# LIST OF TABLES

## CHAPTER II

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Characteristics of remote sensing platforms and sensors</td>
<td>41</td>
</tr>
<tr>
<td>2.2</td>
<td>Data sets</td>
<td>42</td>
</tr>
</tbody>
</table>

## CHAPTER III

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Stratigraphic sequence of Goa</td>
<td>52</td>
</tr>
</tbody>
</table>

## CHAPTER V

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Village-wise marine fish catch (in tones) During the year 1998 to 2005</td>
<td>175</td>
</tr>
</tbody>
</table>
# LIST OF CHARTS

## CHAPTER I

Chart 1.1: Coastal zone functions, uses and values 17

## CHAPTER II

Chart 2.1: Data, tools and techniques 43  
Chart 2.2: Methodology – visual interpretation (monoscopic / stereoscopic) 44

## CHAPTER III

Chart 3.1: Methodology – Coastal geomorphology mapping 71  
Chart 3.2: Coastal landforms classification scheme 72  
Chart 3.3: Methodology – Shoreline changes 73

## CHAPTER IV

Chart 4.1: Coastal ecosystem classification scheme 113  
Chart 4.2: Methodology – Coastal ecosystem mapping 114

## CHAPTER V

Chart 5.1: Coastal resources classification scheme 176  
Chart 5.2: Methodology – digital image classification coastal land resource mapping 177
CHAPTER VI

Chart 6.1: Tiracol, Chapora, Baga, and Siquerim rivers and tributaries 219

Chart 6.2: Mandovi and its tributaries 220

Chart 6.3: Zuari and its tributaries 221

Chart 6.4: Sal, Benaulim, Saleri, Talpona, Galgibag rivers and tributaries 222

Chart 6.5: Methodology – CRZ corridor generation 223

Chart 6.6: Coastal regulation – classification scheme 224

Chart 6.7: Coastal regulation – Institutional framework 225

CHAPTER VII

Chart 7.1: Systematic framework, institutional strengthening and Governance 287

Chart 7.2: ICZM Components 288

Chart 7.3: ICZM approach and methodology 289
LIST OF FIGURES

CHAPTER I

Fig. 1.1: Location map 18
Fig. 1.2: Taluka map 19

CHAPTER II

Fig. 2.1: Spectral regions used in remote sensing 22
Fig. 2.2: Typical EMR interactions in the atmosphere and at the earth's surface 23
Fig. 2.3: Atmospheric transmittance 24
Fig. 2.4: Comparison of reflectance of few land classes 25
Fig. 2.5: GPS satellites 31
Fig. 2.6: Components of a GIS 33
Fig. 2.7: Elements of GIS 34
Fig. 2.8: Vector data model 35
Fig. 2.9: Raster data model 35

CHAPTER III

Fig. 3.1: Coastal landforms – North Goa 74
Fig. 3.2: Coastal landforms - Central Goa 75
Fig. 3.3: Coastal landforms – South Goa 76
Fig. 3.4: Coastal landforms – Pernem Taluka 77
Fig. 3.5: Coastal landforms – Bardez Taluka 78
Fig. 3.6: Coastal landforms – Tiswadi Taluka 79
Fig. 3.7: Coastal landforms – Mormugoa Taluka 80
Fig. 3.8: Coastal landforms – Salcete Taluka 81
Fig. 3.9: Coastal landforms – Quepem and Canacona Talukas 82
Fig. 3.10: Shore line changes – Pernem Taluka (1964-1996) 83
Fig. 3.11: Shore line changes – Bardez Taluka (1964-1996) 84
Fig. 3.12: Shore line changes – Tiswadi Taluka (1964-1996) 85
Fig. 3.13: Shore line changes – Mormugoa Taluka (1964-1996) 86
Fig. 3.14: Shore line changes – Salcete Taluka (1964-1996) 87
Fig. 3.15: Shore line changes – Quepem and Canacona Talukas (1964-1996) 88

CHAPTER IV

Fig. 4.1: Riverine ecosystems – North Goa 115
Fig. 4.2: Riverine ecosystems – Central Goa 116
Fig. 4.3: Riverine ecosystems – South Goa 117
Fig. 4.4: Coastal ecosystems – Pernem Taluka 118
Fig. 4.5: Coastal ecosystems – Pernem Taluka 119
Fig. 4.6: Coastal ecosystems – Bardez Taluka 120
Fig. 4.7: Coastal ecosystems – Bardez Taluka 119
Fig. 4.8: Coastal ecosystems – Tiswadi Taluka 121
Fig. 4.9: Coastal ecosystems – Tiswadi Taluka 122
Fig. 4.10: Coastal ecosystems – Mormugoa Taluka 123
Fig. 4.11: Coastal ecosystems – Mormugoa Taluka 122
Fig. 4.12: Coastal ecosystems – Salcete Taluka 124
Fig. 4.13: Coastal ecosystems – Salcete Taluka 125
Fig. 4.14: Coastal ecosystems – Quepem Taluka 126
Fig. 4.15: Coastal ecosystems – Quepem Taluka 127
Fig. 4.16: Coastal ecosystems – Canacona Taluka 128
Fig. 4.17: Coastal ecosystems – Canacona Taluka 127
Fig. 4.18: Coastal ecosystems – Satari Taluka 129
Fig. 4.19: Coastal ecosystems – Bicholim Taluka 130
Fig. 4.20: Coastal ecosystems – Ponda Taluka 131
Fig. 4.21: Coastal ecosystems – Sanguem Taluka 132
Fig. 4.22: Coastal ecosystems – Satari Taluka 133
Fig. 4.23: Coastal ecosystems – Canacona Taluka 133
Fig. 4.24: Coastal ecosystems – Ponda Taluka 134
Fig. 4.25: Coastal ecosystems – Sanguem Taluka 134
Fig. 4.26: Coastal ecosystems – Tiswadi Taluka -1966 135
Fig. 4.27: Coastal ecosystems – Tiswadi Taluka -1998 136
Fig. 4.28: Coastal ecosystems – Salcete Taluka - 1966 137
Fig. 4.29: Coastal ecosystems – Salcete Taluka - 1998 138
Fig. 4.30: Coastal eco-resources - Tiswadi Taluka - 1964 139
Fig. 4.31: Coastal eco-resources – Tiswadi Taluka - 2002 140
Fig. 4.32: Drainage network – Tiswadi Taluka 141
Fig. 4.33: Socio-demographic data of villages - Tiswadi Taluka 142
Fig. 4.34: Coastal eco-resources - Salcete Taluka - 1964 143
Fig. 4.35: Coastal eco-resources – Salcete Taluka - 2002 144
Fig. 4.36: Drainage network – Salcete Taluka 145
Fig. 4.37: Socio-demographic data of villages - Salcete Taluka 146

CHAPTER V

Fig. 5.1: Land resources – North Goa 178
Fig. 5.2: Land resources – Central Goa 179
Fig. 5.3: Land resources – South Goa 180
Fig. 5.4: Coastal resources - Pernem Taluka 181
Fig. 5.5: Coastal resources - Bardez Taluka 181
Fig. 5.6a: Coastal resources - Tiswadi Taluka – tidal Mandovi 182
Fig. 5.6b: Coastal resources - Tiswadi Taluka – tidal Zuari 182
Fig. 5.6c: Coastal resources - Tiswadi Taluka – tidal Cumbarjua 183
Fig. 5.7a: Coastal resources - Mormugoa Taluka 183
Fig. 5.7b: Coastal resources - Mormugoa Taluka – tidal Zuari 184
Fig. 5.8: Coastal resources - Salcete Taluka 184
Fig. 5.9: Coastal resources - Quepem Taluka 185
Fig. 5.10: Coastal resources - Canacona Taluka 185
CHAPTER VI

Fig. 6.1: % Distribution of Village panchayat and revenue village (area wise) under the CRZ - Pernem Taluka. 226 - 227

Fig. 6.2: % Distribution of Village panchayat and revenue village (area wise) under the CRZ - Bardez Taluka 228-230

Fig. 6.3: % Distribution of Village panchayat and revenue village (area wise) under the CRZ - Tiswadi Taluka 231-232

Fig. 6.4: % Distribution of Village panchayat and revenue village (area wise) under the CRZ - Bicholim Taluka 233

Fig. 6.5: % Distribution of Village panchayat and revenue village (area wise) under the CRZ - Ponda Taluka 234-235

Fig. 6.6: % Distribution of Village panchayat and revenue village (area wise) under the CRZ - Mormugao Taluka 236

Fig. 6.7: % Distribution of Village panchayat and revenue village (area wise) under the CRZ – Salcete Taluka 237-238

Fig. 6.8: % Distribution of Village panchayat and revenue village (area wise) under the CRZ - Quepem Taluka 239

Fig. 6.9: % Distribution of Village panchayat and revenue village (area wise) under the CRZ - Canacona Taluka 240-241

Fig. 6.10: % Distribution of Village panchayat and revenue village (area wise) under the CRZ - Sanguem Taluka 242

Fig. 6.11: % Distribution of Village panchayat and revenue village (area wise) under the CRZ - Satari Taluka 242

- xiii -
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1</td>
<td>Administrative data architecture for ICZM</td>
<td>263</td>
</tr>
<tr>
<td>7.2</td>
<td>CRZ – Coastal CRZ Villages</td>
<td>290</td>
</tr>
<tr>
<td>7.3</td>
<td>CRZ – Riverine CRZ Villages</td>
<td>291</td>
</tr>
<tr>
<td>7.4</td>
<td>Demographic profile 1961 – 2001 Pernem Taluka</td>
<td>292</td>
</tr>
<tr>
<td>7.5</td>
<td>Demographic profile 1961 – 2001 Bardez Taluka</td>
<td>292</td>
</tr>
<tr>
<td>7.6</td>
<td>Demographic profile 1961 – 2001 Tiswadi Taluka</td>
<td>293</td>
</tr>
<tr>
<td>7.7</td>
<td>Demographic profile 1961 – 2001 Mormugao Taluka</td>
<td>293</td>
</tr>
<tr>
<td>7.8</td>
<td>Demographic profile 1961 – 2001 Salcete Taluka</td>
<td>294</td>
</tr>
<tr>
<td>7.9</td>
<td>Demographic profile 1961 – 2001 Quepem Taluka</td>
<td>294</td>
</tr>
<tr>
<td>7.10</td>
<td>Demographic profile 1961 – 2001 Canacona Taluka</td>
<td>295</td>
</tr>
</tbody>
</table>
# LIST OF PLATES

## CHAPTER II

Plate 2.1: Digital IRS 1D LISS III FCC (2002) 45  
Plate 2.2: Ground control points using DGPS 46  
Plate 2.3: IRS 1D PAN – Goa 47

## CHAPTER IV

Plate 4.1: Coastal ecosystems – Goa 147  
Plate 4.2: IRS 1D PAN Satellite data –Tiswadi Taluka 148  
Plate 4.3: IRS 1D PAN Satellite data –Sacete Taluka 149

## CHAPTER V

Plate 5.1: Fishery / aquaculture / mineral resources 186  
Plate 5.2: Tourism / eco tourism resources 187  
Plate 5.3: Transportation sectors 188  
Plate 5.4: Coastal CRZ corridor with landuse – Pernem Taluka 189  
Plate 5.5: Coastal CRZ corridor with landuse – Bardez Taluka 190  
Plate 5.6: Coastal CRZ corridor with landuse – Tiswadi Taluka 191  
Plate 5.7: Coastal CRZ corridor with landuse – Mormugao Taluka 192  
Plate 5.8: Coastal CRZ corridor with landuse – Salcete Taluka 193  
Plate 5.9: Coastal CRZ corridor with landuse – Quepem Taluka 194  
Plate 5.10: Coastal CRZ corridor with landuse – Canacona Taluka 195

## CHAPTER VI

Plate 6.1: Drainage network with stream order - Goa State 243  
Plate 6.2: Coastal CRZ – Goa State 244  
Plate 6.3: Tidal CRZ – 100m or width or river 245  
Plate 6.4: Coastal CRZ buffer - Pernem Taluka 246  
Plate 6.5: Coastal CRZ buffer – Bardez Taluka 247
Plate 6.6: Coastal CRZ buffer – Tiswadi Taluka  
Plate 6.7: Coastal CRZ buffer – Mormugao Taluka  
Plate 6.8: Coastal CRZ buffer – Salcete Taluka  
Plate 6.9: Coastal CRZ buffer – Quepem Taluka  
Plate 6.10: Coastal CRZ buffer – Canacona Taluka  

CHAPTER VII  

Plate 7.1: Coastal Zone Management – Conservation areas  
Plate 7.2: Coastal Zone Management – Utilization areas  
Plate 7.3: Coastal Zone Management – Development areas  
Plate 7.4: Coastal Development Areas (CRZ – II)  
Plate 7.5: Coastal Ecological / Important Areas (CRZ I, II & III)  
Plate 7.6: Coastal Ecological / Important Areas (CRZ I)