

CONTENTS

EXECUTIVE SUMMARY	v
Acknowledgments	iii
INTRODUCTION	1
MATERIALS AND METHODS	5
Location and Time of Field Work	5
Organisms Counted	6
Sizes and Allocation of Sampling Units	6
<i>Transect Sizes</i>	6
<i>Allocation of Sampling Units</i>	6
Counting Procedures	7
Different Methods of Survey	8
Data Handling and Analysis	9
Characteristics of the Data	9
Biases in Estimates of Population Density	10
<i>Preliminary Multivariate Analyses</i>	10
<i>Univariate Analyses</i>	12
<i>Site and Pass Effects</i>	13
<i>Effects of Transect Length and Width</i>	14
Analyses of Auxiliary Variables	15
<i>Effects of Migration of Fish Across Transect Borders</i>	15
<i>Variations in Counting Times</i>	15
<i>Effects of Depth of Transects</i>	16
<i>Effects of Time of Day on Estimated Density</i>	16
Effects of Observer and Methods of Surveying Large Transects	17
Precision and Cost-Efficiency of Sampling	17
<i>Precision from Transects of Different Dimensions</i>	17
<i>Cost-efficiency of Transects of Different Dimensions</i>	17
RESULTS	19
Characteristics of the Data	19
Biases in Estimates of Population Density	20
<i>Preliminary Analyses - Multivariate Data</i>	20
<i>Large Transects - Univariate Analyses</i>	22
<i>Site Variation and Effects of Pass</i>	22
<i>Effects of Transect Length and Width</i>	26
<i>Small Transects - Univariate Analyses</i>	30
Analyses of Auxiliary Variables	34
<i>Migration of Fish Across Transect Margins</i>	34
<i>Estimated Densities After Correction for Migration</i>	36
<i>Variations in Counting Times</i>	38
<i>Effects of the Depth of Transects</i>	39
<i>Effects of the Time-of-Day of Sampling</i>	42
Effects of Observer and Methods of Surveying Large Transects	42
<i>Comparisons of Observers</i>	42
<i>Comparisons of Counting Methods</i>	44
Precision and Cost-Efficiency of Sampling	44
<i>Precision from Transects of Different Dimensions</i>	44
<i>Cost-efficiency of Transects of Different Dimensions</i>	51

DISCUSSION	55
Characteristics of the Data and Analytical Methods	55
Sources of Bias	57
<i>Transect Dimensions</i>	57
<i>Search Intensity</i>	58
<i>Depth and Time of Day</i>	59
<i>Observers and Counting Methods</i>	59
Precision and Cost Efficiency.....	60
Optimum Transect Dimensions	61
Suggested Procedure for Routine Survey	63
Concluding Remarks.....	64
REFERENCES	66

TABLES

Table 1: Site Descriptions	5
Table 2: (M)ANOVA Models	11
Table 3: Taxa Counted	19
Table 4: MANOVA of Estimated Densities	21
Table 5: Summary of ANOVA of Densities by Taxon- Large Transects	23
Table 6: Details of ANOVA of Densities by Taxon - Large Transects	24
Table 7: ANOVA of Average Densities - Lethrinids & Lutjanids	28
Table 8: Summary of ANOVA of Densities by Taxon - Small Transects	31
Table 9: Details of ANOVA of Densities by Taxon - Small Transects	32
Table 10: ANOVA of Average Densities - <i>C. talboti</i> & <i>L. dimidiatus</i>	33
Table 11: Migration Across Transect Boundaries - Chaetodons & Coral Trout	34
Table 12: ANOVA of Densities Adjusted for Migration	36
Table 13: Search Intensities by Transect Size	38
Table 14: Depths of Transects	41
Table 15: Density Differences Between Shallow & Deep Half-transects	41
Table 16: Rank Frequencies of Counts by Observers 1 & 2	42
Table 17: MANOVA of Precision - Small & Large Transects	44
Table 18: ANOVA of Precision by Taxon - Small & Large Transects	46
Table 19: MANOVA of Cost-efficiency - Small & Large Transects	52
Table 20: ANOVA of Cost-efficiency by Taxon	52

FIGURES

Figure 1:	<i>T. derasa</i> - Effects of Site*Transect Width on Density	22
Figure 2:	<i>A. planci</i> , <i>C. baronessa</i> - Effects of Site*Pass on Density	26
Figure 3:	Effects of Transect Width on Density, by Taxon	27
Figure 4:	Effects of Transect Length on Density, by Taxon	29
Figure 5:	<i>T. derasa</i> , <i>C. trifasciatus</i> - Effects of Transect Length*Width on Density	30
Figure 6:	<i>C. talboti</i> , <i>L. dimidiatus</i> - Effects of Transect Width on Density	33
Figure 7:	Effects of Migration to/from Transects on Density - Chaetodons & Coral Trout	35
Figure 8:	Effects of Transect Size on Density Adjusted for Migration	37
Figure 9:	Observed and Expected Times to Survey Transects	39
Figure 10:	Effects of Counting Method on Density, by Taxon	43
Figure 11:	Effects of Diver Activity on Density, by Taxon	45
Figure 12:	Effects of Transect Length on Precision, by Taxon	48
Figure 13:	Effects of Transect Width on Precision, by Taxon	50
Figure 14:	<i>T. derasa</i> - Effects of Transect Length*Width on Precision	51
Figure 15:	Effects of Transect Width on Cost-efficiency, by Taxon	53

Acknowledgments

We wish to thank the following people, all of whom contributed substantially to the project: Howard Choat, for useful discussions and provision of the facilities of the Department of Marine Biology, James Cook University; Ros Priest and Brian Cohen for assistance with both the organisation and execution of field work, and the tedious data entry; Greg Andrew, Linda Axe, Richard Birdsey, and Steve Neale for field assistance and data entry; Steve Hillman and Jamie Oliver for project management at the GBRMPA end; and (especially) Gina Mercer and Lucy Mercer Mapstone for their support and tolerance during the preparation of this report. We also thank the three reviewers of the draft final report - Peter Doherty, Helene Marsh, and Tony Underwood - whose comments were of great assistance. Any persistent deficiencies, however, are ours entirely. The work was funded by a consultancy agreement from the Great Barrier Reef Marine Park Authority (to JCU and Sea Research) and a National Research Fellowship (to BDM).