool). 3-68

Figure 3.4. A Mekong giant catfish captured in the Dai fisheries situated along Tonle Sap River, Cambodia, at the end of the 2003 rainy season. Photograph by Dr. Zeb Hogan. 3-71

Figure 3.5. A large Asian Giant softshell turtle found dead during my surveys in the upper Cambodian Mekong River, near Sambor village, on 10 April 2005. 3-72

Figure 3.6. Regional distribution of large dams at the end of the 20th century. Excerpt from WCD (2000).....3-79

CHAPTER 4

Figure 4.1. Location map of the lower Mekong River showing where interview surveys were conducted (as shown by the dark red line). No surveys were conducted north of Khone Falls (Muang Khong on map).....4-91
Figure 4.2. MDCP team conducting interviews with a local Cambodian fisher. All Cambodian interviews were conducted by Khmer staff, in Khmer language. Photograph by Yim Sak Sang. 4-96
Figure 4.3. The length of time that respondents from Cambodia and Vietnam had lived in the area where they were interviewed. The majority of respondents have lived in the area more than 10 years. In Cambodia, those interviewees that had lived in the area for more than 30 years had returned to their original village after the Pol Pot regime.....4-97
Figure 4.4. Historical and current distribution map of Irrawaddy dolphin reports from the Mekong River based on interview surveys. The Kratie to Khone Falls river section is now reportedly the primary region where the dolphins are sighted most frequently in the Mekong River. Dolphins now rarely occur south of Kratie to the Vietnamese Delta and are even rarer in Tonle Sap River or Lake. Map produced by Matti Kummu (MRC/WUP-FIN Lower Mekong Modelling Project) and reproduced with his permission.....4-99
Figure 4.5. Historical and current distribution map of Irrawaddy dolphin observations from the Mekong River based on published boat survey data and my results from Chapters 5 and 6. Lloze (1973) reportedly surveyed in Tonle Sap Lake and south along the Mekong River to the Cambodian/Vietnamese border (not surveying into Vietnam). Lloze (1973) caught at least two dolphins from Kampi Pool, Kratie Province for his anatomical studies. Baird and Beasley (2005) surveyed from Khone Falls south to Kratie Township and MDCP surveys covered the entire lower Mekong River from Khone Falls south to the Vietnamese Delta (including Tonle Sap Lake). The MDCP sighting in Vietnamese Mekong waters represents the location of the three dolphin carcasses, not a live dolphin. Map produced by Matti Kummu (MRC/WUP-FIN Lower Mekong Modelling Project) and reproduced with his permission.....4-100
Figure 4.6. An elderly man who discovered an old Irrawaddy dolphin skull in Tonle Sap Lake during the low waters of the dry season in the early 1990s. He kept this skull, as he believed it would bring him good luck. This man was not directly interviewed but observed the interviews and then showed us the dolphin skull he had recovered. 4-101
Figure 4.7. Respondents' reasons (percent of respondents) during interview surveys for the apparent decrease in dolphin numbers in the Mekong River. Bars are separated into Cambodia and Vietnam to illustrate differences in perceptions between country. 4-103
Figure 4.8. Respondents' reasons (percent of respondents) during interviews for the perceived increase in dolphin numbers in the Mekong River. Bars are separated into Cambodia and Vietnam to illustrate differences between country. Only two respondents from Vietnam believed that the dolphin population in the Mekong River was increasing. 4-104
Figure 4.9. The perceived importance of conserving dolphins and fish in Cambodia and Vietnam based on interview surveys.....4-106
Figure 4.10. Respondents perceived reasons why it is important to conserve dolphins in the Mekong River, based on interview surveys. 4-107
Figure 4.11. Cambodian and Vietnamese respondents, illustrating the perceived reasons why it is not important to conserve dolphins in the Mekong River. 4-107

CHAPTER 5

Figure 5.1. The study area in the lower Mekong River from Muang Khong (Laos/Cambodian border), south to the Vietnamese Delta. The river section in red is the Kratie to Khone Falls River section, which is the dolphins' primary habitat during the dry season. The four primary areas occupied by dolphins during the dry season are indicated by red circles. From north to south, the areas are: Chiteal, Stung Treng, Koh Pidau and Kampi. 5-121
Figure 5.2. Photo-identification was one of the primary techniques used to estimate abundance of Irrawaddy dolphins in the Mekong River. From 2004-2005, high quality photographic equipment was used to photograph dolphin groups. I used a combination of a Canon digital camera with 300 mm fixed lens and a converter (2x), which resulted in a focal length of 960 mm. Using this arrangement, I obtained very clear, high quality dolphin images. Photo by Brendan Boucher. .5-123
Figure 5.3. The survey boat drifting in Chiteal pool in the Mekong River, to obtain photographic images of individual Irrawaddy dolphins. I often spent an entire day was spent drifting in one deep water

pool, to obtain adequate photographs. I normally took all photographs. The boat driver and research assistants observed the dolphin group as I was photographing, to estimate group size and composition, as well recording any unusual behaviours or events. Photo by Yim Saksang.....5-124
Figure 5.4. Two examples of photographic image quality. An excellent image (left), in which nicks, notches and even scratches can be clearly seen in focus. A good quality image (right), which although in focus, is not exactly perpendicular to the camera. 5-125
Figure 5.5. An example of a newborn dolphin surfacing beside its mother, sighted during boat surveys. This individual was sighted in Chiteal Pool in January 2004 with adult, Chiteal (CH01). The newborn (named Phnom: CH11), was resighted in Chiteal Pool during every survey conducted to April 2005. Phnom swam constantly with CH01 and exhibited subtle marks on its body (but not dorsal fin) which were acquired in April 2004 and matched from then on in all good and excellent photographs. 5-132
Figure 5.6. The project team members responsible for the dedicated carcass recovery programme photographed with three newborn dolphin carcasses recovered during March 2004 in the Kratie and Koh Pidau primary areas. Photo by: Mr. Chivv That (Kratie Fisheries Office).....5-133
Figure 5.7. Total photo-identification effort (based on the total time photographing Irrawaddy dolphin groups in the Mekong River) in 2004 and 2005 (data from 2001-2003 were excluded from these analyses). Photographic effort was higher in 2004 (71.2 hr) compared with 2005 (41.5 hr) because photo-identification effort was restricted to one month during 2005 (April). 5-136
Figure 5.8. Total time (hours) photographing Irrawaddy dolphin groups in each primary area in the Mekong River from 2004-April 2005. Throughout the study, most photo-identification effort was conducted at Kampi Pool, with the least being undertaken at Stung Treng. 5-136
Figure 5.9. The number of individual dolphins photo-identified in each primary area (consisting of 11 critical areas where dolphins were identified) along the Kratie to Khone Falls river stretch of the lower Mekong River, from January 2001-April 2005. The four primary areas are: Kampi, Koh Pidau, Stung Treng and Chiteal. n = the total number of individuals identified in each primary area. 5-137
Figure 5.10. Discovery curve of the cumulative number of Irrawaddy dolphins identified between January 2001 and April 2005 in the Mekong River. The bars represent the total photographic effort for each survey month and the line represents the cumulative number of dolphins identified. ...5-138
Figure 5.11. The number of times individually identified dolphins were sighted in the Kratie to Khone Falls river section of the Mekong River during 2004–2005. The individual sighted 18 times is Klasico (KA01) sighted only in Kampi Pool, Kratie Province. 5-138
Figure 5.12. Relationships between different rates of population change, time to detection of trend and coefficient of variation (CV) for annual population estimates for Irrawaddy dolphins in the Mekong River. The CVs used to present data variability are the values obtained for population estimates, including two lower CVs (0.15 and 0.20), for comparison. The probability of both Type I and Type II errors was set at 0.05. 5-143

CHAPTER 6

Figure 6.1. Map showing the study area where boat surveys were conducted. The area ranged from the Laos/Cambodian border (Muang Khong) south to the Vietnamese Delta (including Tonle Sap Lake). The Kratie to Khone Falls river section (shown in red), is the only area in the river where dolphins were sighted.....6-154
Figure 6.2. Survey protocol for the Kratie to Khone Falls River section. Survey lines started at a random location in the river, depending on the area to be surveyed for that day. River stretches greater than 1 km wide were surveyed in a zigzag manner, while river stretches less than 1 km wide were surveyed in as straight a line as possible. The oval areas in the middle of the river represent mid-channel islands. 6-160
Figure 6.3. Chiteal deep pool located on the Laos/Cambodian border (Laos is on the opposite bank)6-161
Figure 6.4. A newborn calf sighted in Chiteal Pool (on the Laos/Cambodian border of the Mekong River) in January 2004. The mother of the calf (to the left) was identified as CH01_Chiteal. The calf was surfacing in the typical 'corkscrew' fashion of a newly born dolphin, with its head jerking high out of the water. The foetal folds are also obvious just behind its head (as indicated by the black arrow).....6-163
Figure 6.5. Boat used during surveys in the Kratie to Khone Falls river section. This image shows one of the regions in the dry season where boat survey effort was stopped for the day, as a result of the low probability that dolphins passed through the area because of the shallow depth, large number of rocks and high water velocity. 6-166

Figure 6.6. Survey boat used for line-transect surveys south of Kratie to the Cambodia/Vietnam border, with two observers on-effort at all times. The observer using binoculars stood behind the observer using his/her naked eye. The naked eye observer was also responsible for recording environmental and sighting data. (left). Boat used for surveys of the Vietnamese Mekong River (right). 6-166
Figure 6.7. A summary graph showing 'best' estimates of total dolphins seen for upriver direct counts (shown by the diamonds) and downriver pool counts (shown by the squares), from 2001-2005. A red circle indicates the maximum 'best' estimate for each year. No data were available for direct counts in February 2004. The bars as shown on the right axis represent the minimum water level for the month (obtained from the Mekong River Commission). 6-172
Figure 6.8. The number of Irrawaddy dolphin groups sighted during boat surveys in the Mekong River, at various perpendicular sighting distances from the survey transect line. Sighting rates dropped off significantly after 640 m perpendicular sighting distance. All data to the right of the dotted line (988 m) were truncated from the final analysis (5% of outliers). 6-174
Figure 6.9. A scatterplot of the relationship between the size of a detected cluster and the distance from the line to the geometric centre of the cluster. The correlation coefficient is 0.4. A coefficient with a value of 0 indicates that cluster size and distance from the transect line are not correlated and 1 indicates a very high correlation. 6-174
Figure 6.10. The Hazard rate detection probability curve (red line) fit to the histogram of observed detection distances (blue) obtained during line-transect surveys for Irrawaddy dolphins in the Mekong River. The analysis is based on all sightings 2003-2005 within deep pool habitats. Five percent the outliers truncated. 6-176
Figure 6.11. Relationships between different rates of population change, time to detection of trend and coefficient of variation (CV) for annual population estimates. The highest level of precision obtained for line-transect estimates was CV=0.30. Additionally, comparative CVs of 0.20 and 0.10 are presented in the event that increased sampling was possible. 6-180

CHAPTER 7

Figure 7.1. Map showing the study area where boat surveys were conducted. The area ranged from the Laos/Cambodian border (Muang Khong) south to the Vietnamese Delta (including Tonle Sap Lake). The Kratie to Khone Falls river section (shown in red), is the only area in the river where dolphins were sighted. The lower box represents Kratie Province, and the upper box represents Sung Treng Province. Map created by Matti Kummu. 7-195
Figure 7.2. Distribution of Irrawaddy dolphins inhabiting the Mekong River, based on all dolphin sightings obtained between January 2001-April 2005. Kratie province is shown on the left map and Stung Treng Province, which is further north (see Figure 7.1) on the right map. Sightings are separated into dry season (red dots) and wet season (yellow dots). Chiteal primary area is located on the right map on the Laos/Cambodian border. Since it is a small area, the green colour is hidden by sighting dots and is therefore not visible. Maps created by Erin LaBrecque. 7-196
Figure 7.3. Total survey effort (boat surveys and dedicated photo-identification) in the Kratie to Khone Falls River section. No dolphins were sighted south of Kratie Township.....7-197
Figure 7.4. Distribution of all Irrawaddy dolphin sightings in the Kratie to Khone Falls section of the Mekong River from January 2001-April 2005. The sightings are separated by year. Map created by Erin LaBrecque. 7-198
Figure 7.5. Average water temperature at dolphin sighting locations in the Kratie to Khone Falls river stretch from 2001-2005. Water temperature was highest in May and lowest in January.....7-199
Figure 7.6. Average water clarity at the locations where dolphins were sighted in the Kratie to Khone Falls river stretch from 2001-2005. Water clarity was significantly reduced in August and greatest in April.....7-200
Figure 7.7. Locations of all individual Irrawaddy dolphins photo-identified in the Mekong River from 2001-2005. Most dolphins are represented more than once based on re-sightings. Sightings are separated into dry season (red dots) and wet season (yellow dots). Map created by Erin LaBrecque. 7-201
Figure 7.8. The number of different days an identified Irrawaddy dolphin was sighted in the Kratie to Khone Falls river stretch of the Mekong River, from 2001-2005.....7-202
Figure 7.9. The total numbers of days each of the 15 individual dolphins that were included in the ranging pattern analyses were sighted in the Mekong River, from 2001-2005. 7-203
Figure 7.10. A comparison of the average area (total km^2) Irrawaddy dolphins ranged in the Kratie to Khone Falls river section, from 2001-2005. The 15 individual dolphins included in the analysis are grouped by primary area and separated into dry and wet seasons. 7-203

Figure 7.11. The ranging patterns of an identified Irrawaddy dolphin individual from the Mekong River, TK02: Sa'at, which was only observed to inhabit the Stung Treng primary area. Map A (top) illustrates all sighting locations of TK02 during my study. Map B (bottom) illustrates the dry season sighting locations (red dots). No sightings of TK02 were obtained during the wet season. Map created by Erin LaBrecque. 7-204
Figure 7.12. Ranging patterns of an identified Irrawaddy dolphin individual from the Mekong River, KS01: Suntuk, which was only observed to inhabit the Stung Treng primary area. Map A (top) illustrates all sighting locations of KS01 during my study. Map B (middle) illustrates the dry season sighting locations (red dots). Map C (bottom) illustrates both dry and wet season (yellow dots) sighting locations. Map created by Erin LaBrecque. 7-205
Figure 7.13. Ranging patterns of an identified Irrawaddy dolphin individual from the Mekong River, CH01: Chiteal, which was only observed to inhabit the Chiteal primary area. Map A (top) illustrates all sighting locations of CH01 during my study. Map B (middle) illustrates the dry season sighting locations (red dots). Map C (bottom) illustrates both dry and wet season (yellow dots) sighting locations. Map created by Erin LaBrecque. 7-206
Figure 7.14. Ranging patterns of an identified Irrawaddy dolphin individual from the Mekong River, KA04: Sabai, which was only observed to inhabit the Kampi primary area. Map A (top) illustrates all sighting locations of KA04 during my study. Map B (middle) illustrates the dry season sighting locations (red dots). Map C (bottom) illustrates both dry and wet season (yellow dots) sighting locations. Map created by Erin LaBrecque..... 7-207
Figure 7.15. Ranging patterns of an identified Irrawaddy dolphin individual from the Mekong River, KA05: Rags, which was observed to inhabit both Kampi and Koh Pidau primary areas. Map A (top) illustrates all sighting locations of KA05 during my study. Map B (middle) illustrates the dry season sighting locations (red dots). Map C (bottom) illustrates both dry and wet season (yellow dots) sighting locations. Map created by Erin LaBrecque. 7-208
Figure 7.16. Ranging patterns of an identified Irrawaddy dolphin individual from the Mekong River, GO02: Chop, which was observed to inhabit only the Koh Pidau primary area. Map A (top) illustrates all sighting locations of GO02 during my study. Map B (middle) illustrates the dry season sighting locations (red dots). Map C (bottom) illustrates both dry and wet season (yellow dots) sighting locations. Map created by Erin LaBrecque. 7-209

CHAPTER 8

Figure 8.1. A scatterplot showing the relationship between Irrawaddy dolphin group size estimates in the Mekong River from 2001-2005 and the number of individuals photographically identified within each group. 8-219
Figure 8.2. Comparisons of Irrawaddy dolphin group size in relation to the percent of total encounters during the dry and wet seasons in the Mekong River. In addition, a group of 34 individuals were sighted on 30 July 2004 at Phum Kreing critical area. This group was excluded from this figure, as it was a significant outlier. The numbers above each bar represent the number of groups encountered..... 8-223
Figure 8.3. The percentage of Irrawaddy dolphin groups sighted in the Mekong river between 2001-2005, with $\geq$ 50% of individuals identified in the group. Data from 2001-2002 were excluded from the social structure analysis because of the minimal number of individuals identified (Chapter 5).. 8-225
Figure 8.4. Discovery curve showing the cumulative number of individuals identified against the cumulative number of identifications (with only one identification of each individual counted during each sampling period)..... 8-226
Figure 8.5. Distribution of maximum HWI of Irrawaddy dolphins in the Mekong River (individuals sighted on $\geq$ 4 days and in schools with $\geq$ 50% of individuals identified). The distribution of maximum association indices suggests that most animals formed strong associations with a particular companion..... 8-227
Figure 8.6. Distribution of maximum SI of Irrawaddy dolphins in the Mekong River (individuals sighted on $\geq$ 4 days and in schools with $\geq$ 50% of individuals identified). The distribution of maximum association indices suggests that most animals formed strong associations with a particular companion. 8-227
Figure 8.7. Average-linkage cluster analysis for associations between Irrawaddy dolphins in the Mekong River, using only individuals sighted $\geq$ 4 days and in groups with $\geq$ 50% of individuals identified. Associations higher than 0.50 are indicated by coloured branches. The four primary areas: Stung Treng, Koh Pidau, Kampi and Chiteal (see Chapter 7), are indicated on the dendogram and show distinct clustering during the dry season, particularly dolphins from Chiteal and Stung Treng

primary areas. However, results from Stung Treng must be viewed with caution because of the small sample size (*n*=2).....8-228
Figure 8.8. A sociogram of the association matrix of the top 21 individuals identified during the study period during the dry season. This sociogram shows that there appears to be no associations between the Stung Treng (KKS10/TK02) or Chiteal individuals (CH01/CH02/CH05) between themselves or individuals from other primary areas. However, results from Stung Treng must be viewed with caution because of the small sample size (*n*=2). 8-229
Figure 8.9. PCA of associations between Irrawaddy dolphins in the Mekong River. The PCA clearly shows the four primary areas: Stung Treng (KKS/TK), Kampi (KA/CB), Koh Pidau (GO/PK) and Chiteal (CH). Dolphins from these four primary areas also grouped together in the dendogram (Figure 8.7) (see Footnote 3. regarding an explanation of individual CH04 that associates with individuals from Kampi primary area). 8-230
Figure 8.10. A sociogram of Irrawaddy dolphin association patterns from the Mekong River during the 2003-2005 wet seasons. Only groups where ≥ 50% of the group was identified were included in this analysis. The number of times that an individual was identified during the wet season ranged from two to five times. Only individuals with associations of 0.5 or greater are displayed on this sociogram. As a result of the small sample size the results should be viewed with caution.....8-232
Figure 8.11. Average-linkage cluster analysis for associations between Irrawaddy dolphins in the Mekong River during the wet season, using only groups with ≥ 50% of individuals identified. Associations higher than 0.50 are indicated by coloured branches. The dendogram shows that the Chiteal community appears to remain isolated during the wet season. There are individuals from Koh Pidau and Kampi that associate with other communities and some that appear to have no association with other communities.....8-233
Figure 8.12. Standardised-lagged association rate for Irrawaddy dolphins inhabiting the Mekong River, using only individuals sighted ≥ 4 days and in groups with ≥ 50% of individuals photo-graphically identified. Standard error bars were estimated using jackknife procedures. The null association rate is the lagged association rate expected if individuals are associating at random. The constant companions model best explains the observed temporal association rates of Irrawaddy dolphins in the Mekong River. This model indicates a highly structured population with preferred companions and long-term associations.....8-234
Figure 8.13. An Irrawaddy dolphin feeding in Kampi Pool, near Kratie Township. Irrawady dolphins are commonly seen spitting water in the vicinity of fish at the water surface (top). After a few moments of spitting behaviour, fish are often observed jumping in the air near the dolphin – seemingly disorientated (bottom). Photos by Laura Morse. 8-239

CHAPTER 9

Figure 9.1. Study area for the carcass recovery program. The primary study area is the Kratie to Khone Falls River section (shown in red). From 2003 onwards, there was a high probability that most of the dolphins that died in this river section were reported to my project (see text for further discussion). Surveys south of Kratie were conducted during 2004–2005 to investigate mortality rates and causes throughout the known range of the population. Map created by Matti Kummu. ...9-247
Figure 9.2. MDCP team members measuring the total length a newborn dolphin carcass (OBRE04-28/09), that was discovered in Chiteal Pool during September 2004. This newborn dolphin was estimated to be only a few days old. The foetal folds are still clearly present (indicated by arrows). The cause of death was unknown. 9-251
Figure 9.3. A newborn dolphin discovered in September 2002 near Kampi Pool (OBRE02-08/09). The carcass was weighed using 100 kg scales. This specimen was classified as a newborn (as opposed to a calf), as it had obvious foetal folds (indicated by the arrows) and the umbilicus was unhealed.9-251
Figure 9.4. A large adult dolphin (OBRE01-12/05) that was photographed by a local person at the location where it was found stranded. The dolphin (2.26 m long and 130 kg) was reported to have been caught in a large mesh size gillnet at Tbong Klar Pool, Stung Treng Province. The indentations from the net can be clearly seen around the head, behind the ear and at the base of the flippers, extending around the body. 9-254
Figure 9.5. The number of adult and newborn/young calf Irrawaddy dolphin carcasses recovered from the Mekong River each year. The bars are separated into January - April and May – December, to facilitate comparisons with 2005 data, which was only collected until April. Newborn/young calf mortalities reached a maximum in 2004, with ten carcasses recovered. No data are available for this analysis from May 2005 onwards (although see Appendix VII). 9-256

Figure 9.6. The number of adult and newborn/young calf Irrawaddy dolphin carcasses recovered from the Mekong River between 2001 and 2005. Note that only a few carcasses were reported in the first few years of the study. Therefore, only the months where carcasses were recovered are shown on the bar chart. All months are shown from 2003 onwards. From 2003 onwards, the highest numbers of carcasses per month were recovered in March of each year. These carcasses primarily consisted of newborns/young calves. 9-256
Figure 9.7. The number of adult and newborn/young calf Irrawaddy dolphin carcasses salvaged from the Mekong River and confirmed for each month from January 2001-April 2005 combined. Carcasses of newborns/young calves were recovered every month except May, July and December. Carcasses of adults were recovered every month except July. An adult female carcass recovered on 02 August 2003 was carrying a near term foetus (73 cm). 9-257
Figure 9.8. Known sex of Irrawaddy dolphin carcasses collected in the Mekong River (*n*=29), separated by year. Based on these data there were no apparent trends in rate of stranding for either sex or age composition (*i.e.*, adult or calf) of carcasses. Although five calves were recorded in 2003, their sex could not be determined. 9-257
Figure 9.9. Distribution of confirmed Irrawaddy dolphin carcasses found in the upper Cambodian Mekong River between 01 January 2001 and 31 December 2005. The size of each circle has been scaled to represent the number of dolphins found dead within a radius of 2km. This map was produced by WCS Cambodia Program and is also shown in Gilbert and Beasley (2006): Appendix VII. 9-259

CHAPTER 10

Figure 10.1. Location map of Kampi Village where the Dolphins for Development ICDP was implemented (indicated by the red circle). 10-284
Figure 10.2. Rural development and diversification of livelihood project activities: (left) crops being grown in the village, (middle) fingerlings being distributed to villagers for the land-based fish ponds, (right) a well constructed in the village to provide freshwater. 10-289
Figure 10.3. Examples of the community-based tourism project activities at Kampi viewing site: a sign constructed to inform tourists not to swim in the dolphin pool (left), development of regulations to minimise boat disturbance to the dolphins, such as operators paddling when dolphins are near the boat (middle), a toilet block constructed by CRDT (right), which tourists can use by paying a small fee for its maintenance. 10-291
Figure 10.4. Education and awareness-raising project activities: (left) construction of dolphin and fisheries conservation signs; (middle) a young boy holding a calendar his family was given to record dolphin distribution; (right) one of two educational signboards erected at the Kampi viewing site. 10-293
Figure 10.5. Stakeholder relationship building project activities: a boat and engine being donated to the Kratie Fisheries Office, with funding obtained from the British Embassy, Phnom Penh (left); a local counterpart being trained to use the camera for photo-identification of individual dolphins (middle: Chapter 6); increased patrols to ensure compliance with fishing regulations, such as the use of cast-nets which is a permitted fishing method (right). 10-295

CHAPTER 11

Figure 11.1. Brendan Boucher (CRDT Project Manager) and I conduct photo-identification studies at Kampi Pool, Kratie Province. 11-318
Figure 11.2. Example of a small-scale workshop held a Kampi Village to inform the village about the results of the MDCP interviews. 11-319