

UNIVERSITY OF KWAZULU-NATAL

**EXPLORING COASTAL SPACES: TOWARDS
LINKING SOCIAL AND ECOLOGICAL
SYSTEMS**

2009

DARRYL COLENBRANDER

ABSTRACT

Coastal zone definitions are typically guided by the presence of absolute demarcations. As a result, the coastal zone becomes confined to, and identified as, an absolute space. This research challenges the 'fixed' nature of the coastal zone and suggests that there are a wide range of relational spaces that overlap and engage with each other to form the coastal space. These spaces and their sphere of influence extend beyond the 'boundaries' of what is legally defined as the coastal zone. Multiple coastal spaces have been identified based upon coastal stakeholder perceptions of what is relevant to the management of the coastal zone. Although there is a place for the absolute manner in which coastal zones are defined, definitions founded on absolute parameters tend not only to create a fixed abstract space, but they also naturalize a geographical construct to an unhelpful scale in terms of the functioning of coastal socio-economic and environmental systems. The absolute manner in which the coastal zone is defined and the reduced scale at which such a definition and the associated legislation is directed, severs and discounts, both temporarily and spatially, the influences of relational spaces that function at broader scales. The complication arises when the influences of such spaces are enmeshed within and beyond that legally defined coastal space. The legal definition and the associated legislation, in essence, attempts to address and solve issues occurring within the legal space, but disregards causative mechanisms that may lie outside of that legal space. This study suggests that a broader scaled and more holistic approach to defining the coastal zone, namely a system characterized by flows of interrelated spaces, will enable higher levels of sustainability to be achieved.

PREFACE

This thesis study is submitted in fulfilment of the academic requirements for the degree of Master of Environmental Science. The research described in this document was carried out under the supervision of Dr. Louis Celliers of the Oceanographic Research Institute and Ms. Catherine Oelofse of the School of Environmental Sciences, University of KwaZulu-Natal, during the period from March 2007 to June 2009.

This document comprises the original work of the author. Material contained herein has not been submitted for any degree or diploma in any other tertiary institution. Where use has been made of the others, it is duly acknowledged in the text.

L. Celliers

C. Oelofse

D. Colenbrander

FACULTY OF SCIENCE AND AGRICULTURE

DECLARATION 1 - PLAGIARISM

I,, declare that

1. The research reported in this thesis, except where otherwise indicated, is my original research.
2. This thesis has not been submitted for any degree or examination at any other university.
3. This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.
4. This thesis does not contain other persons' writing, unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:
 - a. Their words have been re-written but the general information attributed to them has been referenced
 - b. Where their exact words have been used, then their writing has been placed in italics and inside quotation marks, and referenced.
5. This thesis does not contain text, graphics or tables copied and pasted from the Internet, unless specifically acknowledged, and the source being detailed in the thesis and in the References sections.

Signed

.....

ACKNOWLEDGEMENTS

To my mother, your light will shine within me forever.

To my supervisors, Louis and Cathy, your patience, encouragement, interest and understanding is what made this research possible. This has been a journey that I will reflect back upon for many years to come. Thank you.

To my family, thank you for your support.

To the respondents, thank you for showing an interest and contributing to this research.

TABLE OF CONTENTS

ABSTRACT	I
PREFACE	II
DECLARATION 1 - PLAGIARISM	III
ACKNOWLEDGEMENTS	IV
TABLE OF CONTENTS	V
ACRONYMS	VIII
LIST OF FIGURES	IX
LIST OF PLATES	X
LIST OF TABLES	XI
CHAPTER 1: INTRODUCTION	1
1.1 AIM AND OBJECTIVES	7
1.2 STRUCTURE OF THESIS	8
CHAPTER 2: THEORETICAL FRAMEWORK: UNDERSTANDING COASTAL ZONES	10
2.1 INTRODUCTION.....	10
2.2 CONCEPTS OF SPACE.....	13
2.2.1 Absolute (physical) space	13
2.2.2 Relative space.....	22
2.2.3 Relational space.....	24
2.3 SYSTEMS AND SCALE.....	27
2.4 MANAGEMENT APPROACHES	33
2.4.1 Command and control.....	33
2.4.2 Adaptive management	38
2.5 LINKING SOCIAL AND ECOLOGICAL SYSTEMS	41
2.5.1 The need for linking social and ecological systems	43
2.6 CONCLUDING REMARKS	46
CHAPTER 3: THE MANAGEMENT OF COASTAL ZONES	48
3.1 INTRODUCTION.....	48
3.2 HISTORIC AND LEGAL BACKGROUND	48
3.3 TRENDS IN COASTAL MANAGEMENT IN SOUTH AFRICA	50
3.4 LEGISLATION RELEVANT TO THE MANAGEMENT OF SOUTH AFRICA’S COASTAL ENVIRONMENT.....	52
3.4.1 The Constitution of the Republic of South Africa (Act 108 of 1996)	53
3.4.2 National Environmental Management Act (Act 107 of 1998)	53
3.4.3 Environmental Conservation Act (Act 73 of 1989).....	54
3.4.4 National Environmental Biodiversity Act (Act 10 of 2004)	55
3.4.5 Marine Living Resources Act (18 of 1998)	55

3.4.6 Sea Shore Act (Act 21 of 1935)	56
3.5 DEFINITIONS OF THE COASTAL ZONE.....	57
3.5.1 National Environmental Management: Integrated Coastal Management Act, 2008	57
3.5.2 Draft eThekweni Coastal Management Strategy, 2005	58
3.5.3 United Nations Environmental Programme, 2005.....	59
3.5.4 United Nations Environmental Programme, Global Environment Facility and The Land-Ocean Interactions in the Coastal Zone, 2006	60
3.5.5 US Department of Commerce, National Oceanographic and Atmospheric Administration, The Coastal Protection and Restoration Division, 2008.....	60
3.5.6 The State of Delaware, U.S.A, 2008.....	61
3.6 CONCLUDING REMARKS	62
CHAPTER 4: METHODOLOGY.....	64
4.1 INTRODUCTION.....	64
4.2 INTERPRETATION AND POSITIONALITY.....	65
4.3 SYSTEMS THEORY AND DATA ANALYSIS	68
4.4 UNDERSTANDING THE SPACES OF COASTAL SYSTEMS	69
4.4.1 Conceptualising the coastal spaces	70
4.4.2 Study area.....	73
4.5 THE INTERVIEW APPROACH	74
4.6 DATA CAPTURE, ANALYSIS AND INTERPRETATION	75
4.7 STRUCTURE OF RESULTS	82
4.8 LIMITATIONS OF THIS RESEARCH	84
4.9 MAPPING THE COASTAL SPACES	84
4.10 CONCLUDING REMARKS	85
CHAPTER 5: THE CONCEPTUALISATION OF THE COASTAL ZONE.....	86
5.1 INTRODUCTION.....	86
5.2 THE COASTAL ZONE AS A VIEWSHED	87
5.3 THE COASTAL ZONE AS AN ABSOLUTE SPACE	90
5.4 THE COASTAL ZONE AS A LEGAL SPACE.....	92
5.5 THE COASTAL ZONE AS A SOCIAL SPACE	97
5.6 THE COASTAL ZONE AS A BIOPHYSICAL SPACE.....	100
5.7 THE COASTAL ZONE AS AN ECONOMIC SPACE.....	102
5.8 THE COASTAL ZONE AS A SYSTEM OF SPACES	104
5.9 CONCLUDING REMARKS	109
CHAPTER 6: CRITICAL ISSUES AND THEIR RELATIONS WITHIN COASTAL SPACES	111
6.1 INTRODUCTION.....	111
6.2 THE ECONOMIC PILLAR.....	113
6.3 THE GOVERNANCE PILLAR	116
6.4 THE SOCIAL PILLAR.....	119
6.5 THE BIOPHYSICAL/ENVIRONMENTAL PILLAR.....	123
6.6 CONCLUDING REMARKS	128
CHAPTER 7: IDENTIFYING RELATIONAL COASTAL SPACES.....	130

7.1 INTRODUCTION.....	130
7.2 A SPACE OF RISK.....	131
7.3 A SPACE OF POLLUTION.....	137
7.4 A SPACE OF BIODIVERSITY.....	142
7.5 THE ECONOMIC SPACE OF THE COASTAL ZONE.....	146
7.6 A SOCIAL SPACE.....	148
7.7 CONCLUDING REMARKS.....	153
CHAPTER 8: CONCLUSION.....	155
REFERENCES.....	165
APPENDIX 1: EUCLID’S POSTULATES.....	176
APPENDIX 2: PROVINCIAL COASTAL COMMITTEE TERMS OF REFERENCE.....	177
APPENDIX 3: THE QUESTIONNAIRE.....	181
APPENDIX 4: CONCEPT MAPS.....	182
4.1: PROJECT EXECUTIVE: COASTAL POLICY, eTHEKWINI MUNICIPALITY.....	182
4.2: SURVEYOR GENERAL: DEPARTMENT OF LAND AFFAIRS.....	183
4.3: HEAD OF ENVIRONMENTAL MANAGEMENT: eTHEKWINI MUNICIPALITY.....	184
4.4: CHAIRMAN: SOUTH DURBAN COMMUNITY ENVIRONMENTAL ALLIANCE.....	185
4.5: REGIONAL COORDINATOR: WILDLIFE AND ENVIRONMENT SOCIETY OF SOUTH AFRICA..	186
4.6: MANAGER: RESEARCH, TOURISM KWAZULU-NATAL.....	187
4.7: ENVIRONMENTAL MANAGER: NATIONAL PORTS AUTHORITY.....	188
4.8: DIRECTOR: ENVIRONDEV.....	189
4.9: BUSINESS PORTFOLIO MANAGER: FUTUREWORKS.....	190
4.10: DEPUTY DIRECTOR: MARINE AND COASTAL MANAGEMENT, DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM.....	191
4.11: COORDINATOR: BIODIVERSITY RESEARCH, EZEMVELO KWAZULU-NATAL WILDLIFE...	192
4.12: SUSTAINABLE DEVELOPMENT DIVISION LEADER: GOLDER ASSOCIATES.....	193
4.13: DIRECTOR: PHELAMANGA PROJECTS.....	194
4.14: NATURAL RESOURCE MANAGER: SOUTH AFRICAN CANE GROWERS ASSOCIATION.....	195
4.15: PLANNING AND EHS EXECUTIVE: TONGAAT HULETT DEVELOPMENTS.....	196
4.16: DIRECTOR: OCEANOGRAPHIC RESEARCH INSTITUTE.....	197
4.17: CHIEF SCIENTIST: KWAZULU-NATAL SHARKS BOARD.....	198
4.18: DEPUTY MANAGER: COASTAL AND BIODIVERSITY MANAGEMENT: DEPARTMENT OF AGRICULTURAL AND ENVIRONMENTAL AFFAIRS.....	199
4.19: SENIOR PLANNER: eTHEKWINI MUNICIPALITY.....	200
APPENDIX 5: CLASSIFICATION OF RESPONDENTS.....	201
APPENDIX 6: POWER RATINGS.....	202
APPENDIX 7: DEFINITIONS OF POWER.....	204
APPENDIX 8: ECONOMIC IMPACTS OF THE SMALL CRAFT HARBOR.....	205
APPENDIX 9: SOME OF THE SOCIAL IMPACTS OF THE SMALL CRAFT HARBOUR.....	208

ACRONYMS

DEAT:	Department of Environmental Affairs and Tourism
EESMP:	eThekwini Environmental Services Management Plan
EIA:	Environmental Impact Assessment
EKZNW:	Ezemvelo KwaZulu-Natal Wildlife
GESAMP:	Group of Experts on the Scientific Aspects of Marine Environmental Protection
GDP:	Gross Domestic Product
GGP:	Gross Geographic Product
GIS:	Geographic Information Systems
HWM:	High Water Mark
I & APs:	Interested and Affected Parties
ICAM:	Integrated Coastal Area Management
ICM Act:	Integrated Coastal Management Act
ICM:	Integrated Coastal Management
ICZM:	Integrated Coastal Zone Management
KZN:	KwaZulu-Natal
KZN NCS:	KwaZulu-Natal Nature Conservation Service
KZN PCC:	KwaZulu-Natal Provincial Coastal Committee
LWM:	Low Water Mark
NEMA:	National Environmental Management Act
ORI:	Oceanographic Research Institute
ORVs:	Off-road vehicles
PCC:	Provincial Coastal Committee
RNNP:	Royal Natal National Park
SCH:	Small Craft Harbour
SDI:	Spatial Development Initiatives
SIA:	Social Impact Assessment
UNEP:	United Nations Environmental Programme

LIST OF FIGURES

Figure 1: Coastal populations and shoreline degradation.....	3
Figure 2: Flow chart reflecting the theoretical framework developed in this research.....	10
Figure 3: Relationship between a length of a line and sampling interval.....	20
Figure 4: Catch and effort data for the Maine lobster industry.....	31
Figure 5: The adaptive management cycle.....	39
Figure 6: An overview of the methodological framework used in this research.....	65
Figure 7: The process of interpretation.....	76
Figure 8: An example of a concept map.....	77
Figure 9: A brief overview of the structure and content of the results chapters.....	83
Figure 10: The use of absolute demarcations to determine the ‘position’ of the coastal zone.....	90
Figure 11: An indication of the complex legal framework used to govern the coast, and the dependency of such legislation on absolutely determined boundaries.....	93
Figure 12: Concept map of the Coordinator of Biodiversity Research, EKZNW.....	112
Figure 13: Concept map of the Head of Environmental Management, eThekweni Municipality.....	113
Figure 14: Concept map of the Business Portfolio Manager, Futureworks.....	115
Figure 15: Concept map of the Chairman of the South Durban Community Environmental Alliance.....	126
Figure 16: Concept map of the Environmental Manager: National Ports Authority.....	127
Figure 17: The 10 m contour of Durban CBD and surrounds effectively identifies the geographical area at risk (seaward of red line) from sea level rise and storm surge events.....	132
Figure 18: The extent of the Umgeni River catchment as a representation of the biophysical extent of the space of pollution.....	138
Figure 19: The space of biodiversity.....	145
Figure 20: The areas of Durban’s inner city forming part of the social profile against the 100 m landward boundary of the coastal zone.....	149
Figure 21: The HWM as defined as an absolute space.....	158
Figure 22: The HWM rather as an ‘envelope of mobility’	158
Figure 23: The coastal zone as defined within and absolute space.....	159
Figure 24: The multiple coastal social spaces that arise as a consequence of the proposed development of the SCH.....	159
Figure 25: The biophysical space of risk overlaid with multiple social spaces.....	160

Figure 26: The Umgeni River catchment reflecting the biophysical space of pollution overlaid with the space of risk and the various social spaces.....	160
Figure 27: Vetch’s Bite reflecting the multiple and interrelated coastal spaces.....	161

LIST OF PLATES

Plate 1: Booming development in Umhlanga, KZN, reflecting both the appeal of the coast, but also the negative impact that high rise buildings have on coastal viewsheds and the associated aesthetics.....	88
Plate 2: The coastal viewshed as seen from Berea Ridge, Durban, KZN.....	89
Plate 3: Tourists visiting Durban’s beach front and enjoying the beach: a reflection of the coastal ‘social space’	98
Plate 4: Beachwood Mangroves Nature Reserve at the Umgeni Estuary. The use of biophysical attributes, such as mangrove forests, to determine the extent of coastal systems.....	100
Plate 5: Business along Durban’s beach front reflecting the coastal ‘economic space’	102
Plate 6: Fishing is often at the centre of conflict between other beach users along Durban’s beach front.....	122
Plate 7: Destruction in Ballito (KZN) caused by the March 2007 storm surge event.....	131
Plate 8: Milnerton Club House in Cape Town during the August storm surge event, 2008. Infrastructure at risk from storm surge events is a country-wide issue.....	135
Plate 9: Pollution in the Umgeni River catchment, Durban, KZN. This pollution ultimately ends up in the coastal zone causing negative socio-economic and environmental impacts.....	137
Plate 10: Access to the beach in Salt Rock, KZN, reduced as a consequence of high density strip development and the associated high walls and security fences.....	152
Plate 11: Access points that are present are few and far between, with little space for amenities such as toilets and showers.....	152

LIST OF TABLES

Table 1: A general matrix of spatialities	27
Table 2: Other legislation relevant to the coastal zone	56
Table 3: List of respondents	71
Table 4: Extract of an example of a table representing the biophysical/environmental pillar of sustainable development	81
Table 5: Economic concerns of coastal stakeholders.....	114
Table 6: Issues identified within the governance pillar of sustainability	116
Table 7: Issues identified within the social pillar of sustainability.....	120
Table 8: Issues identified within the environmental pillar of sustainability.....	123

CHAPTER 1: INTRODUCTION

Coastal regions have significant socio-economic potential. The value of coastal resources is reflected in the great variety of legislation applicable to these resources. The question however arises: what does ‘coastal’ mean? According to the US Commission on Marine Science, Engineering and Resources (1969) the coastal ‘zone’ may be defined as:

“...the part of the land affected by its proximity to the sea, and that part of the sea affected by its proximity to the land as the extent to which man’s land-based activities have a measurable influence on water chemistry and marine ecology” (US Commission on Marine Science, Engineering and Resources, 1969, cited in van den Bergh and Nijkamp, 1997: 2).

Although such a definition applies a biophysical and systems-orientated¹ approach towards determining what the coastal zone is, no reference is made to coastal socio-economic attributes and influences. Such a description cannot therefore, according to van den Bergh and Nijkamp (1997), be deemed as an all-encompassing and measurable definition of what the coastal zone is. As such, and considering that there are numerous definitions that attempt to spatially define the ‘contact space’ between land and sea masses, there is no one universally accepted definition of this space, and more specifically, where its boundaries may lie (Graber, 2005, cited in Schwartz, 2005; Endangered Wildlife Trust, 2007).

The broad scope of definitions used to describe this ‘contact space’ is reflective not only of a dynamic system that provides important socio-economic resources, but also of a system that consists of multiple ‘spaces’. As a consequence of the coastal zones value and complexity, various legislative frameworks have been put in place to manage this space. However, to provide a vital point of reference, legislation requires that this space, or the coastal ‘zone’ is defined. To determine the area of jurisdiction of the various legislative frameworks, as well as to provide clarity on the rights and responsibilities of stakeholders that act within the coastal zone, coastal zone definitions are typically guided by fixed and absolutely determined boundaries. Thus, coastal definitions and the independent legislative frameworks are effectively ‘overlaid’ against a space that is characterised by dynamic and multi-scale complexity. This research argues that this disjuncture of ‘static’ and fragmented legislation which is applied against a broad scaled system of ‘fluidity’ is

¹ For more information on systems theory, refer to Chapter 2: section 2.3.

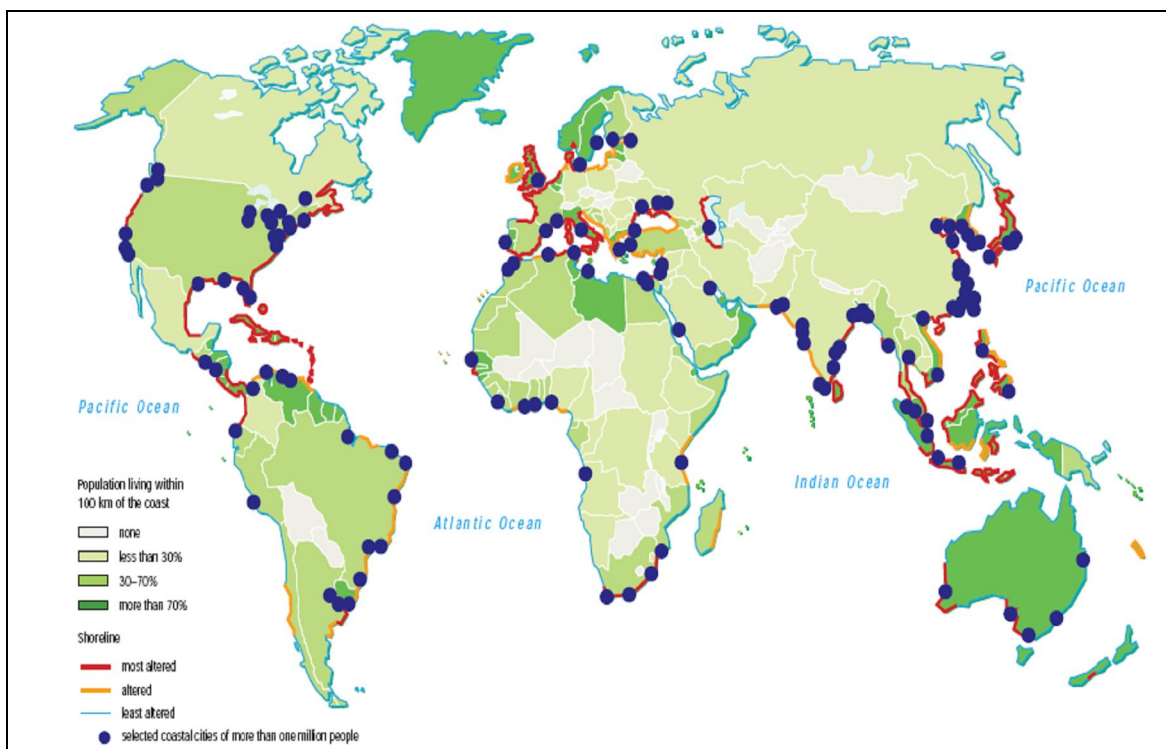
effectively leading to unsustainable practices within the interface between marine and terrestrial environments (Collier *et al*, 2001; Whitehead, 2004; DEAT, 2006).

An example of this ‘unsustainability’ (and as a consequence of the disjuncture between ‘static’ legislation and dynamic systems) is reflected in the issue whereby coastal legislation is marred by ambiguity and the consequent ‘loop-holes’ that arise from this ambiguity (DEAT, 2000; Binns *et al*, 2003). Similarly, the effectiveness of legislative frameworks, in respect of coastal management, is further weakened due to “...complex relationships and interactions between overlapping and often competing rights, restrictions and responsibilities, both in the marine environment and at the land-sea interface”² (Williamson *et al*, 2005: 2). This research argues that it is issues such as these that are a direct consequence of the inability of absolutely guided and fixed legislative frameworks to accommodate the dynamic and complex nature of coastal systems. This research intends to determine how the complexity of coastal systems may be more effectively accommodated through the application of alternative concepts of space in defining coastal zones and thereby improve the degree to which coastal zones are managed.

The problems associated with current legislative and management approaches surrounding coastal regions has led to the need to explore alternative management techniques (Clark, 1996; van den Bergh and Nijkamp, 1997; French, 2004; Rajabifard *et al*, 2005; Williamson *et al*, 2005; DEAT, 2006). The necessity to drive such change is given further impetus when the growing intensity and extent of development and the associated pressures taking place within coastal regions, both on a local and international scale, is considered (van den Bergh and Nijkamp, 1997; French, 2004; Draft eThekweni Municipality Coastal Management Strategy, 2005; Celliers *et al*, 2007). For example, it is estimated that by 2025 the stretch of coast between Accra to the Niger delta will become an unbroken chain of cities, with a population estimated to reach 50 million along a 500 km section of coastline (Hatzios, 1996, cited in UNEP, 2006). Indeed, if the definition as given by the US Commission on Marine Science, Engineering and Resources (1969) is considered, and assuming the source of human influence extends 60 km inland, it can be

² A practical example of this is reflected in the ‘confusion’ that often arises between authorities jurisdictional responsibility in relation to the position of the high and low water mark. An applied example is reflected in the regulation of off-road vehicles (ORVs): the use of ORVs in the coastal zone is prohibited in South Africa (provision is made for exceptions). However, there is a lack of clarity in terms of the landward ‘position’ of the coastal zone and as such where ORVs may or may not be permitted.

inferred that 50% of the world’s population live within the coastal zone (van den Bergh and Nijkamp, 1997; Glazewski, 2005; World Bank, 2007). Figure 1 reflects similar data on the intensity of human development along the coastline. Not only does this area provide desirable conditions for a significant proportion of the world’s population, but such an area is a “...concentration point for many industrial activities; it is a communication and transportation area for a large share of our goods and services; and it is a vulnerable ecosystem of an invaluable quality” (Van der Plas 1996, cited in van den Bergh and Nijkamp, 1997:1).



(Source: UNEP, 2006)

Figure 1: Coastal populations and shoreline degradation.

In South Africa’s case, and in respect of developmental projections, the importance of coastal regions, as the future node for socio-economic development, is substantiated by the fact that five out of the eight Spatial Development Initiatives (SDI’s)³ identified by the South African government occur within coastal regions (Glazewski and Haward, 2005). Additionally, research conducted by Celliers *et al* (2008) has shown that within KwaZulu-Natal, the rate of change in land use cover from natural and agricultural landscapes to

³ Spatial Development Initiatives are government initiatives that focus high level support towards promoting sustainable industrial development in areas where poverty and unemployment are high (South African Info, 2008).

urban and rural landscapes⁴ has increased substantially. The percentage increase of this land use class is proportional at any distance inland from the entire length of the sea shore: the closer to the sea shore, the greater the percentage the urban/rural land use class becomes and vice versa.

The intense concentration of human populations and activities within coastal regions indicates that there are a variety of social and economic benefits that coastal regions offer that are not found to the same degree elsewhere. The attractiveness and nature of coastal environments and the subsequent concentration of people within coastal regions is placing severe pressure on coastal resources (GESAMP, 1990; Hinrichsen, 1990). This is exacerbated by the sensitivity of coastal systems to anthropogenically induced changes, specifically in the form of water and noise pollution, landscape destruction and interventions of natural processes within coastal systems (van den Bergh and Nijkamp, 1997). To address such concerns, it is clear that legislative frameworks and the resultant sectoral management approaches need to shift to a more inclusive, systems- orientated and adaptive approach. According to Atkins (2004), such an approach may be enacted through Integrated Coastal Zone Management (ICZM). Integrated Coastal Zone Management is defined as a process that “...attempts to ‘join up’ the different policies which become relative to the coast as well as bringing together stakeholders from local to national levels to inform, support, and implement these policies” (Atkins, 2004: 1).

Within the current climate of increased environmental awareness, and as a reflection of the need to integrate policies applicable to coastal regions, the South African government is about to promulgate its first legal instrument that will be dedicated towards the promotion of the integrated management and governance of the coast. This tool is the Integrated Coastal Management Act (ICM Act)⁵. Within this process, and as a result of the precise terms of reference that become essential for the ‘effective’ capability of legislative and legal frameworks, attention has been directed towards defining as precisely as possible terms of reference for attributes that are deemed as being ‘coastal’. As a key baseline informant, the ‘coast’ or at least what is perceived to be as the ‘coastal zone’, has had to be defined.

⁴ In this case study, agricultural landscapes were predominantly represented by sugar cane farms. The term ‘rural’ is used to describe landscapes characterised by the presence of relatively dense rural homesteads.

⁵ The Integrated Coastal Management Act was assented by the president on the 9th of February 2009 and is currently awaiting a date from which it will become legally enforceable.

Although there are a host of definitions that describe what the coastal zone is and equally as many techniques that attempt to determine where coastal boundaries may lie, mainstream and applied definitions are typically situated within legal contexts. These definitions, due to the very nature of legal and legislative processes, are required to be physically imposed and precise in order to create a 'known' and therefore legally defensible space. This is typically initiated by 'anchoring' such a space through the delineation and fixation of coastal boundaries on maps. Coastal zones and their definitions that are guided by empirically and absolutely determined parameters, ultimately results in the creation of a geographic construct.

Empirically based or absolutely determined coastal zones may cater for the needs of legislative and administrative capabilities. The question however arises as to what impact definitions and their associated fixed socially constructed boundaries (in respect of location, extent etc.) have within the context of complex and dynamic systems within coastal regions. The position of these boundaries has lead to serious socio-economic implications for the rights and responsibilities of coastal stakeholders (Clark, 1996). The question also arises as to the impact of these boundaries on ecological systems and our ability to manage natural resources sustainably. As Leach and Kitchingman (2005) suggest, where mobile natural boundaries define the spatial limits of a natural resource, administrative boundaries should only be set at the extremes of the natural variation of that resource. Similarly, it is inappropriate to employ spatially based management approaches over these resources, unless these resources, and those environmental factors that govern the availability of these resources, are predictable and function within fixed spatial parameters (Leach and Kitchingman, 2005). The difficulty of determining the extent of the variation of resources, and thus where to place administrative boundaries, is compounded when the dynamics of environmental processes are non-linear in nature (van den Bergh and Nijkamp 1997; Berkes *et al*, 2003). In a more holistic sense, the degree of complexity (and therefore uncertainty), is further exacerbated given the realisation that socio-economic systems are inherently linked within environmental systems (van den Bergh and Nijkamp, 1997; Berkes *et al*, 2003).

The interface between land and sea masses is more than a one-dimensional convergence between two physically different mediums. Rather, this interface is a nexus of complex interacting socio-economic and environmental 'spaces'. Defining the coastal zone through

the use of absolutely determined boundaries is necessary to support legislative and legal processes and capabilities. However, the use of absolute space to determine the 'position' of the coastal zone is a form of confinement and is therefore exclusionary.

It is from this perspective of examining the concept of space in relation to coastal management that this research departs. This research therefore intends to a) examine and gain an understanding of what constitutes the coastal space, b) to explore why these multiple socio-economic and ecological spaces should be recognised, and c) to explore/suggest how these socio-economic and ecological spaces may be used to inform and improve management approaches within coastal regions. As a means to achieve this, the concept of space will be explored in three ways. The first way is to examine space as an absolute container of social and ecological systems as proposed by Newton, Descartes and Kant (Harvey, 1997). An example of this is the use of absolute space to create and to determine the 'position' of the coastal zone: the 'coastal zone' is thus contained within an absolute space. The second way, as proposed by Einstein, is where space becomes relative: relations between objects in space change based upon how you measure those relations. For example, to travel from A to B may be measured by means of absolute space i.e. ± 10 kilometres. The distance between A and B may also be measured by cost or time. Space is thus relative (Harvey, 1997). The third and final way to examine space is in a relational sense. Space is defined by social processes and these spaces in turn shape social processes (Harvey, 1997). For example, the 'coastal zone' is defined and contained within an absolute space (socially constructed) which in turn shapes the manner in which the coast is perceived and managed (social processes). Relational space thus reflects the relations between society and space and their co-production of the environment (Oelofse, 2009a).

Considering the ICM Act is soon to become legally enforceable, understanding the nature of coastal zones is recognised as a priority area of research and is necessary to provide a sound foundation from which to achieve the overarching objective of the White Paper, namely sustainable coastal development in South Africa.

1.1 AIM AND OBJECTIVES

This study commences from the viewpoint that:

Coastal regions are dynamic and complex systems that require integrated and holistic management approaches. Without appropriate management systems, our ability to mitigate the impact of human induced disturbances will be partial and therefore ineffective.

The aim of this research is:

To explore the re-conceptualisation of the coastal zone as a set of relational spaces so as to promote a more holistic and integrated management system for coastal regions.

The objectives of this research are:

- 1) To use the concepts of space, scale and systems to reflect on the complexity of social-ecological systems within coastal regions;
- 2) To identify the manner in which coastal stakeholders define and understand the coastal space;
- 3) To identify multiple relational coastal spaces that emerge as a result of coastal stakeholders understanding of coastal issues;
- 4) To determine the implications of coastal definitions as defined by absolute space, within a relational environment, and
- 5) To examine why relational coastal spaces important to coastal management prescriptions.

Due to the wide range of terminologies used to describe the coast, it is necessary to clarify the use of such terms as used in this research:

Coastal Zones, Coastal Regions, Coastal Systems and the Coastal Space

In the context of this research, the word 'coast' or 'coastal' refers to the broad interface between land and sea masses. The term 'coastal zone' is used when referring to the dependency of legislative frameworks on a definition as a necessary point of reference. The terms 'coastal regions' and 'coastal systems' are used when referring to the coast in a more fluid sense, where the coast is an expansive bio-physical system not bounded by

artificial boundaries. The term ‘coastal space’ refers to all the absolute, relational and relative spaces that collectively make up the coastal fabric.

1.2 STRUCTURE OF THESIS

Due to the broad scope of this research, this thesis has been structured in such a way as to provide systematic clarity of the various issues under investigation. Chapter 2 presents the theoretical framework which frames this research. It focuses on the theory of space, scale, and systems. The use of the concepts of space provides critical insight which enables mainstream coastal management approaches to be critiqued. The chapter finally focuses on the theory of social-ecological systems and the influence that management approaches have towards linking or polarising social and ecological systems.

Chapter 3 explores the manner in which coastal regions are managed. Within the coastal management framework, attention has been directed towards historic coastal management approaches (both within an international and local context), trends in coastal management within South Africa, and a brief overview of the various legislative bodies that become applicable to coastal regions within South Africa. To highlight the differing manner in which coastal zones may be defined, the chapter ends with a discussion on a number of coastal zone definitions and a description of the context in which these definitions are applied.

Chapter 4 describes the methodological approach used in this research. The methods employed to achieve the aims and objectives of this research are outlined, and reasons given as to why particular methods were used. The advantages and limitations of such methodologies are highlighted.

The results of this research are discussed over three chapters. The first results chapter (Chapter 5) explores and uses coastal stakeholder conceptions to reflect the coast as a set of relational spaces as opposed to an absolutely determined ‘zone’. Chapter 6 identifies issues within the coastal zone based upon the perception and understanding of coastal stakeholders. The final results chapter (Chapter 7) synthesises the first two results chapters

as a point of departure and is used to identify those relative and relational spaces that make up the coastal fabric.

Chapter 8 provides the conclusion of this research. Coastal stakeholder conceptions are used to re-examine the coastal zone within more of a contextual setting. Relational spaces that arise from this are used to identify spaces that become relative to coastal management prescriptions. Through examining the manner in which management prescriptions can 'factor in' these relational spaces, mechanisms are identified to strengthen the process of linking social-ecological systems within coastal regions and thus leading towards increased degrees of sustainable coastal management.

CHAPTER 2: THEORETICAL FRAMEWORK: UNDERSTANDING COASTAL ZONES

2.1 INTRODUCTION

This literature review uses a variety of theoretical approaches (Figure 2) to uncover and explore factors shaping how and why coastal zones are defined and the consequences thereof. A range of theoretical frameworks are used to explore the questions raised in this research. Although these bodies of knowledge have emerged independently, they are used in an integrated way to provide concepts useful for understanding and re-conceptualising the coastal zone.

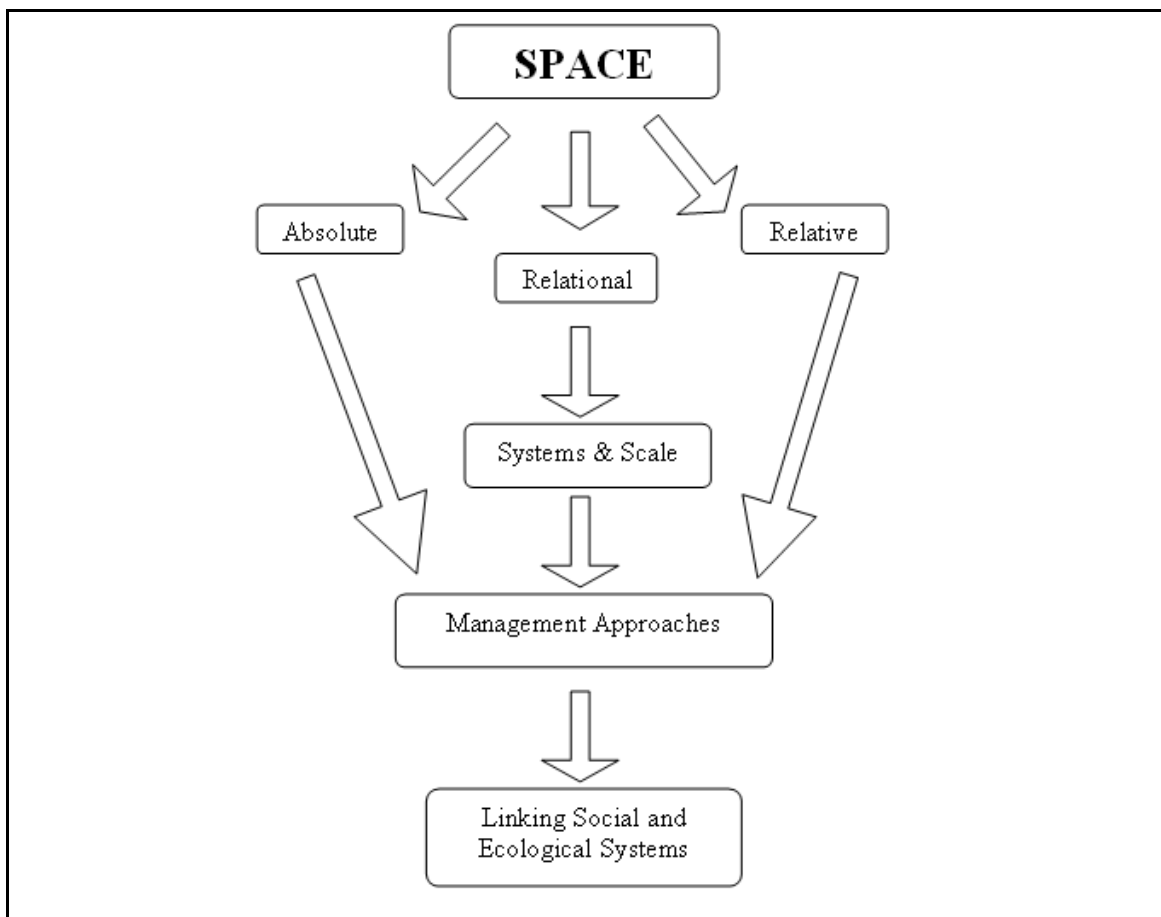


Figure 2: Flow chart reflecting the theoretical framework developed in this research.

The literature review first examines the concept of space and provides an account of the meaning of ‘space’. Space is a theoretical and abstract concept, yet it is recognised as being deeply significant to this research as it provides the fundamental body of knowledge necessary for understanding the complexities surrounding the definition of the coastal zone and the management of coastal regions. Through acknowledging and utilising space as a

multidimensional concept, as opposed to conventional linear and one-dimensional (absolute) conceptions of space, insight is gained about the ‘underlying’ and perhaps obscure mechanisms that shape the nature of coastal management. The importance of the concept of space in relation to defining coastal zones is exemplified by the differing manner in which people and cultures perceive ‘space’ (Harvey, 1969; Golledge, 2002, cited in Hubbard *et al*, 2004). For example, different people may perceive the coast, and what it constitutes, differently. These perceptions shape the nature of coastal zone definitions. This in turn opens further avenues of investigation towards the ‘coastal zone’ as a geographical and social construct. The nature of this construct may have significant implications for the manner in which coastal regions are managed. Considering this, and to gain a more holistic understanding of what constitutes the ‘coastal space’, the literature review turns to exploring alternative and more expansive concepts of space, namely relative and relational space.

Taking key and relevant insights from the theory of space, the discussion then focuses on the theory of systems and scale. The examination of the theory of systems and scale brings into question the manner in which western scientific prescriptions are founded, namely the production of knowledge based upon reductionist methodologies (Von Bertalanffy, cited in Harvey, 1969; Acheson *et al*, 1998, cited in Berkes *et al*, 2003). The practice of reductionism is undertaken in order to contain and grasp an ‘understanding’ of systems to facilitate more effective management practices. The question arises as to whether this compartmentalisation and myopic view of systems reflects our inability to understand what is a more fluid and complex reality? The examination of the theory of systems and scale provides an important foundation from which to determine relative and relational spaces.

Through an analysis of systems theory, it is necessary to explore the concept of scale. Definitions of systems depend upon the scale at which such systems are perceived. To encourage effective management towards the desired degrees of sustainability, the question arises as to where and how the limits (boundaries) of such systems are set. Similarly, the definition of the coastal zone is dependent upon the scale at which the coastal zone is perceived. What are the implications of a definition that constructs a narrow perception of the coastal zone? This is important considering that legislation is guided by such definitions. This research explores the phrase ‘coastal zone’ as a geographic construct and how this may naturalise a myopic perspective in relation to what is a system that

functions at broader scales. What are the implications of this compartmentalisation towards achieving what is now the global priority of sustainability? It is these questions that this research seeks to address. The importance of such questions cannot be ignored considering the energy being spent on developing legislation that ‘fixes’ coastal systems.

The third part of the literature review focuses on management approaches. These include approaches of command and control, and adaptive management. The inclusion of management frameworks within the literature review is justified from the perspective that firstly, governance (as a form of management) forms one of the four key pillars of sustainable development, and secondly, constructs of space embedded within management approaches. For example, command and control management focuses on controlling and restricting the range of variation within systems. Such an approach makes the assumption that problems experienced are linear in nature in terms of cause and effect, and that remedies to such problems are typically addressed through the development of legislation and regulations (Holling and Meffe, 1996). The connection to space and the coast is made when such legislation and regulation is guided and dependent upon absolute boundaries that determine the ‘position’ and physical extent of the coastal zone. The question arises as to whether such a management approach and the absolute space contained within it, has the capacity to cater for the variation that takes place over broader spatial and temporal scales. Conversely, adaptive management reflects the need to ‘learn-by-doing’, and to encourage co-evolutionary management that keeps in line with socio-economic and environmental systems change (Holling and Meffe, 1996). This links to relational and relative space as adaptive management recognises the need to move from restrictive and fixed absolute spaces towards fluid and more relational ‘open’ spaces.

Finally, with the culmination of the abovementioned bodies of knowledge in mind, this review examines theory that links social and ecological systems. This theory is based on the notion that socio-economic and ecological systems are inextricably linked while contemporary mainstream western management approaches view them as separate entities (Berkes *et al*, 1998 and 2003). It is proposed that to achieve higher levels of sustainability, it is necessary for social systems to become ‘re-immersed’ within ecological systems (Berkes *et al*, 1998 and 2003). In the context of coastal regions this requires that absolutely orientated definitions which assume an absolute notion of space, and the connected approaches of command and control, need to be ‘unsettled’ so as to accommodate

relational spaces within complex socio-economic and environmental systems. The various bodies of knowledge discussed in the literature review are therefore drawn upon to firstly identify those mechanisms that naturalise the detachment of social and ecological systems and to determine the implications this has for the way in which coastal zones should be defined and managed.

2.2 CONCEPTS OF SPACE

The study of space, according to Kitchen and Tate (2000:4), "...seeks to explore the relationships between places and patterns of activity arising from the use people make of the physical settings where they live and work". By exploring such a concept, primary causal mechanisms shaping the complexity of the coastal zone, and the manner in which it is managed, will be uncovered. Equipped with this insight, recurring themes will surface and as such will form key 'vantage points' from which to gain a clear understanding of the research questions of this thesis. The role of concepts of space in influencing management approaches is highlighted through the examination of a case study. This study is discussed in more detail in section 2.2.2.

2.2.1 Absolute (physical) space

According to Harvey (1969), the evolution of space as a scientific concept is bound up in the progress of physical theory. Physical theory emanates from within the conceptual framework of positivistic science. Positivistic science is based on the principle whereby speculation is avoided through the use of objectivity and formal logic in order to gain knowledge of absolute reality (Kitchen and Tate, 2000). 'Objectivity' and 'formal logic', according to the positivist epistemology, are applied in the analysis of empirical data. Thus, absolute geometry, based on Euclid's postulates (Appendix 1) developed as a logical extension from these tangible and learned visual experiences and as such has been commonly accepted as the most appropriate spatial language with which to describe and measure relationships between objects in physical space (Harvey, 1969; Gatrell, 1991; Law *et al*, 1998). To date, and as Gatrell (1991) states, spatial relations have been determined primarily on some measure of physical distance. This approach of spatial

language leads us to the first concept of space, that of Euclidean or absolute (physical) space.

Absolute space is typically used to measure distance and direction with the metric of Euclidean geometry. The metrics of absolute space is applied widely and examples of such metrics include units such as meters and kilometres to measure distance between objects. Degrees of latitude and longitude are additional examples of absolute space in the form of Euclidean mapping (Law *et al*, 1998).

Absolute space infers that each object in space occupies a point location (a set of coordinates) as denoted by (x_i, y_j) and that determining the distance between members of this set would typically be solved by the following equation (as a formal definition of Euclidean distance): $d(i,j) = [(x_i - x_j)^2 + (y_i - y_j)^2]$ (Gatrell, 1991). Indeed Geographic Information Systems (GIS), as one of the most widely used spatial analytical tools today, is based primarily on Euclidean geometry (Gatrell, 1991). The extensive application of such a language is born from the dependency of physical geography during the positivist era on a conceptual framework that tries to understand the location of objects and events in space by assigning an absolute location to those objects and events (Harvey, 1969 and Gatrell, 1991).

Absolute space and sustainable development: a critique

This critique of the concept of absolute space is given within the context of the global priority of promoting increased degrees of sustainability. As this research focuses on concepts of space and the implications of such concepts on sustainable practice within coastal regions, it is argued that a critique is necessary for exposing core issues that may hinder progress towards achieving improved degrees of sustainability. The term ‘degree’ is used as there is a range of sustainability outcomes which may include weak or strong degrees of sustainability. These degrees of sustainability are determined based on what predetermined sustainable goals or criteria are met (Gibbs *et al*, 1998).

The most recognised definition of sustainable development is from the World Commission on Environment and Development as “meeting the needs of the present without compromising the ability of future generations to meet their needs” (Berger *et al*,

2001:83). The concept of sustainable development, as an indispensable prescription for addressing global socio-economic and environmental concerns, gained momentum through the Brundtland Report of 1987. It is important to note that the focus of this concept has since shifted. According to Berger *et al* (2001), emphasis was initially channelled towards a technocratic and seemingly myopic prescription limited to achieving sustainable harvests of renewable resources such as forests and fisheries. The critique of this initial approach is substantiated given the continued environmental degradation and associated negative socio-economic consequences experienced at a global scale. The thinking behind the concept of sustainable development has therefore had to deepen and consider a broader spectrum with which to enable a more active approach towards addressing these global concerns. As such the contemporary prescription towards achieving sustainable development has evolved towards a more holistic approach. The focus of sustainable development has thus shifted from that which employed empirically affiliated prescriptions towards a multidisciplinary approach with the intent of developing a broader understanding of the complex set of relationships between the four pillars of sustainability: that of governance, economic, social and environmental spheres (Berger, 2001). The recent development of the field of sustainability science reflects this.

Through expanding our understanding of these relationships, the ability of our management prescriptions to negate negative socio-economic and environmental impacts is enhanced (Johnson *et al*, 1983). In this sense our ability to achieve higher degrees of sustainable practice, and thus the most desired, is therefore ultimately dependent on the productive functioning of societal mechanisms (Gibbs *et al*, 1998). The acknowledgement of the dependence of achieving higher degrees of sustainability on our understanding of social mechanisms therefore brings into question the appropriateness of applying positivist-based methodologies in pursuit of the most desired degrees of sustainable practice (Colenbrander, 2006). The importance and magnitude of such a question is put into context considering the explosion of GIS as an increasingly popular planning and management tool, but which is grounded in positivist and empiricist versions of science (Gatrell, 1991; Harris *et al*, 1995; Pickles, 1995). Geographic Information Systems in this context will be discussed further at a later stage.

The critique of absolute space as a means towards understanding societal mechanisms is launched from the premise that absolute space is an abstract concept that does not exist in,

or reflect reality (Harvey, 1969; Lefebvre, 1991 cited in Hubbard *et al*, 2004). This critique is further substantiated by the idea that people's perception and understanding of space is not absolute. Similarly, as stated by Tuan (1997, cited in Hubbard *et al*, 2004:5), "people do not live in a framework of geometric relationships, but a world of meaning". This is also applicable to the functioning of natural systems: processes within natural systems do not recognise abstract boundaries; they operate as a dynamic system of which the predictability is often unknown. According to Roberts and Suppes (1967, cited in Harvey, 1969: 192), "...our ability to see in Euclidean terms is learned rather than innate". In this sense Euclidean space should not be deemed as a 'perception' of space, but rather a representation of space by means of an imaginary concept (Piaget and Inhelder, 1956, cited in Harvey, 1969). Thus, the use of absolute space to determine relationships between objects is implicated in the production of a 'relativised' abstract space (Lefebvre, 1991, cited in Hubbard *et al*, 2004).

Absolute spatial science, as indicated, is firmly grounded within the broader positivistic ontology. Harvey (1969) suggests that the application of positivistic science towards understanding social dynamics leaves a substantial gap in our understanding of the functioning and dynamics of society. Advocates from the naturalist perspective counter this critique by suggesting that "...human behaviour is subject to the operation of laws of cause and effect, and the nature of these laws can be identified by the process of hypothesis-testing against empirical evidence" (Johnson, 1983:27). However, according to Harvey (1969) laws of cause and effect as a linear process cannot address those complexities of human agency. The laws of cause and effect therefore yield only a partial verification of circumstances and that without a precise verification, those causal mechanisms cannot be determined (Harvey, 1969). Our ability to understand the complex interaction between the four spheres of sustainability is therefore restricted and perhaps obscured.

Based on the critique given above it is evident that the concept of space may be used in a variety of ways and that a 'container' view of space can only contribute partially towards solving geographical problems. The recognition of the need to explore other spatial languages to encourage alternative perspectives for resolving geographical problems took hold in the late 1960's and early 70's (Cloke, 1991). The shift in the spatial language in

response to the quantitative revolution was additionally substantiated by Harvey (1969:191):

“Some of the problems raised by location theory – the spatial expression of which is frequently discussed in Euclidian terms – have aroused interest in new ideas of social space. Such space appears to be non-isotropic⁶ and the processes operating in that space often seem to demand a different metric (or non-metric) system for discussing spatial relationships and spatial pattern; in short geographers have begun to explore other spatial languages”.

In view of the long standing acknowledgement of the need to explore and use alternative concepts of space as opposed to using a ‘container’ perception of space, the question arises as to what progress is being made in this regard within the current ‘age of information’? Of specific relevance to the ‘age of information’ is the explosion of GIS applications as increasingly popular management tools but which are firmly grounded within the language of Euclidean space (Gatrell 1991; Harris *et al*, 1995; Pickles, 1995).

Absolute space and Geographic Information Systems: a critique

Geographic Information Systems are being increasingly applied to inform management decisions (Gatrell, 1991; Harris *et al*, 1995; Pickles, 1995). The range of applications in which GIS may be used is growing. Reflecting the durability of GIS and the broad scope to which GIS may be applied, is the growing discipline of coastal GIS: GIS that focuses on solving geographical problems that are unique to coastal regions. Considering this, and considering the questions asked by this research, it is necessary to explore GIS, its connection to space, and the implications of this on the broader imperative of coastal management.

A Geographic Information System is a computer based tool that is used to solve problems. There is a multiplicity of definitions that attempt to describe what a GIS is and what it is used to do. Due to the nature of GIS and the broad field in which it is applied, these definitions vary in their descriptive content. There is however a central theme: GIS is an information system that produces information through the spatial interpretation of data (Gatrell, 1991; Harris *et al*, 1995; Pickles, 1995; Cinderby, n.d.). Data in this sense may be

⁶ Isotropic: having the same physical properties in all directions.

defined as “...symbolic representations of features” (Maquire *et al*, quoted in Pickles, 1995:2).

The application of GIS for the past decade has been viewed as a success by both GIS technicians and their scientific peers (Maquire *et al* 1991, cited in Cinderby, n.d.). This apparent success is attributed mainly to spatial representations derived through the powerful analytical capabilities of GIS. Indeed, the ability of GIS to ask descriptive questions and provide descriptive results has become genuinely useful and important to the planning and resource management fields (Gatrell, 1991; Harris *et al*, 1995; Pickles, 1995). The critique of GIS however, according to Harris *et al* (1995:200) is launched from the perspective that the apparent success of GIS is attributed to its ability of “...exploiting the easy parts of the problem” and that GIS is ill-equipped to investigate more pressing issues of socio-economic orientation that are inherently linked to, and drive, broader and perhaps more pressing geographical problems (Cinderby, n.d.).

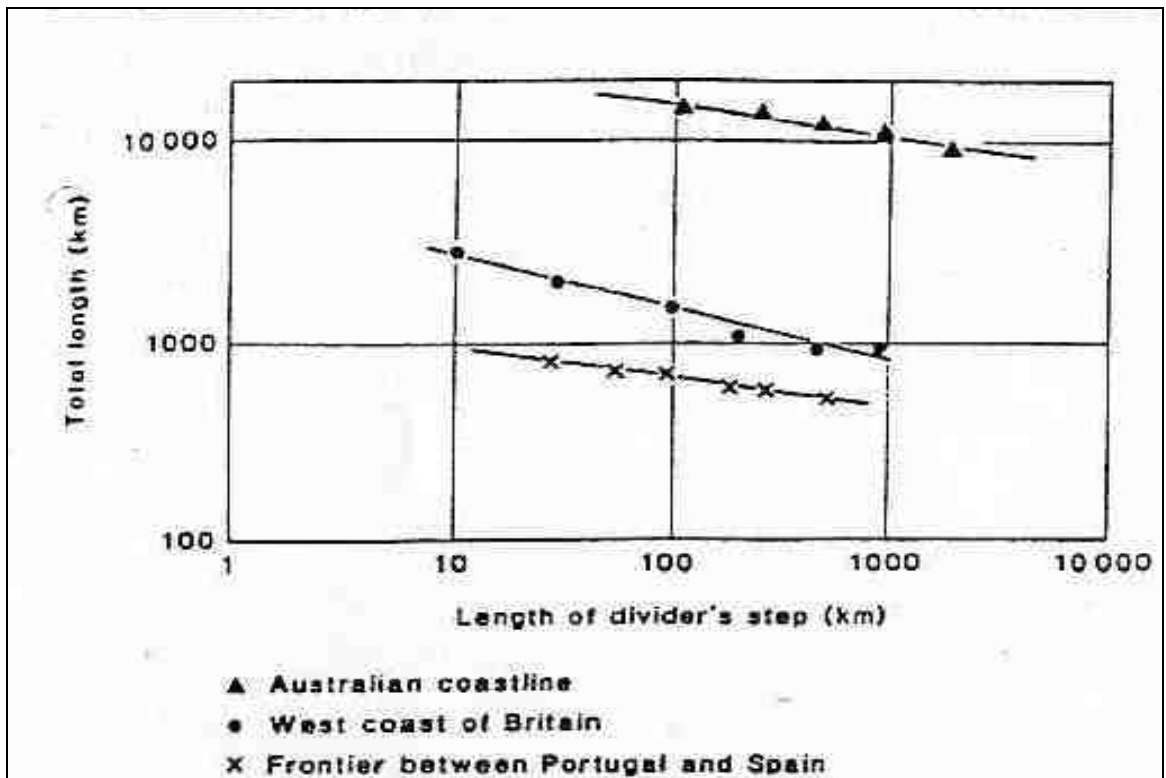
According to Pickles (1995), GIS emerged in the 1960’s as a product of positivist and empiricist versions of science and has recently re-emerged as a tool that has become extensively grounded within the land planning and management sectors and which is rapidly spreading to other disciplines (Gatrell, 1991; Harris *et al*, 1995; Pickles, 1995). This re-emergence, according to Pickles (1995:12), is a result of the “...collaboration between, and a revitalisation of, spatial analysis, cybernetics and computer developments of the 1970’s”. Due to the nature of its roots, and according to critical theorists in geography, the growth of GIS may be viewed as the rehabilitation of the positivist epistemology (Pickles, 1995). The association between GIS and positivistic science is substantiated by the fact that GIS is firmly embedded within Euclidean concepts of space (Gatrell, 1991). In this context, the question arises as to the appropriateness of the absolutely orientated spatial nature of GIS applications (and their outputs) towards determining the nature of spatial relations between objects within the broader intent of solving geographical problems. For this research, it becomes especially significant considering the growing application of GIS towards mapping and defining coastal boundaries.

The use of absolute space, and as will be indicated in a case study in section 2.2.2, has its limitations for exploring alternative and perhaps more realistic and meaningful relations

between objects in space. In acknowledgement of the limitations of absolute space, GIS has developed 'relative equations' in an attempt to explore alternative concepts of space. For example, the distance between two objects on either side of Manhattan City, New York, cannot, in terms of real space, be given as a distance measured by a straight line between those two objects (Gatrell, 1991). Manhattan 'space', as a real space, consists of a grid based urban environment where the manner in which people move, is determined by the street pattern. To cater for this grid-based characteristic, the 'Manhattan' distance equation as an alternative and more 'realistic' attempt to account for relative space was developed. This equation is given as follows: $d(i,j) = [x_i - x_j] + [y_i - y_j]$ (Gatrell, 1991).

According to Gatrell (1991), three points can be made about this attempt to factor in relativity. Firstly, this equation shares the same metric properties as Euclidean space and therefore follows the same principles of Euclid's postulates. Secondly, to determine spatial proximity between objects, the results in terms of relative distances will differ from those as determined through the use of the Euclidean metric. Thirdly, Manhattan space is not coordinate invariant: if the axes are re-positioned, the distance between points will differ. This therefore implies that the Manhattan equation may only be appropriate in grid-like cities in which the axes share the same pattern as the streets. Such an attempt therefore fails to breach the confines of Euclidean space.

The role of fractals in topological dimensionality provides an additional example that brings into question the capability of empirically based methodologies to reflect reality. The issue of topological dimensionality is based on the premise that the length of an object depends upon the scale at which that object is measured. For example, when a straight line is measured, the logarithm of length, if plotted against the logarithm of the sample interval, a linear relationship is observed. However, with an irregular line, this is not the case. The length of the line is dependent upon the scale at which that line is measured. With a decrease in scale (increased detail) there is an increase in the total distance. This may be simply demonstrated by the use of dividers to measure distance along an irregular line. The distance of this line will vary based upon what width (scale) the dividers are set at (Figure 3).



(Source: Gatrell, 1991)

Figure 3: Relationship between the length of a line and sampling interval.

The same phenomenon is applicable to surface measurements: the length of, and area of a surface, is dependent upon the degree of undulation and the scale at which that surface is measured. The implications of this for scientific investigation and accuracy cannot be ignored. In an attempt to address this issue, GIS has 'rounded up' the degrees of dimensionality. The purpose of which is to enable a simulation of surfaces of varying degrees of irregularity to provide 'norms' for geomorphologic interpretation (Gatrell, 1991). For example, the dimension (D) of a featureless plain is given where the value of $D=2$ and for a solid cube, $D=3$. For a surface that has varying degrees of irregularity, such as any given surface on the earth, the fractional dimensionality is given as being between 2 and 3. According to Gatrell (1991), one of the basic properties of fractals is that they are 'self-similar' (self-similar in the sense that when an object is enlarged, it is still identical to the object as a whole). In a practical sense, this implies that an entire coastline will appear identically to, and be generated by, the same processes as any smaller 'cell' of that coastline (Gatrell, 1991).

Considering these examples, the question arises to whether the age of information, technology and our increasing dependence on maps for spatial interpretation, are not generating their own, more appropriate, tier of scale? (Dressler 1989, cited in Pickles,

1995). With this in mind, a second question arises: what are the implications of natural resource management prescriptions which have been informed by a 'constructed' tier of scale and where such a scale is smaller than the spatial scale within which natural systems function? This links directly into the notion as posed by Leach and Kitchingman (2005) where dynamic natural boundaries form the spatial limits of a natural resource, administrative boundaries (as determined through the application of GIS) should not only be set at the extremes of the natural variation of that resource, but also set at the scale so as to include those factors that influence the availability of that resource. This is especially significant considering that, and in respect of coastal resources "...different coastal processes operate at different spatial scales" (Gatrell, 1991:126).

It is at this stage that the role of GIS, it's ties to positivist and empiricist versions of science and the absolute orientation of such a tool is questioned on it's ability to understand and reflect reality. Pickles (1995:7) critically unpacks this notion by suggesting that the spatiality of GIS is a "...virtual space of data manipulation and representation whose nominal tie to the earth (through GPS and other measuring devices) is infinitely manipulatable and malleable". According to Nelson (1992, cited in Pickles 1995:7) the result is that our world is becoming "...increasingly virtual, as its appearance departs more and more from depending on the structure of physical reality". Hall (1993, cited in Pickles: 1995:21), suggests this phenomenon is no more evident in production of maps, where maps are not only seen as pictures of the world, "...but depictions of the world that can be shaped, manipulated and acted upon".

The critique of GIS has lead to the claim by Pickles (1995) that GIS may be nurturing a 'virtual' and not a 'real' perspective of reality. The implications of this, according to Pickles (1995), is that geographers are being diverted in a direction that is naturalising a myopic perspective and that broader spatial representations are not being acknowledged and understood. As Gatrell (1991:129) states, "...in our every day worlds, rather than the artificial worlds constructed in GIS, spatial separation is experienced less in terms of physical distance and more in terms of time, cost, or 'perception'". This underlines the necessity of relativity to determine relationships between objects in space. This is critical considering the extent of application of GIS to coastal regions, and whether the empirical grounding of GIS enables the recognition of these broader relative and relational spaces.

Gatrell (1991) states that not much progress has been made in exploring and using these alternative spaces for considering relations between objects within GIS applications.

2.2.2 Relative space

Considering the critique of absolute space and its application through management tools such as GIS, there is a clear indication of the need to be wary of adopting a rigid view of the concept of space. Our visual perception of space and how we understand space is not absolute, we do not see or think in straight lines of metrics as determined by Euclidean geometry, nor is the nature of relationships between objects governed purely by Euclidean distance (Harvey, 1969). Such a concept of space is abstract and does not exist in, or reflect, reality.

For example, the practical application of absolute space to determine relations between objects in space is revealed by Law *et al* (1998) in a case study of an Environmental Impact Assessment (EIA). One of the primary requirements of an EIA is to determine who the Interested and Affected Parties (I & APs) are in relation to the proposed change (in this case change takes the form of a proposed development and the subsequent social and environmental impacts). In so doing, those I & APs that are directly impacted upon (primary stakeholders) and those that are indirectly affected (secondary stakeholders) by this development are distinguished. This hierarchy is necessary in order to assign a 'weighting' to impacts incurred by the various stakeholders and as such who should receive greater consideration in respect of safeguarding their interests. In reality however, and as indicated by Law *et al* (1998), such distinctions are not easily made.

Conventional practice typically employs absolute spatial parameters as a guideline to determine who the primary and secondary stakeholders are. The assumption is made that the closer the stakeholder is in terms of absolute space from the development, the greater the chances of impact from the development on that stakeholder. Thus, the closer the stakeholder, the greater the weighting assigned to that stakeholder and the higher the stakeholder is placed on the priority list of consideration i.e. as a primary stakeholder (Law *et al*, 1998). In the language of spatial theory, this assumption is similarly stated by Tobler (1970, cited in Hubbard *et al*, 2004) who suggests that there are relations between all

objects in space but that these relations become ‘stronger’ when objects are nearer together, as measured by absolute space.

The truth of such assumptions is brought into question through research conducted by Law *et al* (1998). The case study focused on an EIA that was being conducted due to a planned gentrification of the Royal Natal National Park (RNNP) Hotel. It was envisaged that such an upgrade would have positive ‘spin-offs’ for the communities surrounding the RNNP. The KwaZulu-Natal Nature Conservation Service (KZN NCS)⁷, which was the organisation responsible for driving the EIA at the time, employed a Neighbour Relations Policy that dealt specifically with promoting communications between the RNNP and the surrounding community. Although the different community wards were located equidistant to the RNNP boundary, only one ward (ward A) was situated adjacent to the major access route to the RNNP. The other ward (ward B) was only accessible by means of secondary roads and therefore required greater travelling times to gain access to. As a result, ward A was awarded primary stakeholder status within the Neighbour Relations Policy and ward B was not. As such, community relations between KZN NCS and ward A were instigated by means of increased links, activities and ultimately more benefits. The exclusion of ward B from sharing and promoting benefits directly associated with the upgrade of the hotel led to conflict between the wards and between ward B and the KZN NCS. Although the different wards were located equidistant from the RNNP (as measured by absolute space), they were weighted differently for stakeholder status. This distinction arose as ward A was located alongside the major access road to the RNNP whilst ward B, although also bordering the RNNP, was only accessible via secondary roads at a greater distance from the major access road. As such, the increased distance (and related measures of increased time and cost) resulted in the exclusion of ward B.

Due to differences in time and cost associated with accessing the various wards, they were perceived differently in respect of their stakeholder status. The status of ward B differed due to the manner in which its relation to the park was perceived and measured. It was felt that ward B was too ‘distant’ and as such it was not awarded primary stakeholder status.

⁷ The KwaZulu-Natal Nature Conservation Service is now known as Ezemvelo KwaZulu-Natal Wildlife (EKZNW).

Within this same case study an additional example is highlighted to identify who the I & APs are, and the consequences of applying absolute space to determine the status of I & APs. The case is given whereby the Mahai River acts as an important source of water to both the RNNP Hotel as well as to several downstream communities. Measured by means of absolute space, the communities downstream were not perceived as primary stakeholders due to the significant distance between these communities and the RNNP Hotel. However, the Mahai River was also subject to sewerage disposal from the RNNP Hotel and that the current and predicted downstream sewerage levels, in respect of drinking standards, were unacceptable. Although communities downstream of the RNNP Hotel were located at a greater distance from ward A in relation to RNNP Hotel, they were directly impacted upon by the development, by means of poor water quality for drinking purposes. The downstream communities should therefore have been redefined as primary stakeholders as they were directly impacted upon by pollution in both space and time as the sewerage pollution moved along the river (Law *et al*, 1998).

Considering this case study, it is clear that spatial concepts need to be regarded in a more flexible manner and that concepts of space be applied according to the contextual setting (Harvey, 1969). Relative space is not concerned with absolute distances between objects, but rather the relations that determine the degrees of association between places and objects in space relative to human activities (Law *et al*, 1998). The use of relative space therefore provides an enabling framework from which to gain a broader understanding of relations that may exist between objects in space.

2.2.3 Relational space

There is a clear indication that space may not only be determined through the use of metrics, but that space, and the manner in which it is determined, is also dependent upon a system of relations (Russell, 1948, cited in Harvey, 1969). This implies that objects in space may be tied together by a particular relation. Substantiating this is Gatrell's (1991:120) view that space encompasses "... a 'set' of objects to which may be attached associated attributes, together with a relation, or relations defined on that set". The use of absolute space to determine relations between objects reflects only a single relation, a relation that is a social construct, and thus an abstract relation between those objects.

However, through the conception of space in a relative sense, it is evident that there are multiple ‘meaningful’ relations between objects in space, as is indicated in the Royal Natal National Park Case Study (Law *et al*, 1998). In this example a set of connections or relational spaces, which reflect the different ‘spaces of livelihoods’ of various stakeholders were identified.

A further extension of these more ‘meaningful’ spatial relationships that constitute the ‘coastal space’, includes the exploration of the third and final concept of space, namely that of relational space. According to Harvey (1997) space is shaped by social processes and these spaces in turn shape social processes resulting in relational spaces. Harvey (1997) argues that once things are constituted, produced or made, they begin to shape and influence the very social processes that made them (Harvey, 1997). Relational space can be explained through the use of the Group Areas Act (Oelofse, 2008). The establishment of the Group Areas Act was a fixed planning mechanism that promoted segregation based upon racial orientation during apartheid (Oelofse, 2008). This resulted in different racial groups living in different areas in the city. The spatial organisation of people according to race impacted on social processes and social reproduction. These impacts included the emergence of resistance movements against this Act, as well as the increasing ‘divide’ and polarisation of racial groups as they were not afforded the chance to understand each other due to the spatial and social distance created between the various races. This in turn reinforced social segregation and ultimately forged stronger racist tendencies between communities (Oelofse, 2008).

In this research, the coastal zone as defined by an absolute space, is viewed as a space that has been defined by means of social processes. The defined space of the coastal zone as a ‘thing’ contained within an absolute and fixed space represents a socially constructed and abstract space. This research examines this humanised space, and through the application of the concept of relational space, determines how this space in turn shapes social processes. For example, the coastal zone is defined and contained within an absolute space. The establishment of this abstract space in turn requires management interventions such as the establishment of legislative frameworks and coastal committees. The development of these management interventions represent social processes that have arisen as a consequence of the formal establishment of a defined space – the coastal zone. These relational spaces of management structures are designed to manage and protect coastal resources. However,

these management structures are anchored within the ambit of an absolute space. Two questions arise from this: what other relational spaces are influential to the coastal zone, but which fall outside of the defined physical space, and secondly, what are the implications of having management structures in place, but which cannot act on connected activities that take place outside of an absolute space?

With social processes, the presence of these connections that extend beyond the boundaries of the defined physical space is substantiated by Tuan (1997, cited in Hubbard *et al*, 2004) who suggests that people are not bounded within a world of physical absolute space, but a world of fluidity and connectivity. Similarly, ecological systems do not recognise and are not confined to the presence of artificial boundaries (van den Bergh and Nijkamp 1997; Berkes *et al*, 2003).

This research therefore argues that the use of absolute physical space to create and to define the coastal zone excludes more open and meaningful relational spaces. The significance of these relational spaces is that they should be recognised and included in management prescriptions that focus on the coastal zone, to achieve higher degrees of sustainability.

This section has examined three concepts of space, namely absolute, relative and relational space. The use of the different concepts of space provides a window for exploring and understanding alternative conceptualisations of the coastal zone. Table 1 is a summary of these three concepts of space. Table 1 presents Harvey's definition of space in relation to Lefebvre's triad of space to reveal the complexity of defining space and the relations that construct space. Although this study does not deal with this level of complexity, it is useful to examine how both Harvey (2006) and Lefebvre (cited in Harvey, 2006) reflect on different concepts of space.

Table 1: A general matrix of spatialities

	Material Space (experienced space)	Representations of Space (conceptualised space)	Spaces of Representation (lived space)
Absolute Space	Walls, bridges, doors, stairways, floors, ceilings, streets, buildings, cities mountains, continents, bodies of water, territorial markers, physical boundaries and barriers, gated communities....	Cadastral and administrative maps, Euclidean geometry, landscape description, metaphors of confinement, open space, location, placement and positionality, (command and control relatively easy) – Newton and Descartes	Feeling of contentment around the hearth, sense of security or encarceration from enclosure, sense of power from ownership, command and domination over space.
Relative Space	Circulation and flows of energy, water, air, people, information, money, capital, acceleration and diminution in the friction of distance...	Thematic and topological maps (e.g. London tube system), non-Euclidean geometries and topology, perspective drawings, metaphors of situated knowledge, of motion, of mobility, displacement, acceleration, time-space compression and distanciation, (command and control difficult requiring sophisticated techniques) – Einstein and Rieman.	Anxiety of not getting to class on time, thrill of moving into the unknown, frustration in a traffic jam, tensions or exhilarations of time-space compression, of speed, of motion.
Relational Space	Electromagnetic energy flows and fields, social relations, rental and economic potential, sounds, odors and sensations wafted on the breeze.	Surrealism, existentialism, psychogeographies, cyberspace, metaphors of internalization of forces and powers, (command and control extremely difficult – chaos theory, dialectics, internal relations, quantum mathematics) – Leibniz, Whitehead, Deleuze, Benjamin.	Visions, fantasies, desires, frustrations, memories, dreams, phantasms, psychic states (e.g. agrophobia, vertigo, claustrophobia)

(Source: Harvey, 2006:135)

2.3 SYSTEMS AND SCALE

The numerous definitions of the coastal zone indicate that this ‘zone’ is a dynamic and complex system. For example, the South African Committee for Oceanographic Research defined the coastal zone as “... a system with open boundaries which may include estuaries, onshore areas and offshore areas wherever they form an integral part of the coastal system” (South African Committee for Oceanographic Research, cited in Council for the Environment, 1989:3). McFadden *et al* (2007) describes the coastal zone as a complex system characterised by non-linear processes that operate across different spatial scales. As this research intends to explore the coastal zone within a relative and relational sense, it is appropriate to examine general systems theory and to draw on work by Berkes on social-ecological systems.

According to Berkes *et al* (2003:5) systems theory is concerned with the exploration and explanation of "...wholes and wholeness". Systems theory evolved out of the need to develop scientific principles to assist in our 'struggles' of understanding dynamic systems within which there is a high degree of interacting parts (Ashby, 1963, cited in Harvey, 1969). The strength and necessity of systems theory in developing a more complete understanding of the world is based on the premise that it provides an operational framework from which to enhance our understanding of the degrees of connectedness and the nature of such connections within systems. Systems theory advocates that, to gain an understanding of the world around us, it is necessary not only to understand the properties of parts of a system, but to also gain an understanding of the nature of the relations between those parts (Harvey, 1969). Thus, to enhance our understanding of systems, systems theory proposes the examination of the interrelation of parts, as opposed to the fragmented examination of those parts in isolation (Berkes *et al*, 2003).

This theory is in stark contrast to the western prescriptions of science that took hold from the 17th Century which argued that to gain an understanding of reality, it is necessary to reduce systems to their basic elements. The breakdown of systems into smaller elements is justified by the necessity to generate a detailed analysis thereby improving the understanding of those parts. This approach, otherwise known as reductionism, is firmly grounded in western scientific culture and forms the basis of natural resource management in centralised bureaucracies across the globe (Berkes *et al*, 2003).

Berkes *et al* (2003:5) however argue that our "...understanding comes from the examination of how the parts operate together, and not from the examinations of the parts in isolation". This argument is given further clarity by Von Bertalanffy (1968) who suggests that the specialisation of science has led to the development of disciplines that operate in isolation and is therefore leading to increased levels of detailed analysis. No matter how specific and at what scale that research may take place, each discipline ultimately arrives back at similar explanatory structures as identified by general systems theory (Von Bertalanffy, 1968, cited in Harvey, 1969). As Von Bertalanffy illustrates, a car may be seen as a single element within a traffic system, and is a system in itself (Von Bertalanffy, 1968, cited in Harvey, 1969). Similarly, and in respect of the biological examination of interactions of organs within the human body as a system, a single organ

functions as a system. Within that organ, it is apparent that even a single cell functions as a system in itself. There are, therefore systems within systems (Harvey, 1969).

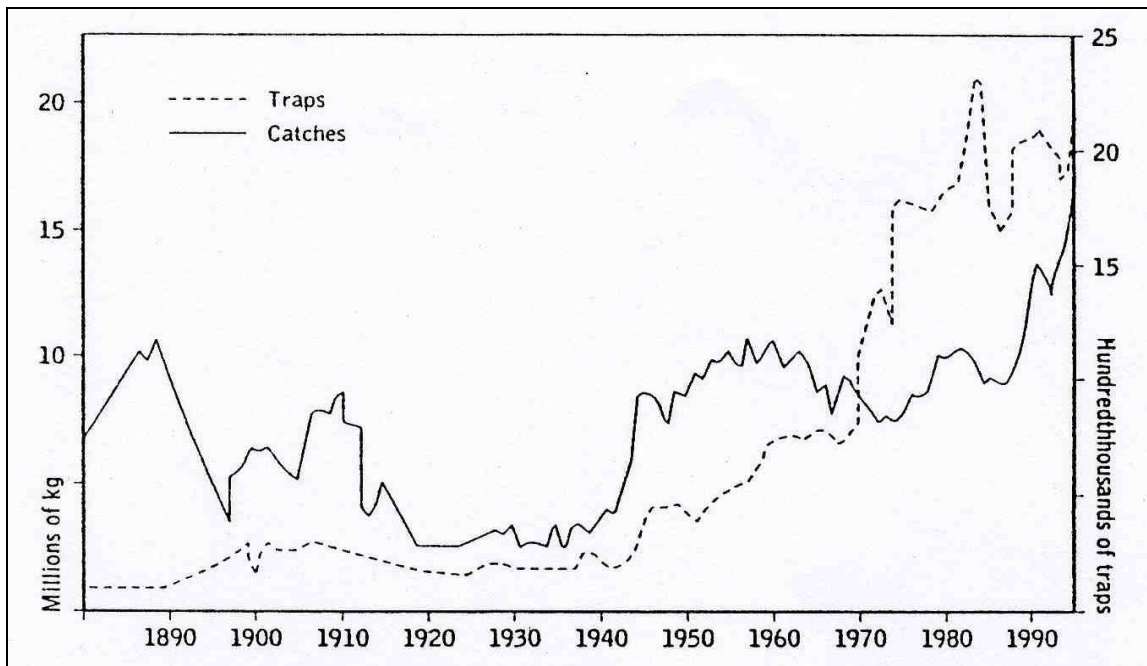
As indicated in section 4.3 of the methodology of this research, systems are made up of objects and the relationships between those objects. Considering the statement that there are systems within systems, the interpretation of an object and the relations between objects is therefore dependent upon the scale at which that system is perceived to be operating (Harvey, 1969). This reveals why different people may perceive the coastal zone (as a system) differently. The definition of the coastal zone depends upon the scale at which people perceive coastal processes to function and hence is shaped by scalar parameters. The question arises as to how and where to set the limits of absolutely orientated definitions and to explore what the implications are of a definition that is based upon a narrow scale? This is significant considering that what is perceived to be a system at one level or scale, may in itself comprise only a component of a system at a broader level or scale and *vice versa*. This may continue *ad infinitum* (Harvey, 1969).

Concepts of scale are not only related to space but also time. According to Berkes *et al* (2003), over the last 40 years both space and time, have been reduced to accommodate our analytical capabilities in an attempt to understand systems. Investigations of systems have either frozen space and experimented over time, or frozen time and investigated space i.e. GIS analysis of spatial patterns (Berkes *et al*, 1998). Thus the multi-dimensional nature of scale in both time and space provides a major obstacle to our analytical and predictive modelling capabilities. These techniques of ‘freezing’ space and experimenting over time, or ‘freezing’ time and investigating space have however been central to conventional natural resource management strategies. According to Acheson *et al* (1998) and Berkes *et al* (1998), attempts at achieving the sustainable management of natural resources are failing as a result of these reductionist methodologies. This is for example reflected in the global decline in fish stocks even though such stocks are being ‘actively managed’ through management prescriptions informed by scientific research (Acheson *et al*, 1998 and Mann Borgese, 2000).

The difficulty that science experiences to accurately predict the functioning of environmental systems is largely due to the analytical inability of science to obtain extensive and high-resolution data across necessary temporal and spatial scales

simultaneously. This is exacerbated by the notion that systems operate at larger scales with complex relationships and feedback mechanisms that are not yet clearly understood (Acheson *et al*, 1998 and Mann Borgese, 2000). The numerically based nature of conventional stock/recruitment models, according to Acheson *et al* (1998:408) "...plays down the importance of habitat or other ecological factors which are critically important to preserve the system in the long run". Similarly, "the objective of numerical management is to control mortality on target species with no attention to the environment" (Acheson *et al*, 1998:408). According to Acheson *et al* (1998), this is the fatal flaw within stock/recruitment modelling techniques. An example of the limitations of numerically-based models and their inability to cater for systems that function at broad scales is evident in the fish stocks within the Baltic Sea. According to Jansson and Velner, (1995, cited in Berkes *et al*, 2003), fish stock recruitment patterns share links with, and are dependent upon, weather systems in the north Atlantic. Methods of stock/recruitment models (due to their limitations), however, do not extend beyond the spatial scale of the numerical and biological analysis of those fisheries within the Baltic Sea. As such the value of predictive capacity is severely restricted by the scale at which systems analysis is undertaken. Similarly this applies to the management of the coastal zone where management of coastal resources is guided by the 'position' of the coastal zone. The position of the coastal zone is guided by physically determined boundaries. For example, the ICM Act defines the landward limit of the coastal zone as being no greater 1000m from the high water mark (HWM) (DEAT, 2007). Processes that have impacts on the defined coastal zone may however originate from outside of this defined zone.

A more detailed example that highlights systems' complexity is provided by the lobster fishery of Maine, U.S.A. Since the early 1880's, and as indicated by Figure 4, lobster catches have varied significantly (Acheson *et al*, 1998). According to Acheson *et al* (1998), variations in lobster catch rates cannot be substantiated by, or attributed to, changes in regulations regarding the harvesting of lobsters. Neither can these variations be explained by biologist or fisher hypotheses that provide explanations of predation by large ground fish, legal enforcements and fluctuations in food supply. Similarly, and as commonly thought, large scale fluctuations in catch rates cannot, in this case, be linked to trapping effort. Although trapping effort remained relatively constant prior to and during 1920's and 1930's, a significant decline in catch rates of lobster was still experienced between 1910 and 1940.



(Source: Acheson *et al*, 1998)

Figure 4: Catch and effort data for the Maine lobster industry.

This decline in lobster population cannot therefore be related to trapping pressure especially considering the relatively simplistic and inefficient gear used during that time. With this evidence, fisheries scientists predicted that with a significant increase in trapping effort, as evident from the 1940's, there would be a reduction in parent stock. The reduction of mature lobsters equates to fewer eggs in the water, resulting in less successful recruitment and ultimately to a further decline in lobster populations and thus catch rates. As indicated by Figure 4 this predicted decline did not take place.

Acheson *et al* (1998) suggest that lobster catch rates and the associated fluctuations of lobster populations are implicated in a more complex and broader scaled system. The complexity in this case centres on relationships between abiotic environmental parameters and the social dynamics of the Maine fishing community. With reference to abiotic parameters, lobster abundance is regulated by temperature regimes that influence the settlement strength of lobster larvae (Wahle and Steneck, 1992, cited in Acheson *et al*, 1998). Successful larval settlement is dependent upon and triggered by a thermal threshold where temperatures need to exceed 15°C (Boudrea, *et al*, 1992, cited in Acheson *et al*, 1998). As it takes between seven and ten years for a lobster to reach maturity and thus enter the fishery, the size of the population entering into the fishery is dependent on the warmth of the summer seven to ten years prior to being recruited into the fishery.

Regression analysis suggests that this theory only partly explains fluctuations of lobster catch rates. Further examination however indicates that population densities, and their association with temperature thresholds, become interlinked with trends in social discourses and practices of conservation ethics. It is important to note the distinction between conservation ethics and the enforcement of legal regulations. While regulations were put in place in the 1920's and 1930's to control harvesting of lobster, these regulations were widely violated. Conversely, the presence of a conservation ethic is defined by the willingness of trappers to voluntarily regulate lobster harvesting based on certain guidelines.

The conservation ethic within the Maine fishery has gained momentum over the past 70 years. It is argued by Acheson *et al* (1998) that the degree of conservation ethic has positive impacts on lobster populations and therefore lobster catch rates. The interconnection between the biophysical parameters of temperature thresholds is represented by the smaller undulations within the general increase of lobster catch rates over the last 70 years. However, even with the limited accuracy of stock/recruitment models from which predictions of fishing effort and catch rates were made, these reductionist techniques and models still form the basis from which scientific investigations and management prescriptions are formulated (Acheson *et al*, 1998).

From this example it is evident that concepts of scale become implicated in the complex interaction of temporal and spatial linkages not only within ecological systems, but within social systems as well. Scale is thus an important concept in understanding the functionality of complex systems. This has critical implications for management prescriptions surrounding natural resources. It is an important concept in this research which focuses on the nature of relations within coastal systems where such systems are conceptualised as being contained in a physical space defined by legislation. This is especially significant in the context of climate change and the increasing human influence on natural systems where the span of connections is intensifying across scale in both time and space. According to Berkes *et al* (1998:355):

“Biogeochemical and hydrological flows are being transformed on the global level. National environmental problems more and more frequently have their source not only at home but also half a world away, witness greenhouse gas accumulations, ozone hole, AIDS, deterioration of

biodiversity. Natural planetary processes mediating these issues are coupling with the human, economic and trade linkages that have evolved exponentially among nations since World War II”.

It is therefore becoming essential for scientific research to adopt multidisciplinary and cross-scale approaches to investigate, understand and manage the world around us (Berkes *et al* (1998). Additionally it is necessary to analyse and manage systems simultaneously across differing scales (Berkes *et al*, 2003). This research intends to make a contribution to this management by generating an understanding of the complexity of coastal systems and thereby arguing for the need to explore and implement alternative management approaches that recognise and cater for this complexity. As a result, this literature review now turns towards an analysis of management approaches as mechanisms that may either enable or inhibit the ability to manage complex systems.

2.4 MANAGEMENT APPROACHES

This section explores the implications of different management approaches for sustainable practice. It specifically focuses on two approaches namely that of command and control as the contemporary mainstream approach, and adaptive management as an alternative.

2.4.1 Command and control

Holling and Meffe (1996: 329) state that control:

“...is a deeply entrenched aspect of contemporary human societies: we control human behaviour through laws, incentives, threats, contracts, and agreements; we control the effects of environmental variation by constructing safe dwellings, we control variation in our food resources by growing and storing agricultural products; we control human parasites and pathogens through good hygiene and medical technologies”.

This approach towards solving problems, according to Holling and Meffe (1996), is known as ‘command and control’.

The necessity of command and control as a management approach is a product of the gradual development and dependence upon socially constructed norms and expectations through our interactions with nature (Holling and Meffe, 1996). With our growing dependency upon these norms, and as a reflection of our need to avoid threats through predictability, society has developed mechanisms of short-term incentives and controls in an attempt to maintain and harness these norms and expectations (Holling and Meffe, 1996). Thus, when the parameters of these norms are breached, either by means of human behaviour or environmental fluctuations, command and control as a management approach is used as the most effective mechanism to contain such deviations to a more predetermined and predictable state. The same mechanism with the same intent is applied to the management of natural resources to encourage efficiency and maximum productivity to meet human needs (Berkes *et al*, 1998). As such, and in an attempt to avoid surprises and crises, mainstream resource management techniques are geared towards reducing the scope of variation within ecological systems to harness our exploitive potential over natural resources on a short-term basis (Holling and Meffe, 1996).

It is argued by Holling and Meffe (1996) that through the reduction and control of variation within systems, resilience within those systems is lost. The loss of resilience within systems spells greater susceptibility to environmental crises (Holling and Meffe, 1996, cited in Berkes *et al*, 1998). Resilience in this context is discussed in more detail in section 4.1.2. The loss of systems resilience, according to Holling (1986, quoted in Holling and Meffe, 1996:330) results in what is called the “pathology of natural resource management”. Several examples of a loss of resilience through command and control management approaches are highlighted by Holling and Meffe (1996).

According to Holling and Meffe (1996) the practice of monoculture represents the epitome of the reduction of variation and the subsequent loss of resilience. This is reflected in the susceptibility of monocultures to drought, flooding, intense fires, insect or pathogen outbreaks and market vagaries. In response, they require large amounts of energy inputs in the form of fertilisers, pesticides and irrigation. Monocultures also require societal subsidies such as disaster relief and price supports. As such, monocultures are inherently un-resilient towards natural or societal fluctuations.

Fire suppression is used in fire-prone ecosystems such as national parks (as was in the case of the United States) as well as suburban regions. This suppression, through the years, allows the build up of fuel to such an extent that when a fire does take place, it is of such a magnitude and intensity that widespread damage, economic loss and permanent systems change results. Fires that would naturally take place on a more frequent basis are not only less intense, but they prevent the build up of fuel that would otherwise, when eventually ignited, cause great damage. Again, this serves to indicate that suppression or removal of natural fluctuations results in a loss of systems resilience.

Canalisation is used to contain the lateral flow variation of river systems. This restriction of flow variation creates 'room' to allow development to take place within flood plains. However, during extreme storm events, as witnessed in the Mississippi River flooding of 1993, social and ecological systems within the floodplain displayed very little resilience towards coping with such perturbations. Thus, in an attempt at reducing natural variations through command and control, systems resilience to these fluctuations is greatly reduced, and in the case of the Mississippi River floodplain, unprecedented economic expenses were incurred.

As Berkes *et al* (1998) states, the approach of command and control is strongly related to positivist resource management science. Prescriptions of command and control are based upon linear models and mechanistic views of nature. The approach of command and control assumes that problems are one dimensional in nature, do not cut across scale temporally or spatially and are generally linear in nature in both cause and effect (Holling and Meffe, 1996). However, and as elaborated within this literature review regarding the complexity of systems, an approach that assumes a predictable outcome, but which the *a priori* assumption of certainty is not met, has severe negative socio-economic and environmental implications (Holling and Meffe, 1996). These implications may take the form of environmental crises, such as flooding from storm surge events in heavily populated coastal regions, devastating fires, insect population booms and loss of biodiversity due to monoculture, erosion from grazing etc. Holling and Meffe (1996) suggest that in the field of natural resource management, such crises become unavoidable consequences under the approach of command and control. This, they argue, is primarily due to the belief that:

“...humans can select one component of a self sustainable natural system and change it to a fundamentally different configuration in which the adjusted system remains in that new configuration indefinitely without other, related changes in the larger system” (Holling, 1986, cited in Holling and Meffe, 1996:330).

These concepts are critical to this research as changing the configuration of a sustainable natural system equates to imposing absolutely determined boundaries around only a partial component of what is a broader system. In this case the partial component is a result of the linear determination of the coastal zone by means of absolute spatial parameters. Natural processes that share clear linkages with the determined coastal zone do not recognise such abstract boundaries. The confinement of legislation to these boundaries effectively tears out and discounts all the interactions that take place between the coastal zone defined as an absolute space and the larger system.

The loss of resilience through command and control prescriptions may be triggered in a variety of ways. Holling and Meffe (1996) suggest that the inflexibility of bureaucratic systems is such an example. Bureaucracies are there to discourage extreme behaviour and to promote conformity to more desired standards. It is acknowledged that although this may be desirable to some degree within civilised modern society, some bureaucracies have become so rigid that they are unable to display innovative responses when presented with anything outside of the norm (Holling and Meffe, 1996). Thus, a loss of resilience may not only apply to natural systems, but also towards institutional and governance systems as well.

Holling and Meffe (1996) identify a sequence of events that lead to institutional rigidity through command and control and ultimately the loss of resilience within social-ecological systems. These sequences are identified as follows:

- 1) The initial step of research and monitoring.
- 2) Implementations of management recommendations based upon information generated from research and monitoring.
- 3) The success of these management prescriptions. This success results in a shift of focus from the original social and economic responsibilities towards maintaining this success to the improvement of efficiency and reduction of costs. Thus,

priorities are redirected from research and monitoring towards internal agendas of cost efficiency and ultimately the survival of the institution. This results in a “...growing isolation of agency personnel from the system being managed and insensitivity to public signals of concern – in short, growing institutional myopia and rigidity” (Holling and Meffe, 1996:331). This is the first phase of the ‘pathology of command and control’.

- 4) Simultaneously, economic activities that benefit from resource exploitation are able to expand and as such there is capital re-investment into those activities. This results in an increased dependence upon the successful control of natural systems that provides an enabling environment for that growth. It is during this stage that the natural variation of systems begin to become restricted. This restriction in turn leads to a loss of resilience and therefore an increase in exposure to susceptibility and crises.
- 5) The dependency upon the successful control of natural systems, and in the interest of expanding economic gains, creates pressure for more command and control mechanisms. This is the final phase of the pathology of command and control that results in “...increasingly less resilient and more vulnerable ecosystems, more myopic and rigid institutions and more dependant and selfish economic interests all attempting to maintain short-term success” (Holling and Meffe, 1996:331).

The pathology of this management approach arises, according to Berkes *et al* (1998) and Holling and Meffe (1996) in part upon the basis from which our initial knowledge and understanding is generated: via reductionist methodologies of western scientific practice. The solution towards avoiding the negative consequences of command and control approaches, is to enhance our understanding of all aspects of social and ecological systems, most notably functioning, interrelations and dynamics of these systems at an all inclusive spatial and temporal scale: from ‘plants to the planet’ and ‘seconds to millennia’ (Holling and Meffe, 1996). Considering the limitations with which we are bound in terms western scientific analytical capabilities, this is unrealistic: “ecosystems are moving targets, with multiple potential futures that are uncertain and unpredictable. Therefore management has to be flexible, adaptive and experimental at scales compatible with the scales of critical ecosystems functions” (Holling, 1978; Walters, 1986; Lee, 1993 and Gunderson *et al*, 1995, cited in Holling and Meffe, 1996:332).

The role of the concept of space is also important here. As discussed previously, it was argued that it is:

“...inappropriate to employ spatially-based management approaches over natural resources, unless natural resources, and those environmental factors that govern the availability of those resources, are predictable and function within fixed spatial parameters” (Leach and Kitchingman, 2005).

This is not the case, especially within coastal regions. Coastal regions are recognised for their provision of critical environmental resources and hence there is increasing emphasis on developing and strengthening legislation designated to the protection of these resources. Conventionally, the strength of this legislation is dependent upon absolute boundaries that determine the ‘position’ of the coastal zone. Legislation and the associated management prescriptions are therefore applicable within that absolute and reduced space. This study explores the value of promoting management approaches that recognise broader relational spaces and as such “...become compatible with the scales of critical ecosystems functions” (Holling, 1978; Walters, 1986; Lee, 1993 and Gunderson *et al*, 1995, cited in Holling and Meffe, 1996:332).

Considering the critique of command and control and the role that concepts of space play in promoting a more holistic understanding of ecological systems, it is appropriate to explore alternative approaches towards the management of these systems: management approaches that are shaped by ecosystem dynamics, as opposed to management approaches that shape and attempt to control ecological processes.

2.4.2 Adaptive management

This section sets out to explore adaptive management as an alternative approach to command and control. In terms of the methods that are used to develop an understanding of systems, mainstream approaches of western scientific practice direct attention to understanding only fragments of a system. Such an approach “...deals with experiments that narrow uncertainty to the point of acceptance by peers; it is conservative and unambiguous by being incomplete and fragmentary” (Berkes *et al*, 2003:40). Through this reductionist approach, it is assumed that problems are linear in nature and may therefore be

solved by the application of linear models. The converse approach of adaptive management takes on a more dynamic and holistic perspective that enables researchers to identify and understand simple, but cross scale structures and relationships through time and space. As such, a more complete understanding of complex systems is achieved (Johnson, 1999). The approach of adaptive management recognises that not only does our understanding of ecosystems change, but that ecosystems also change within themselves. Adaptive management therefore encourages the co-evolution between management prescriptions and environmental fluctuations (Holling 1978; Walters, 1986, cited in Berkes *et al*, 2003; Glavovic and Boonzaier 2007). A description of adaptive management, according to Johnson (1999:2) and on behalf of the United States Geological Survey, is given as follows:

“Adaptive management tries to incorporate the views and knowledge of all interested parties. It accepts the fact that management must proceed even if we do not have all the information we would like, or we are not sure what all the effects of management might be. It views management not only as a way to achieve objectives, but also as a process for probing to learn more about the resources or system being managed. Thus, learning is an inherent objective of adaptive management. As we learn more, we can adapt our policies to improve management success and to be more responsive to future conditions”.

Figure 5 provides a graphic representation of the iterative and co-evolving nature of adaptive management.

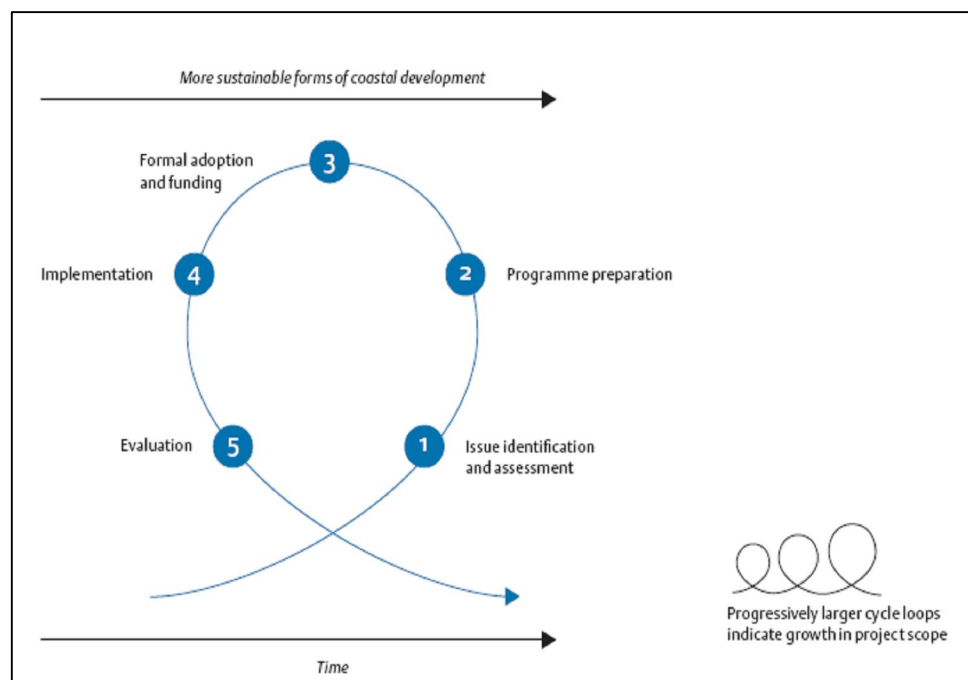


Figure 5:
The adaptive management cycle.
(Source: GESAMP, 2006)

The management cycles consists of five phases, which are repeated every time the fifth phase is completed. The first phase consists of the identification of issues through research and monitoring, which in this context relates to coastal management. Once these issues have been identified, the second phase follows whereby a course of action is formulated to address these issues. This course of action, the third phase, is then funded and formally adopted by stakeholders, managers and political leaders that have the responsibility of creating an enabling framework from which to drive the necessary changes (Olsen *et al*, 2006). The fourth phase consists of the implementation of the programme of action which is then followed by the fifth phase of evaluation in terms of success and failure of these implementations, thus completing a management cycle 'generation'. As indicated by the expanding loops of Figure 5, each management generation, as it gains strength and knowledge, expands towards addressing issues that were either not identified in the previous generation or those that were not considered a priority at the time of the previous cycle (Olsen *et al*, 2006).

The adaptive management cycle emphasizes learning-by-doing. The importance of 'keeping in touch' with ecosystems dynamics is substantiated by the idea that what is learnt about ecological systems in one decade may not be applicable to the next (Hilborn and Ludwig, 1993; Holling and Meffe, 1996; Berkes *et al*, 2003). This is critical for the determination of what 'sustainable' and 'unsustainable' means towards predicting maximum sustained yields of natural resources. It is also critical for enhancing our ability to maintain resilient systems.

This approach of adaptive management differs from the conventional approach of command and control by emphasising the importance of obtaining feedback from the environment. This feedback, which is generated through each 'management generation', is used to shape relevant policies. These policies, to keep in line with systems changes, are re-aligned based upon the prescriptions generated for each new generation (Berkes *et al*, 2003). Through encouraging a two-way feedback between management prescriptions and the state of the environment, a co-evolutionary process is achieved.

There are however many questions regarding the success of adaptive management. Firstly, the question arises as to whether scientists and policy makers are able to design research programmes that are able to learn about natural systems faster than the rate of change of

those systems (Hilborn and Ludwig, 1993). Similarly, and as stated by Celliers *et al* (2008), ecological and societal change may out-perform the implementation horizon of policy and legislative prescriptions in addressing those original concerns. Additionally and as Walters (1997, cited in Johnson, 1999) suggests, management cycles generally do not progress beyond the evaluation phase, and as such, there are no co-evolutionary management generations. This links directly into what Holling and Meffe (1996) call the first phase of the ‘pathology of command and control’. As described by Johnson (1999:5) the first generation does not progress beyond the evaluation phase as there is “...either intransigence by powerful stakeholders (including agencies) or the unwillingness of stakeholders to accept the risk of short term losses that might occur under experimental management”. Thus, until uncertainty is embraced and management institutions systematically learn from their actions, the co-evolutionary intent of adaptive management will not be achieved, but rather it will be redefined as a weak form of ‘flexibility in decision making’ (Gunderson, 1999, cited in Berkes *et al*, 2003).

Provided that this ‘pathology’ does not arise within adaptive management, this research argues that adaptive management enables a more holistic understanding of systems functioning. It is with this management approach that the coastal boundaries and associated zonations that inform and guide legislative frameworks can be re-conceptualised or re-aligned to accommodate coastal ecosystems complexity.

2.5 LINKING SOCIAL AND ECOLOGICAL SYSTEMS

A relatively new body of theory has emerged which attempts to link social and ecological systems. It is based on a critique that society, particularly western society, is functionally independent of ecological systems. According to the proponents of this theory⁸, and in order to achieve higher degrees of sustainable practice, it is acknowledged that the pursuit of social and economic ideals are inherently enmeshed within, and dependent upon, the healthy functioning of ecological systems (Philo and Wilbert, 2000; Folke *et al*, 2002). Indeed, as Berkes *et al* (1998:4) state “...social and ecological systems are in fact linked,

⁸ This theory is relatively new and is represented by two main sources. That of *Linking Social and Ecological Systems: Management practices and social mechanisms for building resilience* (1998) and *Navigating Social Ecological Systems: Building Resilience for Complexity and Change* (2003) by Fikret Berkes, Carl Folke and Johan Colding. As such, references to this theory are restricted to the authors of these sources.

and that delineation between social and natural systems is artificial and arbitrary”. Social and ecological systems are seen as a singular system; however this ‘delineation’ has arisen as a result of a number of factors.

According to Berkes *et al* (1998), scientists, in their quest to understand the world, have examined social and ecological systems in isolation. This, as discussed previously, falls within the western practice of reductionism whereby scientists are of the belief that complex phenomena can become known through “...reducing them to their basic building blocks and identifying the mechanisms by which parts of the machine interact” (Berkes *et al*, 1998:344). To date, very little attention has been directed towards adopting an interdisciplinary approach of investigating the interaction between social and ecological systems as a system in itself (Berkes *et al*, 1998). This research investigates the role of space and how the application of concepts of space may encourage an understanding of the connection between social and ecological systems. What are the implications of the presence of the coastal zone as an ‘artificial’ space in an attempt to re-establish links between social and ecological systems?

Our detachment from ecological systems is given further impetus considering that conventional western scientific investigations towards resource management are embedded within utilitarian and exploitive worldviews and that this implies society’s dominium over nature (Berkes *et al*, 1998). The Western approach to acquiring scientific knowledge, as a universal epistemology, has therefore naturalised a western value system. This in turn has resulted in the generation of institutional pathologies of western ‘environmental managerialism’ which are founded on positivistic prescriptions (Berkes *et al*, 1998; Colenbrander, 2006). Management prescriptions formulated from spatially fixed and often reduced scales therefore have implications for our ability to address more complex, multi scalar problems (Berkes *et al*, 1998; Colenbrander, 2006). This research explores the implications of containing the coastal zone within a fixed and absolute space (through legally defining it) where management prescriptions are anchored to this space, but where this ‘contained’ and ‘confined’ space is assumed to form part of a much broader, open system.

2.5.1 The need for linking social and ecological systems

Given the above arguments this section aims to explain why it is important to link social and ecological systems. The sustainable utilisation of natural resources and resilience are discussed below as they are key reasons given for supporting such an approach.

Sustainable utilisation of natural resources

Conventional resource management prescriptions are failing to achieve the necessary levels of sustainability (Holling and Meffe, 1996; Johnson, 1999; Berkes *et al*, 1998 and 2003). The very use of the term 'resource' reflects the perception of life support systems as mere commodities (Berkes *et al*, 1998). These commodities, which are constructs created from reductionist resource management techniques, are not considered as integral components of larger systems. 'Sustainability' and 'maximum sustainable yield', in terms of resource extraction, have traditionally been determined based upon reductionist orientated methodologies (Berkes *et al*, 1998). This non-systems orientated approach also excludes the influence of social systems on ecological systems. Considering that social systems are dependent upon ecological systems as life support systems, and are thus inherently linked to those systems, the exclusion of the influence of social systems from calculating sustainable harvests can only but yield skewed prescriptions of what is deemed as 'sustainable'. Yet, according to Berkes *et al* (1998:345), to achieve value free, quantitative and precise data, "scientific disciplines are often cocooned; scientific purity is assured by the assiduous avoidance of societal issues".

As social and ecological systems are bound together as a single system characterised by critical feedbacks across spatial and temporal scales, an interdisciplinary and integrated approach is needed for developing a more holistic understanding of what constitutes reality, and what is necessary to pave the way forward to higher degrees of sustainability (Berkes *et al*, 1998). This research examines the idea of coastal zones as complex social-ecological systems but the delineation of such systems by absolute spatial boundaries, through the creation of this social construct, reduces the potential to prescribe more holistically orientated management interventions (Berkes *et al*, 1998). The importance of understanding social and ecological systems as a single integrated system not only becomes implicated in determining realistic and sustained yields, but such knowledge is

essential at higher levels of policy formulation necessary to drive such change (Berkes *et al*, 1998).

Resilience

Holling and Meffe (1996) and Berkes *et al* (2003) argue that, through linking social and ecological systems, the ability to establish higher degrees of resilience within those systems is enhanced. Resilience in this context may be defined as "...the buffer capacity or the ability of a system to absorb perturbations; the magnitude of disturbance that can be absorbed before a system changes its structure by changing the variables and processes that control behaviour" (Berkes *et al*, 1998:6). The importance of encouraging resilience within social-ecological systems becomes apparent considering that managing the unmanageable cannot be avoided (Thompson, 1983, cited in Berkes *et al*, 1998). This unavoidability stems from an impartial understanding of the functionality and complexity of larger systems and as such results in surprises and crises having to be dealt with (Hilborn and Ludwig, 1993; Holling and Meffe, 1996; Berkes *et al*, 1998). The necessity of such an approach is realised when the increasing aggravation of environmental perturbations caused by anthropogenically induced trans-boundary phenomena such as climate change and sea level rise are considered. As Holling and Meffe (1996) indicate, such phenomena and the associated effects are not likely to occur on a predictable basis. The need to develop systems resilience is therefore becoming more and more imperative in buffering social-ecological systems against such perturbations. It is the establishment of this resilience that affords and allows for a margin of error in prescriptions for resource management. Such measures may also have far reaching consequences for socio-economic growth and stability.

In order to identify how resilience of systems may be encouraged, it is perhaps more appropriate to begin a discussion on how resilience may be lost. According to Berkes *et al* (1998), western prescriptions of resource management are typically constrained to a narrow range of scales or are completely scale independent, both temporally and spatially. With respect to the dynamics of systems, and in relation to temporal and spatial scales, Berkes *et al* (1998) indicate that there are feedback mechanisms between periods of gradual and rapid transformations within systems and that these transformations both coexist and compliment each other. In western management prescriptions, those

transformations that exhibit gradual change are supported whereas those that exhibit rapid changes are seen as disturbances that need to be controlled and ultimately removed from systems functioning. The removal of such fluctuations is an attempt to streamline the achievement of production goals (Berkes *et al*, 2003). According to Berkes *et al* (2003:38) “such strategy has dominated the development of modern industrial society during the last decades, and still does, not recognising that it exacerbates cross-scale interactions that challenge ecological thresholds on regional and even global levels”. This approach, as a direct form of the ‘pathology of command and control’, results in a loss of resilience through the reduction of systems variation and ultimately leads to greater degrees of vulnerability (Hilborn and Ludwig, 1993; Holling and Meffe 1996; Berkes *et al*, 2003).

Systems resilience is therefore dependent upon the degree of variation that may take place within the functioning of that system. Berkes *et al* (1998) indicates that the goal of natural resource management is to maintain a critical balance between allowing disturbances to take place, but at a scale which does not impact negatively upon the productivity of the ecosystem and the associated services it provides. In the utilisation of resources, management approaches become strongly implicated in the degrees of resilience that a system may exhibit. As Holling and Meffe (1996:330) suggest:

“...a system in which natural levels of variation have been reduced through command-and-control activities will be less resilient than an unaltered system when subsequently faced with external perturbations, either of natural (storms, fires, floods) or human induced (social or institutional) origin. We believe that this principle applies beyond ecosystems and is particularly relevant at the intersection of ecological, social and economic systems”.

Adaptive management is strongly implicated in maintaining and encouraging resilience within systems. As adaptive management seeks to learn-by-doing, there is a perpetual realignment of management prescriptions with natural systems fluctuations. This research explores the potential of adaptive management in the context of coastal social-ecological systems. The potential of adaptive management is seen in its ability to identify or at least acknowledge variation that takes place within systems. The increased ‘understanding’ of systems may lead to more informed decisions, particularly with regard to how to define coastal zones. This has significant implications considering that coastal legislation is anchored to definitions embedded in the concept of physical absolute space. The alignment

of legislative guidelines (and the process by which they are formulated) to natural systems dynamics will result in higher degrees of resilience and ultimately more sustainable practice (Holling and Meffe, 1996).

2.6 CONCLUDING REMARKS

This literature review has examined and critiqued a variety of theoretical concepts that have been integrated to form a theoretical framework for understanding the complexity of systems and in this case the coastal zone. These are concepts of space, management approach of command and control and adaptive management and the theory of linking social and ecological systems. Concepts of space, and more specifically relational notions of space, become implicated within the concept and context of systems theory. Through the analysis of the concepts of relative and relational space, the complexity of relations between society, space and the environment becomes evident. Relations between objects and/or processes do not take place on a one-dimensional plain, but move across different scales in both time and space. As systems are concerned with 'wholes' and 'wholeness' the use and application of the concept of relative and relational space compliments our ability to gain a more holistic understanding of the functionality of systems. This enhanced understanding generated through the application of concepts of space provides the foundation from which to explore more appropriate management approaches. It is argued the most sensible manner with which to manage such complex systems and uncertainty is through adaptive management. Adaptive management encourages a 'co-evolutionary' approach between what is prescribed by policy and management recommendations and socio-economic and environmental systems change.

This literature review also explores the relations between social and ecological systems, and reflects on the implications of a society that has alienated itself from ecological systems. It argues that social systems are inherently linked to ecological systems. This is substantiated through the notion that livelihoods are dependent upon the healthy functioning of ecosystems and the subsequent services that they provide as life support systems. Similarly, the ability of ecosystem services to act as life support systems is dependent upon the nature of human actions. The need for a theoretical approach that links society to ecological systems is given an air of urgency when several indicators are

considered: attempts at resource management are yielding un-sustainable outcomes, society's ability to cope with environmental perturbations is becoming increasingly less effective, and economic systems, as a reflection of these imbalances, are displaying increasingly volatile traits.

This literature review has drawn from a variety of bodies of theory. These diverse theoretical ideas have been connected together through the core concept, namely the theory of space. The theory of space does not only enhance our ability to understand biophysical processes within systems, but, and perhaps more importantly, it provides an enabling framework from which to expand our understanding of larger, more complex social-ecological systems. This knowledge is important to re-establish linkages between social and ecological systems. Such research is imperative in its intent considering the complex and dynamic nature of coastal systems and the increasing pressures that social-ecological systems are being subjected to within such regions.

CHAPTER 3: THE MANAGEMENT OF COASTAL ZONES

3.1 INTRODUCTION

This contextual chapter provides an account of the history and evolution of coastal zone management, both internationally and in South Africa. The chapter begins with an overview of coastal zones within a legal context, and the rights and responsibilities over the use of coastal resources (Section 3.2). The chapter then focuses on the evolution of coastal management in South Africa and describes the various approaches and changes to coastal management (Section 3.3). This is followed by an overview of legislation that is applicable to the management of the coastal zone (Section 3.4). Finally, and central to the focus of this chapter, is the presentation of various examples of definitions of the coastal zone (Section 3.5). By exploring the differences in the way in which coastal zones are conceptualised in relation to each definition, awareness is generated of how and why the term ‘coastal zone’ is a relative and relational concept.

3.2 HISTORIC AND LEGAL BACKGROUND

South Africa’s coastal legal framework of defining coastal property boundaries and the determination of public and private rights to the sea shore is founded upon principles established by English common law and early Roman law. Roman law established that the sea and sea shore was *res omnium communes*, meaning that coastal areas were open to the enjoyment of all, and that such areas must not be alienated from the public as a result of private appropriation (Glazewski, 2005). In the case where private ownership was allowed, it was typically restricted to the littoral zone, but only so far as the reach of the highest seas (Maloney and Ausness, 1974, cited in Schwartz, 2005). The notion of coastal areas as being *res omnium communes* was modified by Roman-Dutch law whereby it became *res publicae*: government agencies become custodians over coastal regions on behalf of, and for the enjoyment of, the public (Clark, 1996; Glazewski, 2005). In contrast, early English law made provision for the granting of private and exclusive ownership of rights to lords over fisheries in tidal areas (Schwartz, 2005). The English law however gradually evolved to a state where the Crown had *prima facie* title to, and the public had certain rights to, tidal areas as well as navigable rivers (Schwartz, 2005). The rights of the public to coastal

zones therefore became similar to the early Roman law of public rights to the sea shore (Schwartz, 2005). The legacy of the early principles surrounding coastal areas as public property is reflected in South Africa's own legal context, where the ownership of the sea and the sea shore is vested in the State President (Mather, 2007; Kidd, 2008).

Under English common law, and to distinguish between what was owned by the sovereignty and what was privately owned in the littoral zone, the term 'ordinary high water mark' was used to describe the property boundary. The English High Court, in 1854, defined the 'ordinary high water mark' as: "the line of the medium high tides between the spring and neaps, excluding both the neap and spring tides" (Schwartz, 2005: 248). Prior to the escalation of coastal property values in the 20th century, the position of this boundary was based only upon an approximation (Schwartz, 2005). Since the escalation in property values and the demand for property in the coastal zone, various scientific techniques have been employed to spatially demarcate this boundary. One of the well-established techniques involves two engineering components: firstly, a vertical boundary is determined based upon the height of a tide. This height or level constitutes a tidal datum which may otherwise be represented by the mean HWM (Shalowitz, 1963, cited in Schwartz, 2005). The second being a horizontal one, where the tidal datum intersects the shore, forming the HWM line (Shalowitz, 1963, cited in Schwartz, 2005). This technique is based upon a more scientific and technically sound procedure that has provided an enabling framework from which to legally define coastal boundaries according to the HWM. This has led to the development of coastal legislation and the associated rules attached to these boundaries (Schwartz, 2005). The coastal zone has therefore been demarcated in relation to public and private property rights based on the position of the HWM. More recent, and perhaps more technologically advanced techniques, of defining coastal boundaries include biological interpretation through remote sensing and photogrammetric analysis of aerial photographs (Schwartz, 2005).

Coastal regions have been subject to a variety of management approaches. These approaches, and the subsequent phases in management prescriptions, have been influenced by the prevailing social attitudes towards the natural environment held at the time each approach was created (Schwartz, 2005; Glavovic, 2006). According to Schwartz (2005) and Glavovic (2006), during the 19th century the natural environment was seen as a resource to be exploited, managed and controlled. However, since the 1970's, there have

been some important shifts in social consciousness that have had far reaching consequences for the manner in which coastal regions, and the natural environment at large, have been perceived, utilized and managed. The following passage quoted from Schwartz (2005: 313) gives a brief insight into this shift:

“During the 1970s, there was a general worldwide increase in environmental awareness, both in official sectors, such as government and planning, but also within the general public. This was very much a transitory phase for coastal management, because while people became more concerned for environmental welfare and protection, civil engineering still pervaded as the generally accepted solution to coastal problems and the general worldwide increase in disposable wealth in the developed nations increased the demand for, and subsequent development of, coastal tourism. The result of this was the continued development of the world’s coastlines, which thus allowed the continuation of many of the impacts associated with erosion, sediment starvation, and user conflict. By the 1990s, the development of environmental awareness and understanding had progressed sufficiently to produce a switch to greater emphasis on the preservation of natural processes and restoration of habitats. The result of this has been the increased acceptance of soft defence techniques, such as beach feeding and managed realignment or even abandonment of defences, over the construction of solid structures”.

Although this gives an indication of the shifts in environmental awareness and management approaches, the only result of such shifts is given in the description of the change in tactics in terms physical engineering prescriptions. The following section gives a broader account of the trends and evolution of management prescriptions and discourses specific to the South African context.

3.3 TRENDS IN COASTAL MANAGEMENT IN SOUTH AFRICA

Until recently, management of coastal areas in South Africa has been characterized by a predominantly biophysical and bureaucratic style (Glavovic, 2006). According to Glavovic (2006), four distinct eras in coastal management can be distinguished from the last three decades in South Africa. These include the following:

- 1) *Ad hoc sector-based management of the 1970’s*: Although environmental awareness of coastal regions began to grow, as represented by the establishment of

the National Coastal Management Division within the Department of Planning and Environment, management prescriptions were conducted in isolation by a wide range of agencies that did not take cognizance of the interrelated nature and complexities of coastal systems.

- 2) *Coastal zone management regulations, ecology and experts of the 1980's*: During this period, coastal management focused on regulating physical development within coastal areas. This regulation was guided primarily by land use zonations that identified protected areas, intensive use areas, high risk areas due to coastal processes, and recreational areas. The regulation of development was driven by the Department of Environmental Affairs.
- 3) *Participatory policy formulation of the 1990's*: Although it was realized that much progress had been made in coastal management up until the 1990's, it was acknowledged that coastal management did not consider, or at least avoided the impacts of apartheid within coastal regions. According to Glavovic (2006:893), "coastal management had evolved as if it were 'a-political' – cocooned from the reality of apartheid". As such, and as acknowledged by The Department of Environmental Affairs and Tourism, a participatory process for policy formulation was well overdue. This also reflected shifts in environmental management in South Africa at that time towards more participatory approaches.
- 4) *People-centred, pro-poor Integrated Coastal Management of the new millennium*: The facilitation of a participatory process for policy formulation, in conjunction with South Africa's 'war on poverty' has culminated in what is the contemporary prescription of coastal zone management: an approach that emphasizes the importance of stakeholder engagement and the necessity of integrating management approaches between various organizations and institutions influential upon coastal regions.

Resulting from the latter two discourses of encouraging an inclusive pro-poor participatory approach within an integrated framework, the South African government in May 1997 undertook an extensive and integrated process of public participation research and analysis to develop the White Paper for Sustainable Coastal Development in South Africa (DEAT, 2006). The Policy, in essence, "...aims to achieve sustainable development through a dedicated and integrated coastal management approach, in partnership with all South Africans" (DEAT, 2000: Foreword). Within this policy, and in an attempt to address the

'fuzzy' nature of legislation surrounding coastal zones, provision was made for a *Plan of Action* which outlined in detail how the aims and objectives of the White Paper were to be met (DEAT, 2006). Resulting from this, and as a component of this *Plan of Action*, a dedicated Integrated Coastal Management Bill was made available for public comment in December 2006 and is due to become legally enforceable in 2009. This will be South Africa's first legal instrument designated towards the management of the coastal zone and as such it is a tool aimed at assisting the Draft White Paper in realising its goals. The mandate of the Integrated Coastal Management Act is to:

“...establish a system of integrated coastal and estuarine management in South Africa, including norms, standards and policies, in order to promote the conservation of the coastal environment, and the ecologically sustainable development of the coastal zone; to define rights and duties in relation to the seashore and other coastal areas; to determine the responsibilities of organs of state in relation to the seashore and other coastal areas; to prohibit incineration at sea; to control dumping at sea, pollution in the coastal zone and other adverse effects on the coastal environment; to give effect to South Africa's international obligations in relation to coastal matters; and to provide for related matters” (DEAT, 2006:4).

A core function of the Act is not only aimed at addressing the complexities and ambiguous nature associated with past and current governance of coastal zones in South Africa, but also towards capitalising on the ecosystem services that coastal environments may offer towards sustaining and improving livelihoods of coastal stakeholders (DEAT, 2006). Although this may be the most relevant piece of legislation related to coastal regions, there are however a host of other legislative frameworks that are implicated in the management of the coastal zone. The following section gives a brief overview of the various legislative frameworks associated with, and influential upon, the manner in which the coastal zone is managed.

3.4 LEGISLATION RELEVANT TO THE MANAGEMENT OF SOUTH AFRICA'S COASTAL ENVIRONMENT

Legislative frameworks in South Africa are structured in such a way that coastal environments and activities, both directly and/or indirectly related to coastal environments in South Africa, are administered by a range of government departments. Due to the nature of coastal environments as an interface between terrestrial and marine environments and

the associated diversity of activities that take place within this area, it has consequently been acknowledged that there is a degree of overlap between the various legislative bodies in respect function, jurisdiction and management of this zone (Draft eThekweni Coastal Management Strategy, 2005). Although it was the intent of this section to identify any legislation that is relevant to the coastal zone, it was quickly realized that the process of determining which legislation is relevant to the coastal zone and related activities thereof, becomes difficult. Some of these legislative mechanisms encompass policy on a broad and national level while others focus on the local level. Only those legislative frameworks directly relating to coastal zones have been described in this thesis. Provision has also been made to give an indication of the broad scope of legislative mechanisms that are relevant to the coastal zone.

3.4.1 The Constitution of the Republic of South Africa (Act 108 of 1996)

The Constitution (Act 108 of 1996) forms the supreme law of the Republic of South Africa. Within the Constitution, provision is made for the protection of environmental rights. Section 24 of the Constitution states that all South Africans have the right to live in a healthy environment, where such an environment is protected against ecological degradation, for both present and future generations (Constitution of the Republic of South Africa, 1996). The coastal zone is part of the environment which offers significant socio-economic potential. There is an overarching obligation for the sustainable management and protection of the natural environment through measures that:

- 1) “Prevent pollution and ecological degradation;
- 2) Promote conservation, and
- 3) Secure ecological sustainable development and use of natural resources whilst promoting justifiable economic and social development” (Constitution of the Republic of South Africa, Chapter 2: Bill of Rights, Section 24: Environment, 1996).

3.4.2 National Environmental Management Act (Act 107 of 1998)

The role of the National Environmental Management Act (NEMA, 1998) is to “...provide for cooperative environmental governance by establishing principles for decision making on matters affecting the environment...” and to provide a framework that will enable

institutions to “...promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state; and provide for matters connected therewith” (NEMA, 1998:1). The National Environmental Management Act forms the overarching legal framework applicable to all sectors of state regarding activities that impact upon the natural environment, either directly or indirectly. This is especially significant as there are multiple sectors that have an influence on the coastal zone and where their activities require regulation. NEMA strives to:

- 1) “Serve as a guideline by reference to which any sector of state must exercise any function when taking any decision in terms of NEMA or any statutory provisions concerning the protection of the environment , and
- 2) To guide the interpretation, administration and implementation of any law concerned with the protection or management of the environment” (Section 2 of NEMA, 1998, quoted in the Institute of Natural Resources 2002:7).

The importance of NEMA in the management of the coastal zone is highlighted in Chapter 2 (4) (R) where:

“Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure” (NEMA, 1998: 9).

It is important to note that when the ICM Act becomes legally enforceable, the powers installed in the ICM Act will supersede that of NEMA.

3.4.3 Environmental Conservation Act (Act 73 of 1989)

The mandate of the Environmental Conservation Act is to “provide for the effective protection and controlled utilization of the environment and for matters incidental thereto” (Environmental Conservation Act 73 of 1989:1). This Act sets out procedures for Environmental Impact Assessments that have to be complied with in order for certain activities, as listed in the Act, to commence (Draft eThekweni Coastal Management Strategy, 2005). Various provisions within the Act, specifically sections of Part V and Part VI that make provision for the control of activities that have a negative impact on the

environment, have since been repealed by NEMA. Although certain EIA regulations have been repealed, they will continue to remain in effect until they are replaced by new regulations under NEMA (DEAT, 2000).

3.4.4 National Environmental Biodiversity Act (Act 10 of 2004)

The core mandate of this Act is to promote the establishment of networks of biodiversity and the conservation thereof. This will be undertaken by providing:

“...for the management and conservation of South Africa’s biodiversity within the framework of the National Environmental Management Act, 1998; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith” (National Environmental Biodiversity Act 10 of 2004:2).

Considering both the current and historical pressures associated to coastal environments, this Act is a key mechanism for sustainably managing and maintaining the integrity of coastal ecosystems and resources (Draft eThekweni Coastal Zone Management Strategy, 2005).

3.4.5 Marine Living Resources Act (18 of 1998)

Marine resources, not only in South Africa, but also on a global scale, are under severe strain (Acheson *et al*, 1998; Mann Borgese, 2000). In realisation of the need to promote the sustainable utilisation of marine resources and to promote the conservation of marine biodiversity, the Marine Living Resources Act was promulgated. The purpose of this Act is:

“To provide for the conservation of the marine ecosystem, the long term sustainable utilisation of marine living resources and the orderly access to exploitation, utilisation and protection of certain marine living resources; and for these purposes to provide for the exercise of control over marine living resources in a fair and equitable manner to the benefits of all the citizens of South Africa; and to provide for matters therewith”

The dependency of livelihoods on marine resources in South Africa is enormous (Hauck and Sowman, 2004). Considering the role that such an Act plays in the sustainable utilisation of resources, this Act is a critical mechanism towards sustaining and improving coastal livelihoods.

3.4.6 Sea Shore Act (Act 21 of 1935)

The Sea Shore Act was promulgated to “...declare the state president to be the owner of the sea-shore and the sea within the territorial waters of the Republic and to provide for the grant of rights in respect of the sea-shore and the sea, and for matters incidental thereto” (South African Coastal Information Centre, 2007). Thus, the Sea Shore Act effectively secures rights of access for the public to the sea shore and the sea. Within this Act, there is capacity to deal with ownership of rights and responsibilities over the sea and sea-shore (South African Coastal Information Centre, 2007). Certain sections of the Sea Shore Act (those that do not apply to provincial authorities) are due to be repealed once the Integrated Coastal Management Act becomes legally enforceable (Institute of Marine and Environmental Law, 2007).

The above sections have outlined the key pieces of legislation pertaining to the coastline. Table 2 reflects other legislation that is used in the management of the coastal zone.

Table 2: Other legislation relevant to the coastal zone

Act	Responsible Authority
National Parks Act (57 of 1976)	Department of Environmental Affairs and Tourism
The Sea Birds and Seal Protection Act (46 of 1973)	Department of Environmental Affairs and Tourism
Mineral and Petroleum Resources Development Act (28 of 2002)	Department of Minerals and Energy
Municipal Systems Act (32 of 2000)	Local Municipality
Development Facilitation Act (67 of 1995)	Determining the responsible authority is dependent upon the type of application. The application in turn is determined by the location of the land in question relative to administrative structures as well as legislation in terms of which the application is made.
National Water Act (36 of 1998)	Department of Water Affairs and Forestry
National Forest Act (84 of 1998)	Department of Water Affairs and Forestry
National Heritage Resources Act (25 of 1999)	National or Provincial Heritage Resource Authority.

Having considered legislation that is applicable to the management of the coastal zone, the following section now focuses on how the coastal zone is defined, both in legislation and policy. This is fundamental to defining and ‘unsettling’ coastal spaces, which is the focus of this research. The following section provides a selection of definitions of the coastal zone, as presented in the literature.

3.5 DEFINITIONS OF THE COASTAL ZONE

This section highlights the diversity of ways in which the coastal zone can be defined. Local (municipal level), national and international examples are used to explore the variety of such definitions: Are they ‘absolute’ or ‘relational’ in orientation? Are they systems orientated with the intent of accommodating dynamic flows of natural processes, or are they defined based upon the use of the metric of absolute space? Where possible, the context of each definition is given. This is used to gain an understanding of the link between these definitions and the function that such definitions intend to fulfil. The following section presents the definitions of the coastal zone in relation to different legislation, programmes and policies.

3.5.1 National Environmental Management: Integrated Coastal Management Act, 2008

The newly promulgated Integrated Coastal Management Act is South Africa’s first legal tool designated to legislate for the integrated management of the coastal zone. The definition of the coastal zone in this legislation is as follows:

Definition:

“The area comprising coastal public property, the coastal protection zone, coastal access land and coastal protected areas, the sea shore, coastal waters and the Exclusive Economic Zone and includes any aspect of the environment on, in, under and above such an area” (ICM Act, 2008:9).

This description has been formally adopted as the national definition of the coastal zone of South Africa, under the ICM Act. This definition acts as a central point of reference to South Africa’s first legal instrument that focuses on the management and protection of the

coastal zone. The ICM Act requires that those coastal components that collectively constitute the coastal zone, such as the coastal protection zone, coastal public property, and coastal access land are demarcated and that the boundaries of these areas are indicated on zonation maps. This is necessary not only to inform and to guide planning decisions, but that the ‘position’ of the coastal zone is legally defensible in the event that legal challenges arise.

3.5.2 Draft eThekweni Coastal Management Strategy, 2005

This strategy was produced by the Environmental Management Department of the eThekweni Municipality to address coastal pressures within the municipality. In this definition of the coastal zone, the coastal zone has been split up into three categories:

Definition:

1. “Primary coastal management zone which is defined as the highest area of importance to the functioning and feel of the coast including coastal wetlands, estuaries and view scapes;
2. Secondary coastal management zone which includes the river valleys, dams and other activities which contribute directly by way of water, nutrients and sediment (or loss of sediment by sand winning ,dams, etc.) to the coastal system, and
3. Tertiary coastal management zone which encompasses the whole of the eThekweni Municipality area. This covers the indirect impacts in the rest of the city” (Draft eThekweni Coastal Management Strategy, 2005:4).

The purpose of this strategy is to direct attention to issues that are specific to the coast at a local government level. This is indicated in the formulation of a primary definition of the coastal zone which is pragmatic and management orientated (Draft eThekweni Coastal Management Strategy, 2005). It is within this primary definition that provision has been made for the identification of management units based upon geophysical characteristics and coastal use (Draft eThekweni Coastal Management Strategy, 2005).

This definition has been formulated to guide policy relating to coastal matters in KwaZulu-Natal. As it is not intended to function within a legal context, such a definition has not been guided by the imposition of boundaries. This definition focuses on a systems

orientated approach and has been set at the scale to include those processes that have both indirect and direct influences on the coast. This is evident through the use of definitions that define the coast at three different scales (primary, secondary, and tertiary).

3.5.3 United Nations Environmental Programme, 2005

The definition provided by the United Nations Environmental Programme has been used in the context of assessing risk. This definition of the coastal zone is explicitly spatial in nature.

Definition:

“The area of the coastal zone encompasses the upper limits of catchments of coastal rivers to the seaward limits of terrestrial influence, including marine life such as fish and coral reef” (UNEP, 2005:4). In terms of management and planning, UNEP (2005:4) suggests that a definition based upon distance becomes necessary. This is defined as “the terrestrial area within 100km of the coastline, which is the line forming the boundary between the land and sea, defined by the mean high water mark”.

This definition of the coastal zone is provided in a report with the intent of providing a global index towards measuring risk. More specifically, this document aims to “develop a preliminary index for assessing the relative vulnerability of coastal communities to environmental threats” (UNEP, 2005:3). This report not only aims to assist national policy makers but it is hoped that information generated by this report will also act as a form of guidance to international agencies and other cross border bodies that have interests in vulnerability and the spatial distribution of risk (UNEP, 2005).

Although the coastal zone is informed by the presence of absolute parameters, it does apply a systems orientated approach whereby the geographic extent of mechanisms that influence coastal systems i.e. rivers, have been included.

3.5.4 United Nations Environmental Programme, Global Environment Facility and The Land-Ocean Interactions in the Coastal Zone, 2006

The description of the coastal zone in this programme has been adopted as the formal definition within the Land-Ocean Interactions in the Coastal Zone (LOICZ) project.

Definition:

“The area of transition between mainland, islands and adjacent seas. It is an area that is shaped by natural processes that deliver materials to it from rivers, the sea and the atmosphere. The coastal zone has high natural variability as it constantly responds and adapts in its physical, chemical and biological characteristics as wave and current regimes, climate, and morphological processes change” (Le Tissier *et al*, 2006:1).

This definition reflects a conceptualisation of the coastal zone that promotes an ecosystem based approach towards managing international waters as well as their drainage basins. It is intended that this definition will make a direct contribution towards the sustainable management and use of natural resources through a systems based management approach that places emphasis on gaining an understanding of interacting systems in a more holistic sense (UNEP, 2005). Again, this definition functions at an international policy level for the management of coastal regions. As such, the definition does not include the position of absolute demarcations.

3.5.5 US Department of Commerce, National Oceanographic and Atmospheric Administration, The Coastal Protection and Restoration Division, 2008

This definition is stated in the U.S. Code. The U.S. Code acts as a source of information and guideline to national legislation relevant to the U.S.

Definition:

“Coastal waters (including the lands therein and there under) and the adjacent shore lands (including the waters therein and there under), strongly influenced by each and in proximity to the shorelines of the several coastal states, and includes islands, transitional and inter-tidal areas, salt marshes, wetlands, and beaches. The zone extends, in Great Lakes waters, to the international boundary between the United States and Canada and, in other areas, seaward to the outer limit of State title and ownership under the Submerged Lands Act (43 U.S.C. 1301 et

seq.), the Act of March 2, 1917 (48 U.S.C. 749) [48 U.S.C. 731 et seq.], the Covenant to Establish a Commonwealth of the Northern Mariana Islands in Political Union with the United States of America, as approved by the Act of March 24, 1976 [48 U.S.C. 1801 et seq.], or section 1 of the Act of November 20, 1963 (48 U.S.C. 1705), as applicable” (Cornell University Law School, 2008).

Although a national definition of the coastal zone is given, provision is made for individual states to define their own coastal zones in order to accommodate varying socio-economic and biophysical attributes unique to particular regions. Within the context of the national definition, the nature and the extent of the coastal definition is geared towards controlling land based activities that may have a direct or significant impact on the coastal waters as well as to control and to protect geographical areas that may be at risk from sea level rise (Cornell University Law School, 2008).

This definition adopts a systems orientated approach. However, the ‘position’ of the coastal zone is largely shaped by ownership and changes in jurisdictions that become applicable to different parts of the coast.

3.5.6 The State of Delaware, U.S.A, 2008

The state of Delaware acknowledges the coast as the most critical area for its role in the quality of life for its citizens (The State of Delaware, 2008).

Definition:

“All that area of the State, whether land, water or sub-aqueous land between the territorial limits of Delaware in the Delaware River, Delaware Bay and Atlantic Ocean, and a line formed by certain Delaware highways and roads...”.

The definition then details the specifics of which roads are used to define the landward boundary of the coastal zone for the length of the entire state.

This definition has been constructed with the intent to facilitate efficient and clear control of activities that may negatively impact on the coastal zone and thus the quality of life. For example, the State of Delaware has enforced a complete prohibition of industrial development seaward of the boundary as demarcated by the various roads. Other activities

that are deemed as having negative impacts on the coastal zone include offshore bulk product transfer facilities. These not only increase the risk of pollution events but they act as drivers for the establishment of industrial plants within the coastal zone (The State of Delaware, 2008).

3.6 CONCLUDING REMARKS

This chapter has placed emphasis on the identification and description of the coastal zone within a legal and management context. In all cases the coastal zone is subject to some form of control where it has been identified as a key environmental management zone. The degree to which legislation has been applied to the coast suggests that the coastal zone provides important resources and as such needs to be effectively and equitably managed. The variety of legislative mechanisms that are associated with coastal regions gives an indication as to the diversity of assets and activities that take place within coastal regions. This chapter has also revealed that although the coastal zone may be defined in a legal sense, the geographic extent described by these definitions varies greatly. The question arises as to why the geographical extent of legal definitions vary, what drives such differences in these spatial variations and what the implications are of these differences in spatial variations.

From the various examples of the definitions provided in section 3.5, it is clear that definitions of the coastal zone differ. They differ in the informants that they select to guide the description of the coastal zone: some definitions expand to include ecosystems processes that function at broader scales but which have an influence on the coast (system oriented definitions), whilst others are guided by the position of artificial boundaries. It is apparent that the nature of these definitions are determined according to the context within which a particular definition may be situated. For example, definitions that follow a systems oriented conceptualisation of the coast are typically used at policy level surrounding the management of coastal regions. Where these policy orientated definitions refer to the position of boundaries, these boundaries are generally set at distances that incorporate broad scaled systems functioning, i.e. the inclusion of catchments within the definition. It is also apparent that definitions which make reference to absolute demarcations are typically definitions that are situated within a legal context. The purpose

of these absolutely determined definitions is to establish clarity over the rights and responsibilities of coastal stakeholders.

Chapter 2 and 3 have provided the theoretical and legislative framework of this research. Chapter 4 presents the methodology adopted in critically analysing the conceptualisation of coastal zones and 'spaces' in KwaZulu-Natal.

CHAPTER 4: METHODOLOGY

4.1 INTRODUCTION

This research examines the coastal zone as a system. As such, attention is directed towards determining what constitutes the ‘coastal zone’. Although biophysical attributes influential upon the functionality of coastal areas have been investigated, it was also the intention of this research to develop an understanding of what constitutes the ‘fabric of the coastal space’. Within this framework of determining coastal spaces, the reach and interrelation of these spaces have been explored and the nature and extent of these coastal spaces have been determined and ‘mapped’ in this study. These coastal spaces have been determined based upon, and substantiated by, stakeholder perceptions of what constitutes the coastal environment.

It is acknowledged that an exhaustive study may be made of the intricate functionality of the various components within biophysical and socio-economic systems contained within coastal systems. The intent of this research is not to provide a detailed analysis of the intricacies of such coastal spaces, but rather, to take an overarching perspective to identify and broadly examine the predominant conceptualisations of coastal spaces identified by key coastal stakeholders. Within this framework, the range and degree of influence of these spaces has been determined and the linkages between such spaces highlighted. This has been done to facilitate a more holistic understanding of what constitutes, and therefore influences, coastal socio-economic and environmental attributes pertaining to coastal areas.

The methodological framework (Figure 6) begins with discussing the role of interpretation in this research (section 4.2). This is critical as this research focuses on stakeholder perceptions as interpreted by the researcher. This section discusses the subjectivity of the research, the role of subjectivity towards the interpretive turn, and the positionality of the researcher within this research. This chapter then discusses systems theory and data analysis. As this research endeavours to examine the coastal zone as a system, it is necessary to identify the limitations of analysing such systems in their entirety. The limitations of systems analysis and additional limitations of this research are discussed in section 4.3 and section 4.8 respectively.

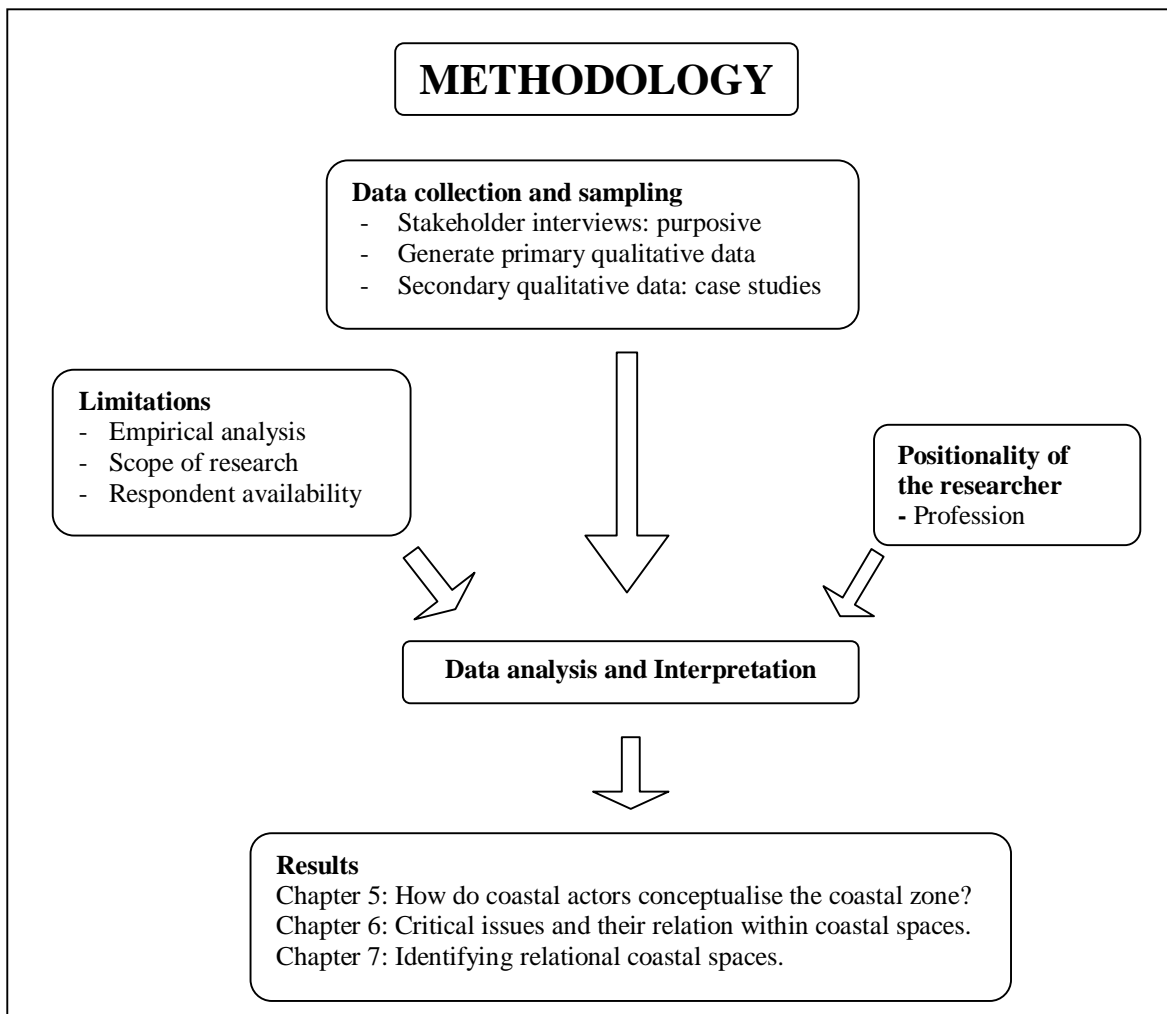


Figure 6: An overview of the methodological framework used in this research.

Following from section 4.3, an explanation is given as to how this research has reflected the coastal zone as a system of spaces (section 4.4.). This then feeds into the next section whereby a description of the interview process is given, and how the data from the interview process was captured, analysed and interpreted (section 4.5. and 4.6 respectively). Section 4.7 describes how the results of this research have been structured. The research attempts to provide a visual description through a thematic representation of the various coastal spaces identified. The process behind this is described in section 4.8. Finally, a brief conclusion is provided.

4.2 INTERPRETATION AND POSITIONALITY

The central theme of this research is to develop an understanding of what constitutes the coastal space, to examine the multiplicity of coastal spaces and further to this, to determine

the nature of relationships between these different spaces. This has been achieved through engagement with stakeholders, and more specifically, by developing an understanding of how the various stakeholders conceptualise the coastal space. Given this intention, the product of this research is based upon the researchers' interpretation of stakeholder perceptions in relation to the theoretical framework presented in Chapter 2.

It is acknowledged that in the process of interpreting stakeholder perceptions, and thus engaging in 'double hermeneutics', the arguments presented in this thesis are exposed to some degree of subjectivity. According to the Cartesian ideal of methodic doubting, researcher subjectivity is seen as a bias that leads to the obscuring of reality (Mottier, 2005). To achieve and reflect a more 'accurate' reality, and according to the orthodox consensus of positivistic science, social phenomena must be examined as external objects that function independently from the researcher. However, it is argued by Mottier (2005:4) that:

“...the goal of social sciences lies in the interpretive understanding of the subjective meaning of social practices and of cultural artefacts, within a life world that the researcher is embedded in. It follows that the study of social reality as an 'external object' is a methodological impossibility”.

Additionally Mottier (2005:4) suggests that, and especially referring to interpretive bias, “given that meaning [derived through interpretation] is embedded in a specific historical and cultural context, the meaning of the object of research is irreducible to the cultural meanings that envelop the interpreter”. In other words, gender, class, race and the immediate contextual conditions within which the data is collected, influences the research process and the nature of the data that is generated (Mottier, 2005).

Even within the context of natural science and its associated positivistic applications, it is acknowledged that interpretation, explanation, objectivity and subjectivity cannot be easily distinguished from one another. As scientific data are already interpreted at the time that the data are observed, and as discussed, knowing that interpretation is conditioned by tradition, objective observation of data cannot therefore take place (Mottier, 2005). The acknowledgement of the impossibility of objective observation has led to the recognition, and rehabilitation of, subjectivity. This 'shift' in thinking has led to what has become

known as the 'interpretive turn'. According to Giddens (1976, quoted in Mottier 2005:1) the interpretive turn views "...data collection as a mutual construction of meaning where the researcher is engaged in 'double hermeneutics'", that is, we construct interpretations of interpretations. It is within this 'interpretive turn' that this research bases its methodological framework. The interpretive turn is represented by disciplines such as ethnomethodology, phenomenology and hermeneutics. These disciplines share a commonality in terms of the analysis of the construction of meaning, that is, the manner in which people make sense of what is reality to them. In light of this, and in contrast to positivist proponents of objectivity, subjectivity is seen as an essential and positive contributor towards interpretive research. In this sense interpretive disciplines do not construct a boundary between the researcher and what is deemed social reality as an external object. Instead, the extraction of information from the participants and interpretation by the researcher is seen as a symbiotic construction of meaning (Mottier, 2005).

Within the framework of the interpretive turn, it is important to reflect upon the positionality of the researcher. Throughout the duration of this research, the researcher has been immersed within the network of coastal stakeholders on a professional level. Initially the position of the researcher as an 'insider' was through the Oceanographic Research Institute (KZN), in the capacity as Scientific Technician, and towards the end of the research, for the City of Cape Town Municipality, in the capacity of Coastal Coordinator. The professional roles of the researcher have focused on the sustainable management of coastal resources. This functional role has therefore positioned the researcher as a coastal stakeholder within his own right. Therefore the 'boundary' between the researcher and the 'social reality as an external object' has not existed. As such, the results generated in this research are based upon what Mottier (2005) refers to as a 'symbiotic construction of meaning'. The acknowledgment of this subjectivity within the research world is seen as a means of strengthening rather than weakening the validity of the research (Mottier, 2005).

Given the nature of this research, and within the 'interpretive turn' framework, this research has applied the discipline of phenomenology. Phenomenology is concerned with understanding rather than explaining the world. As such, this approach was used to gain an understanding of coastal systems, through the lens of coastal stakeholders. According to Pile (1993, quoted in Kitchen and Tate 2000:11) phenomenology is "...a people centred

form of knowledge based on human awareness, experience and understanding...”. By determining coastal spaces through stakeholder conceptualisations, and considering the theory that “...an element is brought into an individuals world only when he or she gives it meaning, because of some intention towards it (Johnston, 1986, cited in Kitchen and Tate 2000:11), this methodological framework is ideally suited to determine, through stakeholder engagement, what the various coastal spaces are, and the nature of relationships between those spaces in a relational context.

4.3 SYSTEMS THEORY AND DATA ANALYSIS

As this research intends to examine the coastal zone as a system, it is necessary to provide a critique of general systems theory. As discussed in the literature review, systems theory proposes that in order to arrive at an understanding of the world, it is necessary not only to develop an understanding of the properties of system components, but to develop an understanding of the nature of interrelations that exist between those components (Harvey, 1969).

The critique of general systems theory (which is also inherently linked to Mottier’s notion of the impossibility of objectivity), is based on the idea that, in order to explain something, it is necessary for that explanation to extract certain events and conditions and thus exclude other events and conditions. This is substantiated by Ashby’s (1966, cited in Harvey, 1969:448) argument that “...any real system will be characterised by an infinity of variables from which different observers (with different aims) may reasonably make an infinity of different selections”. Therefore, through systems analysis and through the spatial isolation of events, the system becomes closed. To cater for the exclusion of these factors, and in terms of empirical analysis and the application of laws, the error symbol (*e*) is typically included in equations such as $Y = A + bX + e$. The symbol *e* may therefore represent the environment of some system that is closed around *Y* and *X*. As such, and within the confines of empirically based science, systems analysis cannot proceed without extraction and closure (Harvey, 1969).

The limitations of systems analysis are further demonstrated when these systems are isolated on temporal scales, i.e. when the functioning and understanding of that system is

based on environmental sequences prior to analysis where change during and after such an analysis is excluded and therefore discounted. It is also important to note that parameters of a system are in a constant state of flux and that our knowledge of the range of these parameters is based on tenuous temporal ‘windows’ of analysis (Schindler, 1987; Holling and Meffe, 1996).

Considering the critique of systems theory, it is not the intention or within the capacity of this research to attempt a complete analysis of the coastal zone as a system of spaces in its entirety. Therefore, only those spaces as identified by the coastal stakeholders have been explored. This stakeholder feedback, as a representation of the ‘collective wisdom’, is used to facilitate a more holistic approach towards understanding and thus managing such systems rather than relying entirely on the understanding of policy makers. It is also acknowledged that the identification of coastal spaces is situated in a particular time and in which these spaces may change over time. Considering the relatively limited temporal window within which this research was conducted, the use of textual analysis has enabled the identification of general longer standing and therefore more representational issues. The use of textual analysis to identify these longer standing issues (Chapter 6) therefore provides a ‘supplement’ to this limited temporal window.

To generate a more holistic perspective of coastal systems, it is necessary to examine the linkages and relations between the various coastal spaces. This enables the development of a more holistic perspective of what constitutes the coastal system and where the parameters of such a system may lie. Understanding system parameters is important to determine the extent of functionality and therefore sphere of influence of that system.

4.4 UNDERSTANDING THE SPACES OF COASTAL SYSTEMS

This section describes how concepts of space are used to develop an understanding of the coastal zone in a more holistic sense. In determining the spaces of coastal systems, both relative and relational concepts of space have been identified and used as concepts to navigate and eventually map the reach and influence of coastal systems. This alternative and perhaps less conventional approach of using relative and relational space to explore coastal zones, is recognised as an abstract yet fundamental method for determining critical

spatial components that constitute coastal systems. It is proposed that an understanding of relational space is necessary to drive a re-conceptualisation of the coastal zone. It is intended that this re-conceptualisation will generate a more holistic perspective of what the coast is, an understanding of how it functions, and will lead to increased degrees of sustainable practice. A diverse perspective of what constitutes the coastal zone in itself creates stronger degrees of resilience as multiple and lateral solutions towards addressing pressures within coastal socio-economic systems are determined and produced. Through the identification of the various coastal spaces, critical linkages have also been determined between socio-economic and ecological systems. Through an analysis of these linkages, it is hoped that insight may be gained which will facilitate more integrated and sustainable management practices within coastal regions.

Managing coastal regions in an integrated manner is necessary if increased degrees of sustainable development are to be achieved within coastal systems (van den Bergh and Nijkamp, 1997). Glavovic (2000:270) states, "...an integrated approach is central to promoting a holistic view of the coast as a system...". However, this research argues the reverse opinion, namely that a holistic view of the coast is central to promoting an integrated approach. This research therefore unsettles the definitions of coastal zones by expanding the conceptualisation of what constitutes coastal systems and the nature of relationships between the various spaces within these systems. Equipped with this new knowledge and conceptualisation of multiple coastal spaces, it is hoped that the process of integrating coastal management will be provided with a more integrated foundation.

4.4.1 Conceptualising the coastal spaces

Due to the complexity of coastal systems, attention in this study has been directed initially towards identifying the core spaces of the coastal system. It is acknowledged that further research will be necessary to 'fine tune' the identification and selection of more peripheral spaces and the nature of their linkages/relations. The selection and substantiation of core spaces of coastal systems has been based upon the determination of 'issues' as identified through the interview process of coastal stakeholders. The terms of reference (Appendix 2) for the KwaZulu-Natal Provincial Coastal Committee (KZN PCC) was used as the framework for identifying who the key coastal stakeholders are (Table 3). The PCC was

selected as a reference point as it consists of government departments, statutory bodies, parastatals and sectors of civil society that have been deemed influential in the promotion of sustainable coastal development (Institute of Natural Resources, 2003; Celliers *et al*, 2007).

Table 3: List of respondents

NAME	ORGANISATION	TITLE	DATE
Respondent 1	KwaZulu-Natal Tourism	Manager: Research	27/09/07
Respondent 2	eThekweni Municipality	Project Executive: Coastal Policy	05/10/07
Respondent 3	Oceanographic Research Institute	Director	05/10/07
Respondent 4	Golder Associates	Sustainable Development Division Leader	07/10/07
Respondent 5	Department of Agricultural and Environment Affairs	Deputy Manager: Coastal and Biodiversity Management	15/10/07
Respondent 6	EnvironDev	Director	14/11/07
Respondent 7	South African Cane Growers Association	Natural Resource Manager	15/11/07
Respondent 8	eThekweni Municipality	Senior Planner	15/11/07
Respondent 9	South Durban Community Environmental Alliance	Chairman	16/11/07
Respondent 10	Natal Sharks Board	Chief Scientist	21/11/07
Respondent 11	Ezemvelo KwaZulu-Natal Wildlife	Co-ordinator for Biodiversity Research	22/11/07
Respondent 12	Wildlife and Environment Society of South Africa	Regional Co-ordinator	23/11/07
Respondent 13	Tongaat Hulett Developments	Planning and ESH Executive	23/11/07
Respondent 14	National Ports Authority	Environmental Manager	26/11/07
Respondent 15	Department of Land Affairs	Surveyor General	07/12/07
Respondent 16	Phelemanga Projects	Director	07/12/07
Respondent 17	eThekweni Municipality	Head: Environmental Management	11/12/07
Respondent 18	Futureworks	Business Portfolio Leader	13/12/07
Respondent 19	Department of Environmental Affairs and Tourism	Deputy Director: Marine and Coastal Management	29/01/08
Respondent 20 (Pilot Interview)	Oceanographic Research Institute	Senior Scientist	21/09/07
Respondent 21 (Pilot Interview)	Oceanographic Research Institute	Senior Scientist	21/09/07
Respondent 22 (Pilot Interview)	Oceanographic Research Institute	Scientist	21/09/07

It must be noted that although every attempt was made to interview as many actors within the PCC membership categories as possible (government, parastatal, and several sectors of civil society), not all ‘representatives’ from all sectors were interviewed. Notably in their absence from the interview list are the representatives from the Department of Water Affairs and Forestry, as well from the Department of Mineral Affairs and Energy. Even though several attempts were made to contact representatives from these organisations, it was not possible to secure interviews with key personnel from these agencies.

Although the PCC has been used as a framework for determining the coastal stakeholders in a provincial context, the outcome of this research will also act as a feedback mechanism indicating the degree of appropriate ‘representivity’ of apparent ‘influential’ agencies and organisations constituting the PCC. The analysis of key stakeholder perceptions from the PCC has generated a broader perspective of what constitutes the coastal space. This perspective of the coast may be achieved through exploring the notion that individuals perceive and understand space differently. According to Harvey (1969) and Golledge (2002, cited in Hubbard, 2004) individuals develop unique perceptions about their surroundings and these unique perceptions reflect an individual’s cultural and physical experience of their surroundings. These cultural and physical experiences not only shape the nature of that individual’s behaviour in that space, but it also affects his or her visual perception of spatial relationships (Segal *et al*, 1966, cited in Harvey, 1969). Thus coastal spaces are understood relative to each individual’s position and experience. The relativity, upon which the determination of spatial relations is dependent, is further substantiated by the fact that individuals perceive and construct space differently (Harvey, 1969; Law *et al*, 1998; Hubbard *et al*, 2004). This is because the perception of space differs and is influenced by “...cultural background, perceptual ability, and scientific purpose” (Harvey, 1969: 197).

The importance of understanding how people perceive the coastal zone is aligned with Golledge’s (2002, cited in Hubbard *et al*, 2004) assertion that, in order to generate an understanding of the geographical world, it is necessary to understand how people view the world around them (Kitchen and Tate, 2000). The magnitude of such an assertion becomes apparent when the decisions people make are based upon this cognition.

A parallel may therefore be drawn between this and the premise from which this research has been launched: that the manner in which coastal stakeholders collectively perceive the coastal space (and the resultant definitions of the 'coastal zone') has direct implications for the manner in which the coast is managed. According to Berkes *et al* (2003) it is imperative to harness a multiplicity of perspectives as this is central to enhancing our understanding of complex systems. This in turn provides an enabling platform from which to improve management and planning decisions.

4.4.2 Study area

Although this research has used the KZN PCC to identify the relevant provincial coastal stakeholders, this research, and the information generated, is not solely restricted to the boundaries of the province of KZN. Several respondents that were interviewed were representative of agencies or organisations at municipal or local, provincial and national levels. As such, their answers and perceptions were not purely restricted to issues unique to KZN. For example, the Deputy Director of Marine and Coastal Management made reference to erosion issues, and the cause of such issues, in Cape St Francis, which is in the Eastern Cape Province. This information was not discounted because it relates to issues outside the province, but was used to substantiate similar issues that take place within KZN.

The criterion for the selection of the case studies was based upon location. It was necessary to use case studies that fell within eThekweni Municipalities border. This was done not only to identify relevant case studies as appropriate 'lenses' through which to substantiate the various coastal spaces identified, but also to contain the scope of this research.

eThekweni municipality is located on the eastern seaboard of South Africa, in the province of KZN. The municipality covers an area of approximately 2297 km² in size (South African Cities Network, 2009). Although it represents only 1.4% of the surface area of the province of KZN, it constitutes a 1/3 of the population (3 million) of KZN (eThekweni Municipality, 2005). eThekweni Municipality has a coastline of approximately 97 km with the city of Durban forming the economic hub along this stretch of coastline. Durban has

the largest and busiest port on Africa's east coast; where over 80 000 containers enter the port each month (eThekweni Municipality, 2005). The four largest economic sectors are manufacturing (30%), tourism (24%) followed by finance and transport (South African Cities Network, 2009). The tourism industry is primarily concentrated along the coast, with an increasing demand for cultural tourism in the west of the municipality.

Durban has a diverse ethnic population. The majority of the population consists of Black Africans (68%), followed by Asian African (20%), White African (9%) and finally Coloured African at 3% (South African Cities Network, 2009). For a family to cover basic household expenses, the family needs to generate R1500 per month. Approximately 57% of the households in eThekweni Municipality earns less than this amount, suggesting that a large portion of the population is living in difficult economic and social circumstances (eThekweni Municipality, 2005).

4.5 THE INTERVIEW APPROACH

Interviews were based on a purposive approach that targeted coastal stakeholders. This approach was used with the intent of developing a more detailed and clear understanding of specific issues relating to the management of coastal systems through tapping into specialist coastal knowledge of the different coastal stakeholders. Information gained from interviews was used to generate a pool of primary qualitative data. These data were obtained/collected through the administration of a semi-structured face-to-face interview. The use of a semi-structured approach is justified as not only does it reduce interviewer bias introduced through free conversation, but it also allows for the effective comparison between the various respondent perceptions as reflected in their answers. A number of important pre-set questions (Appendix 3) were purposefully formulated to be open-ended in order to encourage an 'unrestricted' response from the interviewees. The use of open-ended normative questions is substantiated in order that respondents do not become constrained by unintentional insinuation from the researcher. As such it encourages a more realistic reflection of a person's individual thought (Kitchen and Tate, 2000). Open-ended questions were supplemented by further relevant questions that detailed the respondents' views. Kitchen and Tate (2000) suggested that such probing questions become effective

not only towards encouraging the respondents to elaborate, but also to test the validity of statements given by the respondent.

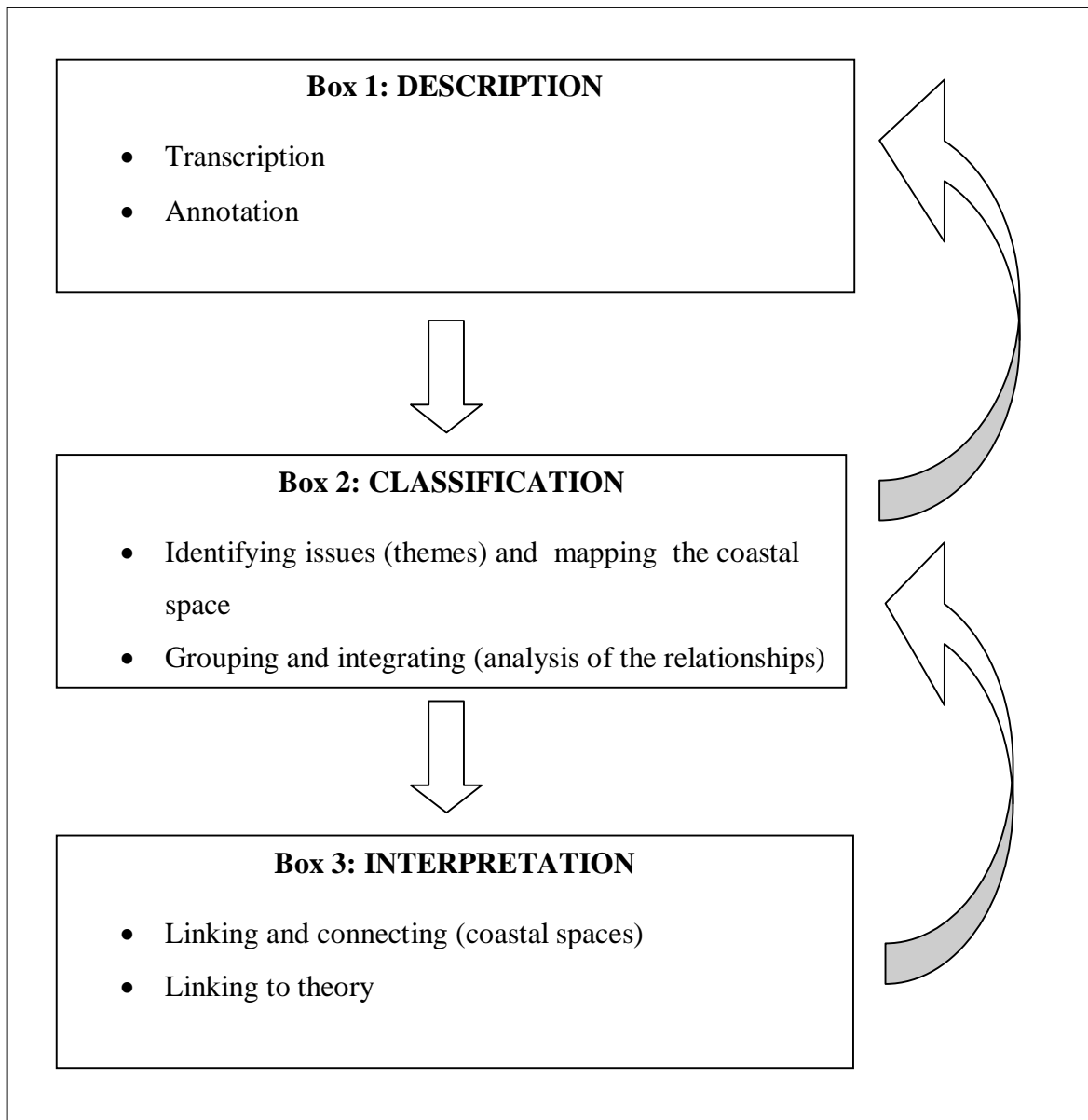
Pilot interviews (Table 3) were conducted with three respondents to test the questions prior to them being presented to all stakeholders. These pilot interviews were conducted with one scientist and two senior scientists from the Oceanographic Research Institute (ORI). The intention of these pilot interviews was to improve the wording of the questions in order to improve comprehension and also to identify other potentially relevant questions. Data from the pilot interviews were not included in the final analysis.

Interview questions followed the funnel approach as used by Bless and Higson-Smith (1995). This technique begins with the questions that are fairly broad in nature. The questions ultimately become more refined to entice a response to specific issues. Although this approach has been applied to the entire interview schedule, each individual question, through the use of further probing questions, adopted the same approach.

To describe as accurately as possible interviewer responses, respondent interviews were digitally recorded with a Sony IC Recorder. Interviews were then transcribed for analysis. During the transcription process, memos and ideas were also recorded.

4.6 DATA CAPTURE, ANALYSIS AND INTERPRETATION

Data analysis was based on a slightly modified ‘omelette’ methodology as applied by Dey (1993, cited in Kitchen and Tate, 2000). This approach consists of the initial phase of data description (Box 1, Figure 7), followed by its classification (Box 2, Figure 7) and then finally interpretation (Box 3, Figure 7; Kitchen and Tate, 2000). Qualitative data used from each stakeholder interview were thematically grouped based on their relation to the different coastal spaces. Themes were determined through the interpretive analysis of respondent interviews. These themes, their apparent magnitude, and the nature of the linkages between the various themes as a system, were identified through a three-phase process (Figure 7).



(Source: Kitchen and Tate: 2000)

Figure 7: The process of interpretation.

The initial step of classification involved the identification of the various themes as coherent classes of data (Kitchen and Tate, 2000). These themes were then interpreted in order to yield a number of ‘coastal spaces’. To facilitate the interpretation and identification of the various coastal spaces, a thematic classification was devised and interview responses were graphically depicted in the form of a concept map for each interview (see Appendices 4.1 - 4.19).

Concept maps are graphic tools that facilitate the organisation and representation of knowledge (Novak and Cañas, 2006). These maps include concepts that are represented

by, and enclosed within, circles and/or boxes (Figure 8). The relationship between these concepts is indicated by a line that connects them.

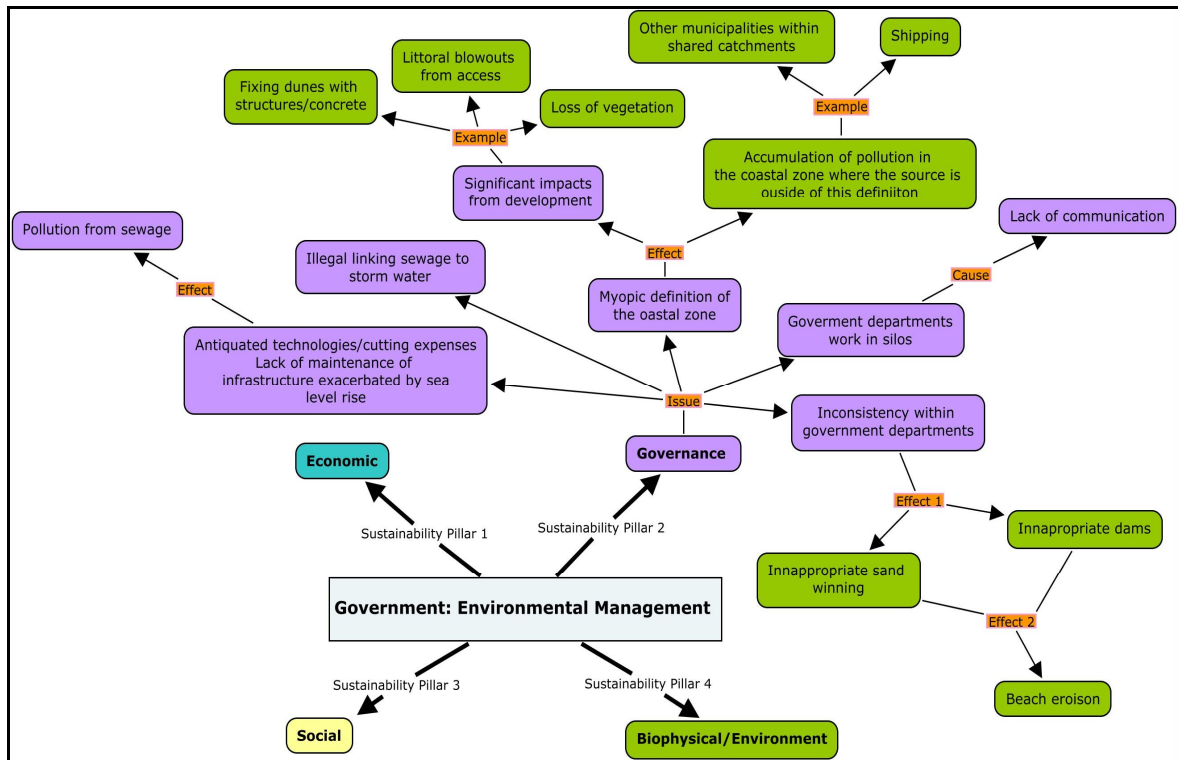


Figure 8: An example of a concept map.⁹

To validate the use of concept maps, it is necessary to determine the context in which this knowledge is situated. According to Novak and Cañas (2006:10), “a good way to define the context for a concept map is to construct a *focus question*, that is a question that specifies the problem or issue the concept map should have to resolve”. As such, focus questions are used to align knowledge within its context. The following focus questions in order of sequence were used to determine the nature of relations between the various coastal issues:

- 1) What are the key issues within coastal systems as stated by the respondent?
- 2) What are the causes behind these issues as stated by the respondent? and
- 3) What are the effects of such issues as stated by the respondent?

⁹ This concept map depicts the responses of an interviewee from the government sector (function: environmental management) subjected to a semi-structured face to face interview that intended to identify and map coastal spaces based upon the four pillars of sustainability.

As this research intends to promote an understanding of sustainability within coastal regions, and considering that sustainability has been accepted as the hegemonic discourse in environment, planning and development in South Africa (Oelofse *et al*, 2006), the structure of the concept map was initially guided by clustering the various issues according to their relation to the four pillars of sustainability. The four pillars of sustainability are:

Environmental

The environmental pillar of sustainability focuses on maintaining the ecological integrity of natural systems. Natural systems, as the biophysical baseline, function as a life-support system. The key towards environmental sustainability lies in achieving the balance between maintaining a biophysical baseline that supports human activities whilst not compromising the ability of natural systems to sustain themselves, in their own right (Oelofse, 2009b).

Economic

Economic growth achieved through development and the subsequent creation of employment is seen as the major means to alleviate poverty in South Africa. However, economic growth achieved through development, but which does not take into consideration the capacity of ecological systems to support this growth, or does not consider social concerns, is not sustainable. Economic sustainability therefore focuses on striking a balance between achieving optimal economic growth whilst maintaining the integrity of ecological systems and minimising the negative impact on social systems (Oelofse, 2009b).

Social

Social sustainability focuses on the resilience and vulnerability both at the level of the individual as well as broader scaled social systems. The 'fabric' of the social pillar of sustainability is made up of aspects such as identity, participation, equity, quality of life and social networks. Coping mechanisms that are adopted towards promoting sustainability also forms part of this social dimension. The presence of coping mechanisms plays a significant role in enhancing the capacity of local people towards more informed decision-making. The ability with which people are able to influence decisions is dependent upon power relations, vulnerability and the depth of democracy (Oelofse, 2009b).

Governance

Environmental governance is the fourth pillar of sustainability. The degree to which sustainable development is achieved is largely influenced by the effectiveness with which the state governs, and its decision-making capability. Although governance is the responsibility of the state, there are cross-cutting issues from the social and economic pillars that may impact on the state's ability to govern effectively. One of the goals of sustainability is to maximise the ability from which the state may govern democratically through being inclusive of a wide variety of stakeholder interests and values (Oelofse, 2009b).

These four pillars of sustainability were established as parent nodes within the concept maps. The focus questions were then used to provide a means to obtain a collective understanding of what may be the cause, or effect of issues identified in the parent nodes. In the case where the respondent did not elaborate, i.e. did not identify the reason behind the cause or effect or vice versa, no further child or sibling nodes were created. To enhance the clarity and understanding of the concept map, each pillar and corresponding issues were assigned a unique colour. This classification system was applied to each of the respondent's transcriptions to encourage a standardised approach with which to analyse responses.

To provide an indication of the contextual setting of the data depicted in the various concept maps, the respondents were classified according to the sector within which they were employed and their individual function. This classification is provided in Appendix 5 showing the sector and function of each respondent. The use of sector and functionality provided a link between the nature of the respondent's perceptions and the positionality of the respondent in terms of the institutional context within which they operate. The necessity of including both sector and functionality is based on the assumption that the institutional setting in which the respondent is positioned, shapes the nature of the respondent's perceptions. It was also recognised that respondents may express a different opinion depending on whether they were representing their institutional or professional¹⁰ view. The questionnaire was structured to encourage a distinction between these views. It must however be noted that the distinction between the institutional and professional

¹⁰ This research views 'professional' and 'personal' opinion as the same thing.

opinion was ambiguous at times. During the interview process, a respondent would typically state an institutional opinion upfront but the response would gradually lapse into an expression of their professional opinion or *vice a versa*.

The construction of the concept maps was also used to facilitate the second phase (Box 2, Figure 7) of the 'omelette' approach, viz. the analysis of the relationships between the different coastal spaces identified by the respondents. The employment of 'cause and effect' focus questions provided a means to identify and depict a relational connection between the various spaces. This phase in turn fed into the third phase whereby linkages between the various spaces were determined and the manner in which these spaces function and interact together to form a system, was explored. The collective functioning of these components and relations was then linked back to the theory in the literature review.

It is important to note that this process was iterative: classification cannot precede description, similarly interpretation cannot precede classification. The former task may be modified to enable a more appropriate route into the following task (Kitchen and Tate, 2000).

Through engaging with respondents, an increasing number of issues (and the nature of relations between such issues) relating to the coastal space, were identified and ultimately culminated in the 'collective wisdom' of the set of coastal stakeholders. This collective wisdom was depicted on a single concept map. Due to the great variation of stakeholder perceptions, it was realised that this was not a practical approach as it did not provide a structured medium from which to further analyse the data. As such, four tables, each focusing on a pillar of sustainability, were created to provide structure to the data. Through a content analysis, an example of an extract of one of these tables is given in Table 4.

Table 4: Extract of an example of a table representing the biophysical/environmental pillar of sustainable development

ISSUE	DESCRIPTION	SECTOR	FUNCTION
Pollution (13) ¹²	Pollution is caused by many sources and has negative impacts, both directly and indirectly on all four pillars of sustainability namely: social, environmental, economic and governance. Major sources include sewerage, effluent from pipelines and discharge from catchments. Sources may be way beyond what is legally defined as the coastal zone.	Government (5) ¹³	Planner (1) ¹⁴
			Environmental Management (2)
			Surveyor General (1)
			Policy (1)
		Civil Society (5)	Consultant (3)
			Environmental NGO (2)
		Parastatal (3)	Environmental Management (2)
Parastatal: Research (1)			
Dams, sand winning and dune mining (9)	The construction of river impoundments as well as sand winning effects hydrological regimes and sediment dynamics. This results in general environmental degradation, but more specifically, it contributes to the erosion of beaches and thus damage to infrastructure.	Government (3)	Environmental Management (2)
			Planner (1)
		Parastatal (3)	Environmental Management (1)
			Research (2)
		Civil Society (3)	Research (1)
			Planner (1)
			Environmental NGO (1)

The tables are structured with the issue identified by the respondents listed in the ‘Issue’ column together with the number of times that that particular issue was raised by the various respondents. This number provides an indication of the priority with which such issues need to be addressed: the more times an issue is raised, the greater the priority it should receive in terms of management interventions. As such, issues have been arranged in descending order. The first issue of each table represents the issue with the highest priority requiring attention. A more general description of the issues is given in the ‘Description’ column. This column provides a collective summary of the particular issue that was identified. The third column describes which sector raised which issue and how many times the issues were identified within a particular sector. The final column of ‘Function’ splits the sector up into the function that the individual from that sector performs, and again the number of respondents per function that raised that particular issue is noted.

¹² This figure reflects the total number of times a particular issue was raised.

¹³ This figure reflects the total number of respondents per sector that raised a particular issue.

¹⁴ This figure reflects the total number of respondents per function that raised a particular issue.

While the number of times an issue is raised may reflect the significance of a particular issue and the urgency with which it needs to be addressed, it is not necessarily an accurate reflection of the significance of that issue. For example, an issue may only be raised by one respondent. The respondent that raises the issue may however be highly influential in the function that the individual performs, and the sector the individual represents. To cater for the influence of power, and to determine the significance of particular issues, this research makes reference to an existing framework of power ratings as identified by Celliers *et al* (2007). This framework identifies the position of agencies and institutions that collectively make up the ICZM landscape in KZN in terms of their power ratings (Appendix 7). In this framework, power was considered as a function of political relevance, the ability to enforce decisions and/or regulations, legislative power, executive power and moral power. The definitions of which are available in Appendix 8.

4.7 STRUCTURE OF RESULTS

Based upon what has been discussed in the methodology, the results of this research have been categorised into three chapters, namely:

- 1) How do coastal actors conceptualise the coastal zone?
- 2) Critical issues and their relations within coastal spaces, and
- 3) Identifying relative and relational coastal spaces.

The structure and the mechanics of the first two results chapters (Chapter 5 and 6) are explained in this section. Chapter 5 which presents how coastal actors conceptualise the coastal zone highlights the differing manner in which different actors perceive the coastal environment. ‘Critical issues and their relations within coastal spaces’ (Chapter 6) identifies, through broad based participatory engagement, the various issues that are relevant to the coastal zone. Chapter 6 feeds into the final results chapter whereby the issues uncovered have been used to identify the various relative and relational spaces associated with coastal regions. Within Chapter 7, the identification of the various spaces is substantiated through the lens of selected case studies. This serves to underline the relevance of such spaces to coastal management (Figure 9).

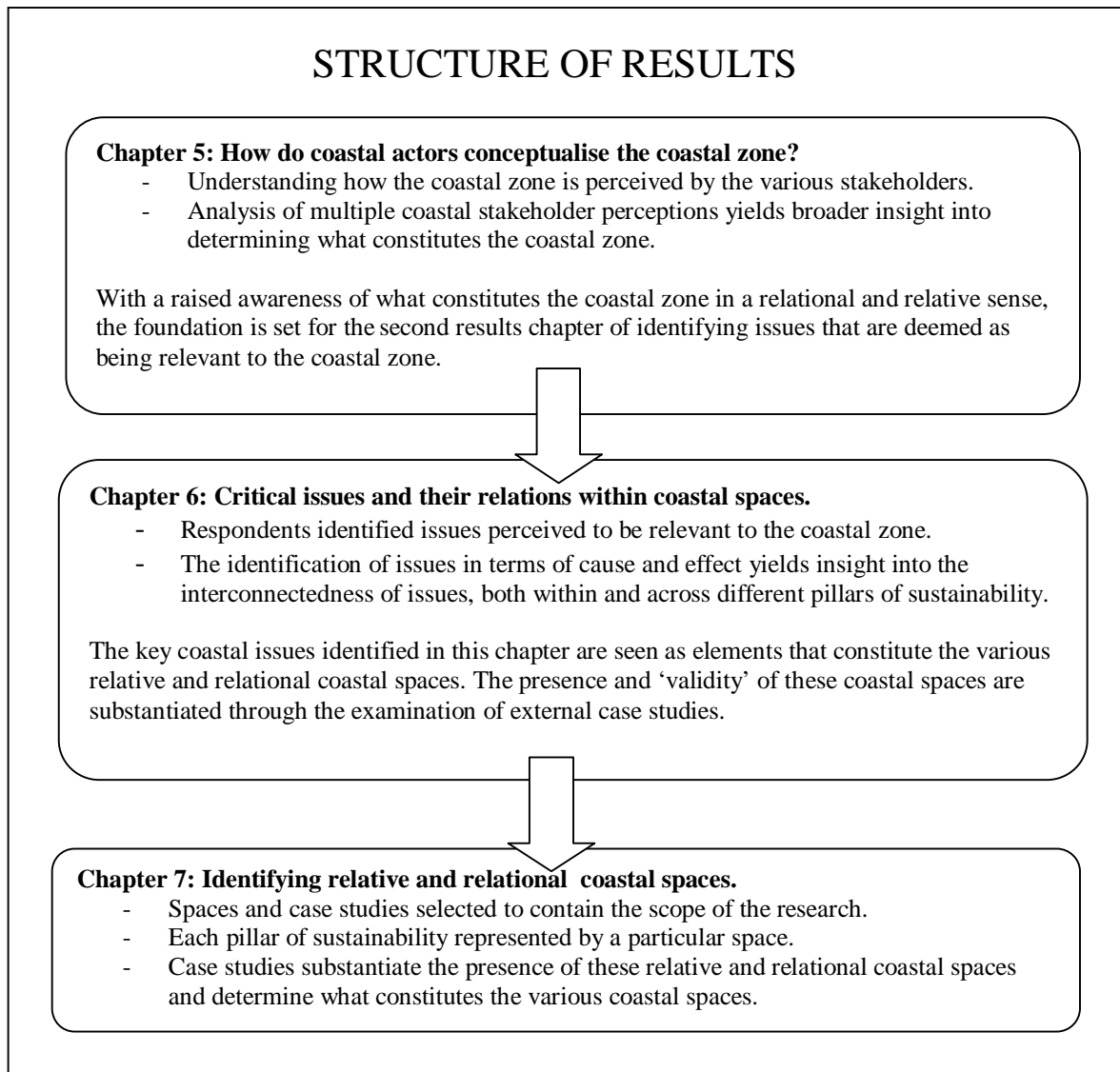


Figure 9: A brief overview of the structure and content of the results chapters.

The following structure has been applied within Chapter 7 which presents relational coastal spaces: firstly, a particular space is identified and defined, e.g. the space of risk. These ‘spaces’ were determined based upon the issues that respondents raised. Case studies were used to highlight these issues, and were therefore used to substantiate the existence of that particular ‘space’. The selection of these external case studies was purposive; as discussed previously these case studies were selected based upon location criteria and that they reflected an appropriate representation of the findings in this chapter. As some spaces are closely related, case studies are in some instances used to examine more than one space. For example, the Amended Environmental Impact Assessment of the proposed Small Craft Harbour, Durban Point Development, was used to examine both the economic and social space of the coastal zone in this location. Finally, a brief description

was given to the nature of such a space in terms of its position within a relative or relational context within the framework of coastal management. For example, the space of pollution may cover the extent of catchments which may extend many kilometres inland. Pollution events in catchments often impacts on the coastal zone. These events, although they may take place outside of the defined coastal zone, therefore share a relational link or connection with the coast. This reflects a relational space of pollution. This space of pollution, in terms of achieving increased degrees of sustainability, is also relative to legislation and the associated management prescriptions. As such the space of pollution is both relational and relative.

4.8 LIMITATIONS OF THIS RESEARCH

This research examines the coastal zone as a system of spaces. This research shows that the nature of such a system is dynamic and complex. Due to the timeframe of this research, as well as resource constraints, this research focuses only on key concepts and spaces reflective of the four pillars of sustainability. Additionally, not all of the representatives of the PCC were able to be interviewed. These included representatives from the Department of Water Affairs and Forestry as well as the Department of Mineral Affairs and Energy.

4.9 MAPPING THE COASTAL SPACES

Although a detailed review of the various coastal systems spaces and their linkages has been undertaken in both the literature review as well as the discussion, an attempt has been made to thematically represent the nature and extent of these coastal spaces through the application of GIS. The intention is to provide a visual cue to reflect the various relative, relational and absolute spaces. Each space will be represented as an individual layer. These layers may in turn be overlaid with other layers. It is acknowledged that the boundary of some spaces may be more easily defined and mapped than others. For example, a catchment may be indicated by a line following the highest contour of that catchment. Risk spaces may similarly be identified by the position of the 10 m contour setback line. These are examples of biophysical attributes with well defined boundaries. In those instances where coastal spaces have less well defined or obscure boundaries or that are dynamic in

nature, such characteristics will be duly indicated through the use of differing graphic illustrations. For example, the cadastral boundary may be represented as a solid line, whereas the HWM, to indicate that it is continually shifting will be represented by a fuzzy 'envelope of mobility'. These more relative and relational reflections of space will be overlaid against the coastal zone as an absolute space. These thematic representations have been set at a true scale and which shows the most detail of the various coastal spaces.

4.10 CONCLUDING REMARKS

This chapter has identified and discussed the various methods that have been used in this research. Through the use of qualitative methodologies and with the supplementation of less conventional techniques, such as concept and spatial mapping of relative and relational spaces, a unique perspective has been generated. Such a perspective yields important insights in solving the issues identified in this research: namely the most appropriate way of defining and managing the coastal zone from a spatial perspective.

CHAPTER 5: THE CONCEPTUALISATION OF THE COASTAL ZONE

5.1 INTRODUCTION

This chapter focuses on exploring the nature of the ‘coastal language’ or discourse used by coastal stakeholders. The analysis of the conceptualisation of coastal zones is substantiated through the use of oral evidence taken from respondent interviews. The nature of these conceptualisations, as indicated through respondent answers, in turn are linked to their professional role and compared with other respondent conceptualisations of the coastal zone. Linkages are drawn between these conceptualisations (and the common themes that arose out of these conceptualisations) of the coastal space, with the definitions discussed in section 5.3. Throughout this process, reference is made to the theoretical framework of this study.

The central aim behind this research is to determine what constitutes the coastal space, and to determine the impacts of the use of absolute space in defining coastal space. This is especially significant considering that South Africa’s first legal instrument (ICM Act) to promote integrated coastal management focuses on the ‘coastal zone’ and is thus dependent upon the meaning of the ‘coast’ as portrayed through its definition. Although descriptions (definitions) are a product of social constructions of an entity, definitions may conversely be used to reflect perceptions and social constructions. This research therefore examines the manner in which coastal stakeholders define the coastal area and is used to explore the meaning of the term ‘coast’.

The following results provide an account of what coastal stakeholders perceive to constitute the ‘coastal space’. It must be noted that although distinct themes have been identified and isolated as spatial units i.e. defining the coastal zone by means of catchments, plant communities, viewsheds etc., it is important to note that stakeholder perceptions are not solely bound to any one theme. In some cases, the language with which individuals describe the coastal space spans multiple themes. As such these themes

become implicated in a flow of spatial relations. The themes identified in this chapter include the coastal zone as:

- 1) a viewshed;
- 2) an absolute space;
- 3) a legal space;
- 4) a social space;
- 5) a biophysical space;
- 6) an economic space, and
- 7) a system of spaces.

Although quotes are used to display the various themes in isolation, the theme of the coastal zone as a 'System of Spaces' is used to capture and substantiate the notion that the coastal zone consists of a multiplicity of connected spaces.

5.2 THE COASTAL ZONE AS A VIEWSHED

The coastal zone is defined by numerous stakeholders as the area from which the ocean can be viewed (Plate 1 and 2). This is known as the coastal viewshed. A viewshed may be defined as that area where any natural element may be visible from one or more vantage points (Whitehead, 2004). In this case, the natural element associated with being coastal is identified as the sea. Thus, wherever the sea may be seen from whichever vantage point, such a point falls within the coastal zone. The identification of the coastal zone through a visual space is predominantly expressed by town planners, namely eThekweni Municipality (Coastal Catchment and Policy Department as well as Development and Planning), Tongaat Hulett Developments and a consultant specialising in the field of environmental economics. With regards to the opinion of the latter, it is indicated that coastal zones should be perceived and defined in context. For example: "if you think of a cluster of services around aesthetic beauty, then you go to viewsheds associated with the coast" (Business Portfolio Leader: Futureworks, 13/12/07). The same respondent notes that if you investigate pollution and water quality issues, the coastal zone may be defined by the extent of catchments (Business Portfolio Leader: Futureworks, 13/12/07). Catchments therefore, in the context of addressing pollution issues, reflect a biophysical

space with which coastal zones may also be defined. The relativity and relations of these spaces will however be addressed in more detail in the theme of a ‘System of Spaces’.

The coastal zone is also identified as a visual space through the perspective of the Planning and EHS Executive, Tongaat Hulett Developments. This respondent indicates that coastal viewsheds play a significant role in determining the market value of properties. It is suggested that the visual appeal of coastal areas may be impacted upon by the establishment of high-rise developments. This is especially the case in Umhlanga Rocks (Plate 1), where development is obscuring the coastal viewshed (Planning and EHS Executive: Tongaat Hulett Developments: 23/11/07).



Plate 1: Booming development in Umhlanga, KZN, reflecting both the appeal of the coast, but also the negative impact that high rise buildings have on coastal viewsheds and the associated aesthetics.

Considering these two examples, the coastal zone becomes implicated within a visual space for two main reasons. Firstly, the significance of the coastal viewshed is related to its aesthetic value. Secondly, and as a product of this aesthetic appeal, is the economic value of coastal property that is influenced by the existence of coastal viewsheds. The

perspective provided by the Senior Planner for eThekweni Municipality (15/11/2007), and as similarly voiced by the Business Portfolio Leader of Futureworks (13/12/2007), describes the coastal zone as a combination of viewsheds and catchments. The Senior Planner for eThekweni Municipality (15/11/2007) suggests that:

“...the coastal zone is not just your narrow beach and your actual surf zone, it is an area that relates to the coast, visually and functionally. If you are a couple of kilometres away but you have a view of the sea and your storm water run-off effects the coast, I would consider this the coast”.

She goes on to say that: “as soon as the visual relationship and storm water is not so strong, I would not consider it to be a coastal area” (Senior Planner, eThekweni Municipality: 15/11/2007). The nature of the coastal zone definition thus captures and describes a biophysical spatial unit (catchment) as well as a visual space. The latter space is strongly influential as a social attraction and associated economic value¹⁵.



Plate 2: The coastal viewshed as seen from Berea Ridge, Durban, KZN.

¹⁵ Refer to Hamilton, J. (2007) for the quantification of this value of coastal viewsheds through the application of hedonic pricing.

As previously mentioned, respondent conceptualisations are not bound to a particular theme on how coastal zones may be perceived and defined. For example, the Project Executive: Coastal Policy suggests that:

“...as a municipality we would look at a distance of four to five kilometres offshore. A lot of our infrastructure is in that zone. We obviously want to understand what the impacts around that would be. We would draw a line approximately five kilometres offshore. Inland would probably be a distance where the viewsheds are. To explain that it would be the Berea ridge” (Plate 2, Project Executive: Coastal Policy, eThekweni Municipality: 05/10/2007).

The coastal zone in this sense is defined by a visual space, reflected by the use of the viewshed as well as an absolute space, reflected by the suggestion of a boundary four to five kilometres offshore.

5.3 THE COASTAL ZONE AS AN ABSOLUTE SPACE

According to several respondents’, the coastal zone is defined by a set of absolute boundaries (Planning and ESH Executive, Tongaat Hulett Developments: 23/11/2007, Project Executive: Coastal Policy for eThekweni Municipality: 05/10/2007 and the Surveyor General, Department of Land Affairs: 07/12/2007). These boundaries are determined by the position of the HWM and other arbitrary boundaries such as 100 m inland of the HWM (Figure 10).



Figure 10: The use of absolute demarcations to determine the ‘position’ of the coastal zone.

The identification of attributes which determined the placement of absolute boundaries does, however, vary between respondents. According to the Planning and EHS Executive, Tongaat Hulett Developments (23/11/2007), the coastal zone is described as that narrow strip along the beach as defined by absolute space:

“I don’t see the coastal zone as being what the Bill [Integrated Coastal Management] says such as one kilometre from the high water mark. It is a much more refined and narrow zone effectively. Maybe 100 m from the high water mark so to speak. I do acknowledge estuaries and rivers need to be looked at as part of the coastal zone....the coastal zone is generally directly along the coast next to the high water mark and needs to include the ocean and marine environment as well”.

Although the coastal zone in this sense is primarily determined by the upper (HWM) and lower (LWM) reaches within which the sea fluctuates during a lunar month, the respondent acknowledges the role of estuaries and rivers within coastal regions.

Another parameter which can be used to define the coastal boundary (inland) is based on elevation. The use of a predefined elevation contour for setting the inland boundary of the coastal zone is raised by the Project Executive: Coastal Policy for eThekweni Municipality (05/10/07):

“For me coastal zone management really should be managing the area between 12 nautical miles up to probably a good few kilometres inland. This could be argued because some definitions talk about 60 kilometres inland. For us, we have a steep topography, we can talk about a couple of kilometres, but Mozambique that has coastal floodplains, you can go 50 to 60 kilometres inland”.

According to the Surveyor General, the coastal zone is defined by the position of the HWM and the LWM. Although it is acknowledged that both the HWM and the LWM are not fixed and that the coastal zone is dynamic in nature, descriptions of the coastal zone by the Surveyor General are dependent upon and restricted to references made to the presence and position of absolute boundaries. According to the Surveyor General, the coastal zone is described as “...that area between the high water mark and the one kilometre mark [inland] and those are both defined in the Sea Shore Act [Act 21 of 1935].that

definition will also be brought forward into the new Integrated Coastal Management Bill” (Surveyor General, Department of Land Affairs: 07/12/07). The Surveyor General acknowledges that these boundaries are ambulatory in nature and that the coastal zone is a dynamic environment:

“...the coastal zone is something that is not fixed in area. The high water mark and the low water mark do change, particularly the high water mark does change as we have seen [in] the floods and the excessive high seas in March” (Surveyor General, Department of Land Affairs: 07/12/07).

It is evident from the above data that the coastal zone is defined in absolute terms. The HWM and the LWM are the key parameters that are used. The position of the HWM and LWM are also used as reference points to determine the position of boundaries further inland.

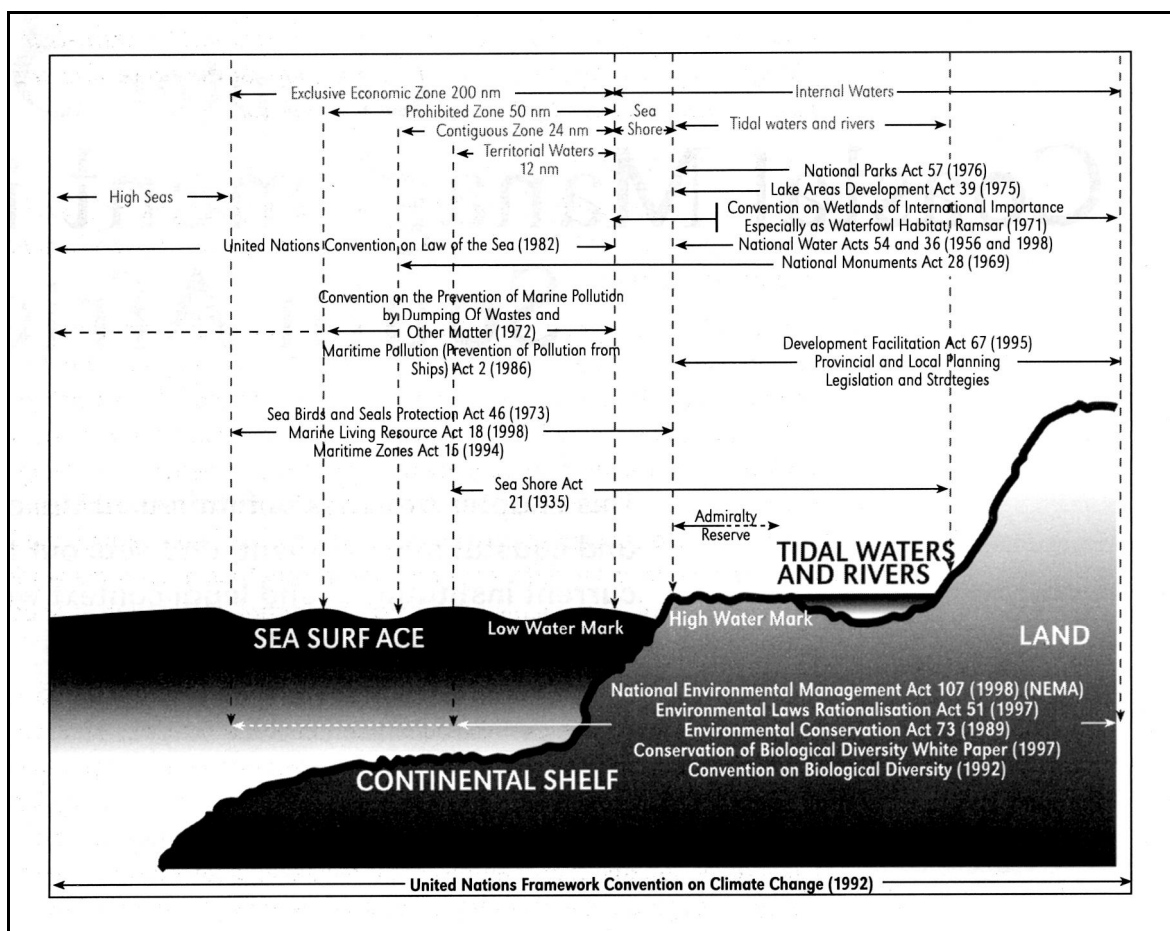
5.4 THE COASTAL ZONE AS A LEGAL SPACE

The legal space is strongly linked to the absolute space within which coastal zones may be defined and contained. The presence of absolute demarcations, and the subsequent legal discourse that develops around the ‘position’ of the coastal zone, results in the formation of a coastal ‘legal space’.

An example of this legal discourse is the Surveyor General’s emphasis and reference to the location of absolute demarcations (as indicated in section 5.3). The significance which is attached to these boundaries by the Surveyor General is attributed to his core responsibility as the ‘protector of rights’ (Surveyor General, Department of Land Affairs: 07/12/07). Reference is made to these boundaries as these boundaries aim to clarify the rights and responsibilities pertaining to coastal resources. It is within this legal context that the coastal space is fixed into a so-called ‘position’ through the use of absolute boundaries. The use of boundaries that provide a platform for some point of reference is similarly noted by the Environmental Manager of eThekweni Municipality: “...one has to think about legal definitions which are there just purely because you need logistical limits to where you apply your decision making” (Environmental Manager, eThekweni Municipality: 11/12/07). The use of artificial boundaries to ‘apply your decision making’

is similar to the State of Delaware (section 3.5.6) where roads (representing artificial boundaries) have been used to guide the decision making process to protect the livelihoods of coastal communities and restricting potential harmful development.

Through these examples, it is evident that boundaries are necessary as legislative frameworks are dependent upon a language that is precise. This ‘preciseness’ is facilitated through the establishment of artificial demarcations as defined by absolute space. Figure 11 provides a good example of the dependence of legal frameworks on demarcations as defined by absolute space.



(Source: White Paper for Sustainable Coastal Development in South Africa, 2000)

Figure 11: An indication of the complex legal framework used to govern the coast, and the dependency of such legislation on absolutely determined boundaries.

A link thus becomes apparent between fixing the boundaries of the coastal space and positivist epistemology: where speculation is avoided by objectivity and formal logic, this is achieved by the containment of the coastal space within boundaries. The use and analysis of empirical data as imbedded within positivist applications of science is reflected

in the application of absolute space to demarcate the coastal zone. The use of absolute space to define the coastal zone results in the formation of alternative spaces. This is directly related to Lefebvre's (1991, cited in Hubbard *et al*, 2004) statement where he suggests that to use absolute space to determine relationships between objects, is to create a 'relativised' abstract space. In this sense, not only is a geographic construct created, but a coastal legal space is created. As this legal space is founded within legislative frameworks such as the ICM Act, and due to the power and influence of such legislation, this legal space and its geographic representation is beginning to represent what is now becoming naturalised as the 'coastal zone' in South Africa.

Although it is the intent of legal definitions to 'contain' the coastal space to facilitate the development of explicit terms of reference, the analysis of respondent interviews indicates that there are a multiplicity of relational spaces that operate at broader spatial scales than catered for by legal definitions, which also have significant impacts on the coastal legal space. This is especially noted in relation to coastal zones as systems and the need for achieving integrated and sustainable coastal development. This is evident in the following statement from the Deputy Manager: Coastal and Biodiversity Management (15/10/2007):

"Legally it [the coastal zone] is quite a narrow area. But in my opinion....it is the area that is influenced by the sea, so it can be narrow and broad as well. If you are looking at pollution....your coastal zone is considerably wider because of the greater impact. Municipalities' inland, all their rubbish ends up in the streams....and then onto the beach. If you look at something like tourism the coastal zone is considerably wider. If you look at the areas that impact on the coast because a lot of tourists from inland come to the sea, the definition of the coastal zone is quite complex depending on the subject matter you are looking at. If you look physically at the area that impacts on the sea, then it is probably quite narrow".

Similarly, and in response to the question where the respondent was asked to give her perspective on what is meant by the term 'coastal zone', the following answer was given:

"In the South African context....the coastal zone inland would be about a kilometre from the high water mark and...100 m to 200 m out towards the sea side. Strictly speaking and....according to the legislative definition....the coastal zone would include all our legal coastal waters. And then....the coastal zone is a little bit broader than the one kilometre strip because there are a lot of the areas that are influenced by coastal processes even though they are more than one kilometre away. [For example] Many parts of an estuary and towns that

develop on a coastal location...in some ways you could argue that the whole of Durban is in some way influenced by the coast” (Director, EnvironDev Consultancy: 14/11/07).

These statements are directly related to the issue of scale. A question was posed in section 2.1, namely what are the implications of a definition that is founded on a narrow scale? It is evident from the respondents’ perceptions that there are multiple scales at which the coastal zone may be conceptualised and defined. These may include the different ‘spaces’ that function at different spatial scales, i.e. the influence of tourism, pollution from catchments and development. The acknowledgment of processes that operate at broader spatial scales, but which have an impact on the coast is similarly reflected in the manner in which eThekweni Municipality defines the coastal zone in the Draft Coastal Management Strategy (section 3.5.2): the coastal zone is defined on three scales, scales which collectively ‘capture’ processes that may influence coastal socio-economic and environmental systems.

This research identified that the process of legally defining the coastal zone by absolute parameters has its basis in positivistic science and is thus a form of reductionism. Containing the ‘coastal zone’ within legal definitions based on the concept of absolute space effectively discounts broader and cross-scaled relations that influence this zone. This is substantiated by the Business Portfolio Manager, Futureworks, in response to the issue of demarcating the coastal zone:

“I think it is completely arbitrary [demarcations]...the coastal zone, it is this big thing...it is nebulous. Is it seascapes that we wish to preserve, or it is coastal beauty or fish stocks along the coast or you add them up and you say that is what makes up the coastal zone. The coastal zone...is the place where that happens. The problem is with those kind of words [regulations], they are artificial, you are trying to push a system into a little square box and that is half the problem why regulations don’t work is because you are wanting to make a one size fits all and it doesn’t” (Business Portfolio Manager, Futureworks: 13/12/07).

The issue of containing and reducing the coastal zone within legal definitions based on the concept of absolute space, but which in effect consists of a broader scaled systems of relations, is similarly voiced by the Deputy Manager of Coastal and Biodiversity Management. This statement is given in response to the question of whether the legal definition affects the manner in which a person works with and manages the coastal zone:

“It’s going to. It currently affects the way that I work because my involvement stops outside of the coastal zone. The way it is done [defined] legally is 100m from the high water mark and ...there are a whole lot of activities within this area that are not allowed to happen unless you get authorization from my department. So my responsibility is to draw up best practice guidelines....for assessing those sorts of applications that come in. So the coastal zone is five times the size I suppose. You know the area that you are working in is much bigger. But it is a difficult one because....some of these really big developments might be outside of the defined coastal zone legally but they have such a significant impact on the coast. It actually seems short sighted to limit ones involvement just to that [narrow strip]. [For example] If you think about this development that’s been approved at Blythedale, the Blythedale Coastal Resort [that consist of] 4000 units. If you think of the impact in terms of number of people wanting to visit that beach, the number of sewerage systems that they are proposing....what is going to happen to that [treated] water? The whole environment is impacted; the coast is impacted significantly by the scale of that development which falls way outside of the coastal zone itself. It gets back to that original definition which is the area that impacts on the coast. That whole development will have significant impacts on the coast. You have got 500 properties along the beach. They are all going to want....access so your littoral active zone, in that case [Blythedale] has got very good coastal vegetation still on it. Everyone is going to make their little path through it and then you are going to have blow outs and the first thing they are going to say is that my view is not there anymore so they are going to cut down the vegetation, it will die and then you are going to have another Ballito where they want to put concrete right on the beach so they have the lovely views. So those are the sort of spin-offs that you have (Deputy Manager, Coastal and Biodiversity Management: 15/10/07).

It is through these examples that a parallel is apparent with the case study of the RNNP provided in section 2.2.2. This is a case study that explores the concept of relative space. It is argued by Tobler (1970, quoted in Hubbard *et al*, 2004:304) that “everything is related to everything else, but near things are more related than distant things”. It was shown that within the RNNP case study, it was not necessarily the case. The nature of relationships between objects is not purely governed by Euclidean distance (Harvey, 1969). Similarly, and as indicated by the respondent perceptions, there are multiple ‘external’ spaces that become relative and relational to the coastal space as contained within the legal definition. It is of concern that although attempts are being made to encourage a more integrated approach to coastal management, ‘external’ spaces which have an impact on the coastal zone as contained within a legal definition, are not being recognised and addressed.

Although absolute boundaries are used within coastal regions to encourage precise terms of reference, ambiguities (and the associated confusion) still exist within jurisdictional responsibility. For example:

“From a jurisdiction point of view, we [eThekweni Municipality] are tied basically to the high water mark because contrary to what people believe the country is being divided into wall to wall municipalities, it is not quite correct. Part of the coastal zone is not under the control of municipalities. It is actually vested in the national government. We have this ribbon that goes around the shoreline. The whole of South Africa is actually managed by government agencies not municipalities....that does complicate lives. If we are attending to a water rescue, some surfer, swimmer....it is actually out of our land jurisdiction, the municipality’s area basically ends at the high water mark” (Project Executive: Coastal Policy for eThekweni Municipality (05/10/07).

The ‘fuzziness’ of coastal legislation and its associated responsibilities described above further substantiates the statement by Williamson *et al* (2005:2) that coastal zones are characterised by “...complex relationships and interactions between overlapping and often competing rights, restrictions and responsibilities, both in the marine environment and at the land-sea interface”. Although well defined frameworks are put in place to address these issues, there is the indication that such frameworks cannot always define and manage all the issues that arise as a result of the relative and relational nature of such spaces.

5.5 THE COASTAL ZONE AS A SOCIAL SPACE

In contrast to the manner in which coastal zones are defined through the use of demarcations as defined by absolute space described in section 5.3 and 5.4, some respondents describe the coastal zone within the context of a social space. It is significant to note that although references are made to the coastal zone as a legal (absolute) definition by a particular respondent, the same respondent makes reference to the coastal zone as a space other than the mainstream legal space. For example, with regard to EIAs, the Deputy Manager, Coastal and Biodiversity Management, states that they are subject to the law that the coastal zone is the 100m strip inland from the HWM. However, the same respondent also refers to the coastal zone using a much broader definition in the context of tourism:

“The fact that we are a holiday destination....predominantly....the latest tourism stats put it 80% of South African tourists come here for the beach before they go anywhere else. Internationally [tourism] it is not as much. But they still come to the beach first. So in that sense the definition [of the coastal zone] gets so much broader in terms of what and who impacts on it [the coastal zone] (Deputy Manager, Coastal and Biodiversity Management: 15/10/07).

In this sense, the coastal zone is not perceived by position of absolute boundaries, but rather the coastal zone is described as a set of social relations. From this respondent’s perspective, it is evident that there is a set of connections between the various spaces constituting the coastal zone, depending upon the context within which the coast is being described. These relations and the resultant spaces identified by the respondent as relative to the coast therefore shape how it may be defined.

Although the respondent, in her institutional capacity, indicates that the definition of the coastal zone becomes broader based upon the context in which it is perceived, in a professional/personal capacity, the coastal zone is a spiritual place, a place for recreation where you can swim, watch the sea and walk: a place of attachment (Plate 3) (Deputy Manager, Coastal and Biodiversity Management: 15/10/07).

Plate 3:
Tourist
visiting
Durban’s
beach front
and enjoying
the beach: a
reflection of
the coastal
‘social space’.



These attributes may represent the very appeal that drives the tourism industry. Supporting a similar perspective of the value of the coastal zone is from the Chief Scientist, Natal Sharks Board: "...a very important aspect of the coastal zone is its visual appeal. It has appeal as an environment to spend time in and that suffers enormously from poor planning" (Chief Scientist, Natal Sharks Board: 21/11/07). The coastal zone therefore is an aesthetic/spiritual and recreational space. Such spaces are anchored to the physical attributes that are typically used in the description of the coast: the sea and the beach

According to the Senior Planner, eThekweni Municipality, the description of the coastal zone is based upon both a visual link to the sea as well as a link between the distance to the sea and its recreational potential:

"The property called Ridgeside¹⁶ near Gateway; it still has a visual link to the sea. In some ways I would consider this to be the coastal zone. People living here would be visiting the beach. They walk to the beach under the M4 underpass, there is a relationship here. Have to think what the relationship is, not just the environmental impact and not just from a land use point of view either" (Senior Planner, eThekweni Municipality, 15/11/07).

The area mentioned (Ridgeside) is perceived to fall within the coastal zone for two reasons: Firstly, it falls within the coastal viewshed, and secondly, there is a recreational link between the residents of Ridgeside and the beach.

The coastal zone may also become implicated in a space of competition and conflicting interests. This is primarily based upon the multiple ecosystems services that the coastal zone provides. For example, the Chairman of SDCEA (16/11/07) states that:

"I would like to see legislation that would say no heavy industry being developed in the coastal zone. That the coastal zone must belong to the people of South Africa. The people should have a say in anything that happens in the coastal zone. I think that is crucial for any legislation. But also what we want.... is transparency, [and to be] equitable and it must be all people, must not just be a few people. We have seen that most of our coastal zone has been bought out bybusinessmen that are privatizing....and making it inaccessible to people. I would like to see legislation that says accessible to the majority of people".

¹⁶ Ridgeside is approximately 2.5km inland from the sea.

In this respect, the coastal zone is a setting whereby social inequalities are played out in terms of access to marine and coastal resources. It becomes a space of privatisation and social exclusion.

5.6 THE COASTAL ZONE AS A BIOPHYSICAL SPACE

The coastal zone may also be defined purely according to its biophysical attributes. The use of biophysical attributes, such as certain vegetation types to define the coastal zone (Plate 4), is raised primarily by natural scientists in this research. According to the Coordinator for Biodiversity Research, EKZNW (22/11/07), the coastal zone may be defined as follows:

“We have tried to define the coastal zone....in addition to being the marine component. On the terrestrial side the cut off point is fairly vague....so we have defined it as those areas that are bounded in the west by the hinterland vegetation types. If we look at the coastal strip, we are dealing with coastal grassland, swamps and woodlands and forest. So our inland boundaries are those vegetation types which are considered coastal and are on the coastal plain. But it isn't a direct match with the geology, with the quaternary and tertiary geology. If I were a geologist I would define it like that but I am more a terrestrial vegetation ecologist so I look at terrestrial vegetation....that is influenced by coastal environments....marine onshore rainfall and so on. But it is a bit of both, it is also the geology” (Coordinator for Biodiversity Research, EKZNW: 22/11/07).

Plate 4: Beachwood Mangroves Nature Reserve at the Umgeni estuary. The use of biophysical attributes, such as mangrove forests, to determine the extent of coastal systems.



Biophysical attributes are also used to define the coastal zone by the Director of ORI (05/10/07), although he uses a more functional level and approach:

“I would divide it [the coastal zone] into two levels....at one level I would identify....the dune region on the one hand and the immediate sub-tidal beach and/or rocky shores on the other hand as the immediate area of concern. But I would also see at another level....as a more functional relationship....coastal lowlands and catchments and continental shelves and Thugela banks....as being part of the coastal zone. Estuaries are a neglected part of the coastal zone....some work that we did identified some of the biggest estuaries in KwaZulu-Natal are in fact offshore....the Thugela bank is a more functional estuary in terms of its nursery functions for fish and shrimps than the river systems themselves. It is really an extension of the estuary in the coastal zone offshore” (Director, ORI: 05/10/07).

The definition and perception of the coastal zone by the presence of biophysical attributes, as evident in the above examples, reflects the mandate of the institutions that the respondents represent. From EKZN Wildlife the mandate is to “conserve representative samples of biodiversity in the province [KZN]” (Coordinator for Biodiversity Research, 22/11/07). From the perspective of ORI, the mandate is to “...stimulate community awareness of the marine environment through education and promote wise, sustainable use of marine resources through scientific investigation” (Oceanographic Research Institute, 2008)¹⁷. These respondents use biophysical attributes for determining the coastal zone. The following respondent, although also acknowledging the use of biophysical attributes to determine the coastal zone, identifies the parameters of the coastal zone as being based upon the geographical distance which people or communities live from the coast, but which are still dependent upon the coast for resources:

“For example, if you take the topography of Maputoland, where there is a long wide plain which has been influenced by coastal action and where people’s livelihoods are influenced by the fact that this is coastal rather than inland or mist belt or whatever. That strip will be a lot wider where largely topography limits the impact of the coastal environment. I don’t think it is just economic and livelihood, it is also the social issues that are associated with that. For some people access to the ocean is a social issue. It is an issue to do with traditional belief systems and practices and customs whereas for other people it is not so important. Similarly with diet issues for many people access to coast for fish or coastal and marine products is important and

¹⁷ This is the mandate of the South African Association for Marine Biological Research, of which the Oceanographic Research Institute is a division of. As ORI is primarily a research orientated institution, ORI’s mandate is aligned more with the ‘scientific investigation’ component.

for others it is not. All these factors affect the definition [of the coastal zone]” (Director, Phelemanga Projects: 07/12/07).

In this case, the definition of the coastal zone is implicated more by a social space, a space where people are dependent upon, or have relations with, the coast for their livelihoods. This highlights the importance of the issue of access to coastal resources, and critical links between social and ecological systems.

5.7 THE COASTAL ZONE AS AN ECONOMIC SPACE

The coastal zone is perceived as an economic resource. The coastal zone provides multiple ecosystem services, which in turn not only contribute to the Gross Domestic Product (GDP) of South Africa, but also to the livelihoods of coastal communities. The nature of these contributions is diverse and may be generated both directly and indirectly. For example, Durban’s beachfront is a popular tourist destination. The tourists in turn form the consumer base which ultimately supports the development of local businesses (Plate 5). These local businesses in turn provide employment opportunities to the broader community.



Plate 5:
Businesses
along Durban’s
beachfront
reflecting the
coastal
‘economic
space’.

The value of the coastal zone, through the field of environmental economics, may be quantified in monetary terms. It is interesting to note that, and as indicated by two respondents, an attempt is made to quantify the coastal zone. However, the parameters used to identify the coastal zone are shown to be wider than the definition, as given in the current ICM Act:

“I was involved in the White Paper in calculating the value of the coastal zone, a couple of us made economic estimates. When we did that we didn’t confine ourselves to 100m, we confined ourselves to the functional relationship between the two. In other words we looked at properties and agriculture....that were benefiting from being close to the sea. So the values were quite broadly calculated” (Director, ORI: 05/10/2007).

Similarly, the Deputy Director of Marine and Coastal Management (29/01/07) states that:

“It has direct value to me....from an economic value, an ecological value....and from a social value. Then professionally I am trying to optimally utilize the coast to the benefit of current and future generations but also to the benefit of South Africa. If you look at the White Paperthat was the first time that we tried to quantify the value of the coast....it was 179 billion Rand per annum....it made the politicians sit up and think about it. It is much more than the value of the fish for example. We are looking at the value of Blue Flag tourism beaches. We have just commissioned a study next to Margate....the Nkonyoni Estuary....where they have looked at the value at that estuary. So there are some studies in South Africa looking at the value of coastal resources. But it is a fairly new field”.

This statement provides support for the notion that there are multiple ecosystem services provided by coastal environments. Respondents were asked where and how they set the parameters for calculating these values. Again, and to provide a value of the coast for the White Paper, the coastal zone is substantially more expansive than the way it is defined in the ICM Act:

“If I remember correctly it was quite wide. For two reasons we wanted to make sure that the value was high and I think therefore we adopted the World Bank approach which says 60 kilometres [inland]. So in our sums we....included the fish, but also the revenue generated by the wine lands for example” (Deputy Director, Marine and Coastal Management: 29/01/07).

On a broader economic scale, the value of the coast is also reflected in the position of large and prosperous cities that are located on the coastline. These large cities owe their status and developmental potential to the synergies offered by coastal environments.

5.8 THE COASTAL ZONE AS A SYSTEM OF SPACES

Through the analysis of respondent conceptualisations, it is evident that respondents are not restricted to defining the coastal zone according to a single theme. The manner in which the coastal zone is defined is dependent upon the context within which the coast is being described. It is established that multiple themes are referred to not only by the same respondent within the same interview, but that different respondents identify similar themes. The coastal zone therefore can be defined as a multiplicity of different spaces. It is also noted that the various spaces are not discussed in isolation. Respondents talk about a specific space which leads to another and so on. The connections and links between the spaces in terms of how they are described, indicates the conceptualisation of a set of relations between the various spaces. This theme of a 'System of Spaces' is therefore identified to highlight exactly this: that the coastal zone is a multiplicity of interconnected and interdependent spaces.

In response to the question where a respondent was asked to give his perspective on what is meant by the term 'coastal zone', the following answer was given:

"Well it is always contextual...if you think about a cluster of services around aesthetic beauty, then you go to viewsheds associated with the coast. If you relate to water quality issues....then your catchments are the main inputs into that. I think it is a difficult thing to determine. Don't think there is a clear answer for that. It is somewhere near the coast. Even Durban could be called a coastal city, even parts of it 50 kilometres away. Like....you might say eThekweni Municipality has a coastal zone....you might say eThekweni is a coastal city, which means....it has implications for the entire area 50 kilometres inland around that. It all depends on what you are doing. If you consider the role of the coast in a city....that zone could in fact be quite big. I mean you could even say KwaZulu-Natal is a coastal province....South Africa may be a coastal country....Lesotho isn't, Zimbabwe isn't, Malawi isn't. So there are very different levels of which to consider the coastal zone. So there are states, provinces, municipalities,you could go down to things like properties, ownership that have linkages indirectly or directly with the coast. It all depends on the context....it gets confusing" (Business Portfolio Leader, Futureworks: 13/12/2007).

This statement not only identifies the need to conceptualise the coastal zone in a relative and relational context (based upon what the issue may be) but it also reflects the importance of recognising the concept of scale. The above respondent identifies the issue

of scale by suggesting that the definition of the coastal zone is dependent upon the scale at which it is considered. The nature of the definition and the spatial extent that the definition covers is dependent upon the issue which drives the need for establishing that particular definition. For example, pollution in catchments is identified as a relative issue to management prescriptions for the coastal zone (see section 7.3 of Chapter 7 for more detail). Pollution may be channelled to the coast via rivers. Such pollution may have, for example, negative implications for Blue Flag status. The definition of the coastal zone (and the coastal legislation that is guided by this definition) should therefore be extended to capture the relational and relative space of pollution. In a biophysical and spatial sense this translates into covering the entire area of the catchment.

The coastal zone is therefore defined by process orientated parameters. The role of catchments as a biophysical representation of a process orientated space features prominently in many of the respondent perceptions of what constitutes the coastal zone. According to the Deputy Director: Marine and Coastal Management: “If you want to manage [the coastal zone] in a bigger extreme, an estuary for example, you need to make it [the coastal boundary] much wider and include the catchment” and “...if you have an estuary that is tidal for 17 kilometres for example the Sundays River, it [the coastal boundary] will potentially be 18 kilometres inland. People forget that is the way it works”. Similarly, and according to the Chief Scientist, Natal Sharks Board (21/11/07), the coastal zone is “...approximately a 500 meter to 1000 meter strip along the shore above the high water mark and then arguably it would be the boundaries of the major estuaries as well because what happens there is going to have a direct impact on the coast”.

Although reference is made to absolute demarcations, an attempt is made to ‘capture’ processes that show relational links to the coastal zone. This approach thus reflects a more systems orientated perception. The approach of this definition to include processes that are associated with and influence coastal systems is related to Leach and Kitchingman’s (2005) approach whereby spatially based management approaches of natural resources should only be applied when the spatial dynamics of the resource is known. It is therefore implied that spatial demarcations should be set, for example, to capture catchments and their associated processes and influences on coastal zones. The need for such a management approach is apparent considering the interconnectedness of coastal systems:

“If you look at St. Francis Bay for example and the problem they have got with that erosion. It is because they have stabilised the headland dune field with exotics. Because they have modified the water coming out of the dunes....they have built a dam just upstream of the estuary, that effected the flushing and now the beaches are eroding. If you want to correct that problem, you will have to go inland into the catchment to solve all those problems” (Deputy Director: Marine and Coastal Management: 29/01/08).

This statement substantiates the need to expand the jurisdiction of coastal legislation, or at least the need to develop legislation that address issues that may have a negative impact on the coast. This statement also implies that planning and management prescriptions need to ‘look outside the box’. The ‘box’ in this case is the legal definition of the coastal zone as defined by absolute space. Coastal zone management must become issue-based and not obscured or refined to that narrow geographic construct naturalised through a definition defined by absolute space. There are multiple issues that may exist outside of this legally defined coastal space, but which are inherently connected to that legally defined strip. In terms of the statement regarding erosion in St Francis Bay, the question is asked: Why has a dam been built? The logical answer is assumed to be because there is an increased demand for water. A second question however arises: Why the increased demand for water? Answer: To provide water for increasing infrastructure and the expected service delivery. Question: What is driving this development and more importantly why is such development allowed to take place in what is obviously a dynamic area? Is it the local municipality’s need for an increased rates base, the privatisation and profit realisation of property within the coastal zone, or is it a lack of political will to control development within such a sensitive area? The questions continue *add infinitum* and so too does the complexity and scale of issues that these questions raise and migrate towards. Although the latter questions may be perceived as far removed from the direct management of the coast, they become linked to the physical ‘integrity’ of the coast (discussed in more detail in Chapter 7).

The argument of the need to adopt a broader perspective to address issues that are relational to the coastal zone is lent further support by the Environmental Manager at eThekweni Municipality (11/12/07):

“I think....legal definitions are there purely because you need logistical limits to where you apply your decision making. I think in terms of systems thinking....the coastal zone is quite a

difficult thing to define because if you are thinking about functional ecological systems. I can link everything in the city to that coast in one way or another which means I must apply my mind across all of it as it all contributes to the coastal zone. The influence of the sea extends that far inland because you define estuaries in terms of salinities....if you think of something like the Umdloti [estuary]....it actually extends way inland. Therefore the kind of setbacks that have been considered in the coastal management Bill don't reflect that....this is going to be the problem. We are going to have to juggle what is legally specified in law which will be a hard and fast line of some preset distance from the sea and then we are going to have to pull on board systems thinking which means that our definition of the coastal zone is going to be quite different. It is going to incorporate all the elements that we believe are necessary to a functional marine and estuarine environment....and that could extend well inland and may involve us considering activities and land use planning in the upper catchments in places like Hillcrest and Everton. As a functional analysis of the coastal zone, they would be key to it. That is going to be the difficulty for us. And that is our business because we are responsible for biodiversity planning in the city and if you look at our open space plan for the city, it is geared around ensuring a sustainable supply of environmental goods and services. A key element is keeping the coastal zone functional from an environmental goods and service point of view. Which means we can't afford to be limited by 100m from the high water mark if in fact the functionality of the coast depends on what development is inevitable”.

In this statement the coastal zone is defined as a system, a system in which the parameters extend way beyond the legal definition. The legal definition is therefore exclusionary. In this systems based conception of the coast, multiple spaces become apparent.

It is noted that there are clear linkages between the various spaces and these linkages may be represented in terms of influence. There is therefore a flow of relations between the various spaces. For example, the integrity of the biophysical component of coastal ecosystems influences the productivity of coastal ecosystems. The functioning of coastal ecosystems however also influences the productivity and output of ecosystem services, upon which many coastal communities are dependent upon for their livelihoods. The productivity of these services may however be negatively impacted upon by activities, such as sand mining, that takes place in the upper reaches of a catchment. The effectiveness of legislation towards mitigating the impacts of such activities is therefore dependent upon its ability to address issues on a more holistic scale. The need for legislation to be more inclusive is again substantiated in the following statement:

“And then if you are conserving water qualities in estuaries then yes that is, you have that asset. That means that you have to engage with the catchment. It does not mean that Vryheid¹⁸ is part of the coastal zone, but it is part of the system that you need to engage with. And you might have legislation to protect an estuary that will influence what somebody does in Vryheid” (Business Portfolio Leader, Futureworks: 13/12/07).

It is acknowledged by the Surveyor General that the management of the coastal zone cannot be confined to that space as determined by the position of HWM and the LWM (as representations of absolute space):

“This area [coastal zone as defined y absolute space] cannot exist in isolation. Have the sea on one side and the adjoining land on the other side. To what extent does that sea shore need the coastal bush, coastal grassland, fynbos or whatever exists adjoining that coastal zone and to what extent does that coastal zone require the sea, where the management of the sea itself impacts on the coastal zone?” (Surveyor General, Department of Land Affairs: 07/12/07).

This statement is especially significant. Notwithstanding the Surveyor Generals duty of the ‘protection of rights’ and the associated reliance on demarcations, acknowledgement is given to the importance of catering for process orientated mechanisms that function outside of the legal definition. Although the Surveyor General makes reference to biophysical attributes of systems (such as sea, coastal bush, coastal grassland, fynbos), according to the Business Portfolio Leader, Futureworks (13/12/07), the coastal zone consists of multiple systems that are interlinked:

“How we need to look at it [managing the coastal zone] is to say what is the problem, what is the scale or the location or the cause of that problem....that would be the basis for solving problems or management advice. So if you have a water quality problem in the Umgeni [estuary],....your [coastal zone] system would have to be going right up into Pietermaritzburg¹⁹. If you were dealing with plastic pollution on the beach, then apart from your catchment, it would then be your shipping network. That could be the whole of the sort of western Indian Ocean that you need to deal with....shipping practice up the Mozambique Channel right as far as Pemba and those places would be sources of plastic pollution that you need to engage with. Or you might deal with a turtle problem up on the north coast....and that means you have got to look at the whole home range of those turtles.... to the other side of Madagascar and Reunion and these kinds of places. So it relates to the issue. [You need] a

¹⁸ Vryheid is a town approximately 160 kilometers inland (as the crow flies) from the sea.

¹⁹ Pietermaritzburg is a town approximately 65 kilometers (as the crow flies) from the sea.

systems approach to the definition. I think that the coast is a place where things happen and generally it is not the place where things are caused. You know the coast tends to be more of a recipient of the land, ocean, river interaction so it's a nexus of a whole bunch of systems coming together: human systems, economic systems, and that is why it is a focus".

The description of the coastal zone as a 'nexus of a whole bunch of systems' is similar to what McFadden *et al* (2007) describes as constituting the coastal zone: a 'nexus of interacting socio-economic and dynamic natural systems activity'. This links directly into the theory of linking social and ecological systems: socio-economic and ecological systems are enmeshed but society has alienated itself from natural systems (Berkes *et al*, 1998). The question arises as to what role legislation, which is guided by absolute spatial parameters (coastal boundaries), has played in the polarisation of social and ecological systems? This question is more pertinent considering that legislation has classified and therefore effectively severed (though the use of artificial boundaries) a component of what is essentially a system that functions at much broader scales.

5.9 CONCLUDING REMARKS

This chapter shows that the coastal zone consists of a multiplicity of different spaces operating at different scales both temporally and spatially. To some respondents the coastal zone is conceptualised as a visual space as it is described as a viewshed.. The coastal zone also becomes a social space, a place of attachment: a spiritual place, a place where you can swim, walk, recreate and watch the sea. The coastal zone is also defined by some respondents by means of biophysical attributes and as such there is a biophysical coastal space. Respondents also conceptualise the coastal zone as an economic space: the coastal zone provides multiple ecosystems services that contribute to the GDP. It is also evident that the coastal zone is not limited to a particular space. Respondents describe the coast as a combination of spaces where these spaces often have an influence on one another. There are multiple spaces that make up the coastal zone and as such the coastal zone becomes a system of spaces.

This section also shows that the coastal zone as defined by absolute space (legal definition) creates an abstract 'legal space', a space that is static and fixed and which tends to marginalise the importance of the real, lived experiences: spaces of fluidity and openness.

An example of this is provided by the Environmental Manager, eThekweni Municipality. She argues that the key function of the Environmental Department is to maintain the ecological integrity of the coastal zone (Environmental Manager, eThekweni Municipality: 11/12/07). Through maintaining the ecological integrity, the productivity of ecological systems to provide ecosystem services is improved. This research shows that there are processes that take place at broader scales which have negative impacts on the integrity of ecological systems within the defined coastal zone. However, as jurisdiction of legislation is restricted to this defined zone, such legislation cannot be used to address those broader scaled issues. In this way the ability of eThekweni Municipality to maintain the productivity of ecosystem services, and thus improve coastal livelihoods, is reduced.

The various themes identified in this chapter, which reflect what constitutes the coastal space, is founded upon the analysis of stakeholder perceptions of the coastal zone. These perceptions reflect the knowledge of the 'lived experience' and understanding of the various stakeholders, in both their institutional and professional contexts. The results from this section indicate that this 'lived experience' and the 'real' coastal spaces highlight the shortfalls of abstract and fixed spaces that are generated from legal definitions. As a result, it is argued that legal definitions are ineffective and ill-equipped to deal with the complexities of coastal regions. Chapter 6 highlights these complexities by exploring a range of issues related to coastal zone management as identified in this research.

CHAPTER 6: CRITICAL ISSUES AND THEIR RELATIONS WITHIN COASTAL SPACES

6.1 INTRODUCTION

This chapter identifies, through stakeholder engagement, the various issues associated with the management of the coastal zone. This chapter only reflects issues raised by those stakeholders interviewed and therefore does not provide an all-encompassing list of coastal management issues. The issues identified by the stakeholders are broadly categorised according to their relationship to the four pillars of sustainability. For example, the issue of conflict which may arise between beach users over coastal resources is placed under the social pillar of sustainability, negative environmental impacts (that arise from pollution) is placed under the environmental pillar and so on. The structure of this chapter is based upon five sub-sections. The first four sections (section 6.1 to 6.4) represent the issues identified under each pillar of sustainability, namely: economic, governance, social and environment followed by a brief conclusion (section 6.5). These issues are reflected in tables that have been created for each pillar of sustainability. These tables are presented in a structured layout that reflects the issue, provides a description of the issue, lists the section and function that raised the issue, and indicates how many times an issue was raised.

It is acknowledged that an issue may be cross-cutting. For example: is the overexploitation of coastal resources a governance, social or economic issue, or is it a combination of all three? Limiting an issue to a specific pillar of sustainability is perhaps misleading and unrealistic. For this reason, concept maps for each respondent have been developed in this research to provide a visual indication of not only the nature of relations between the various issues in respect of cause and effect, but also the linkages between the different pillars of sustainability. Although concept maps are primarily used to reflect the complexity of the coastal space, such maps also reflect differences in respondent conceptions. These enable a link to be drawn between the nature of the respondent's perceptions and the functional role that that respondent performs (Figure 12).

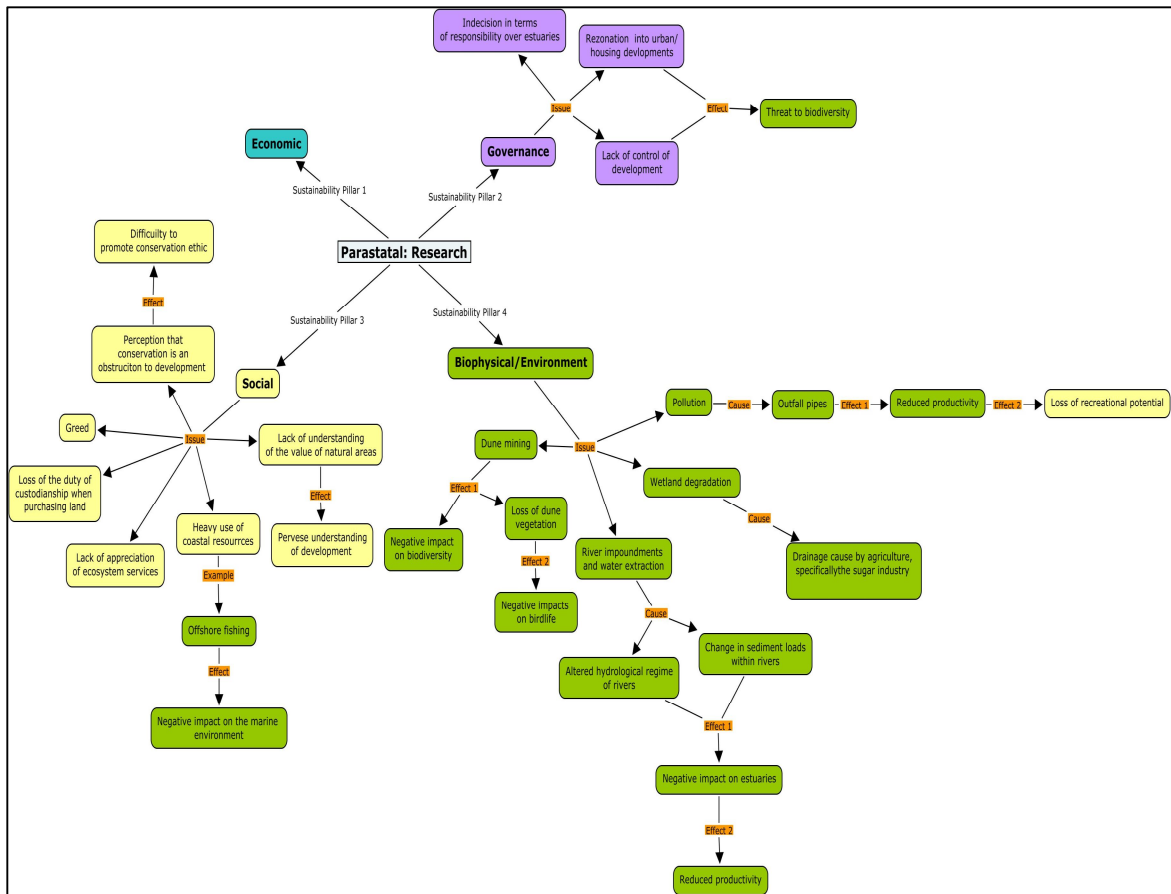


Figure 12: Concept map of the Coordinator of Biodiversity Research, EKZNW.

The link between the respondent's perception of coastal issues and the functional role that the respondent performs is indicated in Figure 12. This concept map reflects the conception of the Coordinator of Biodiversity Research, EKZNW. As this concept map indicates, biophysical associations feature prominently. This is in line with the respondent's functional role of promoting biodiversity within the province of KZN. There are however also associations made with the social and governance pillar but none to the economic pillar. The shape and content of such a map suggests that social and governance issues play a significant role in this respondent's professional mandate: that of the conservation of biodiversity. To provide greater detail, each pillar of sustainability within the concept map has sibling nodes. Each node reflects specific issues, for example, a lack of appreciation of ecosystems services by the public, a lack of understanding, indecision, poor planning and so on. Reflecting a different perspective, the composition of the concept map of the Head of Environmental Management, eThekweni Municipality (Figure 13) suggests that governing issues play a major role in the respondent's duty and ability to effectively manage issues that may have negative consequences on the environment. The identification of governance as the major issue towards managing the coastal zone may be

due to the fact that the respondent is a government employee and is ideally positioned to identify flaws within governing structures, or it may be that it is this pillar of sustainability that this respondent deems fundamental to sustainable coastal management.

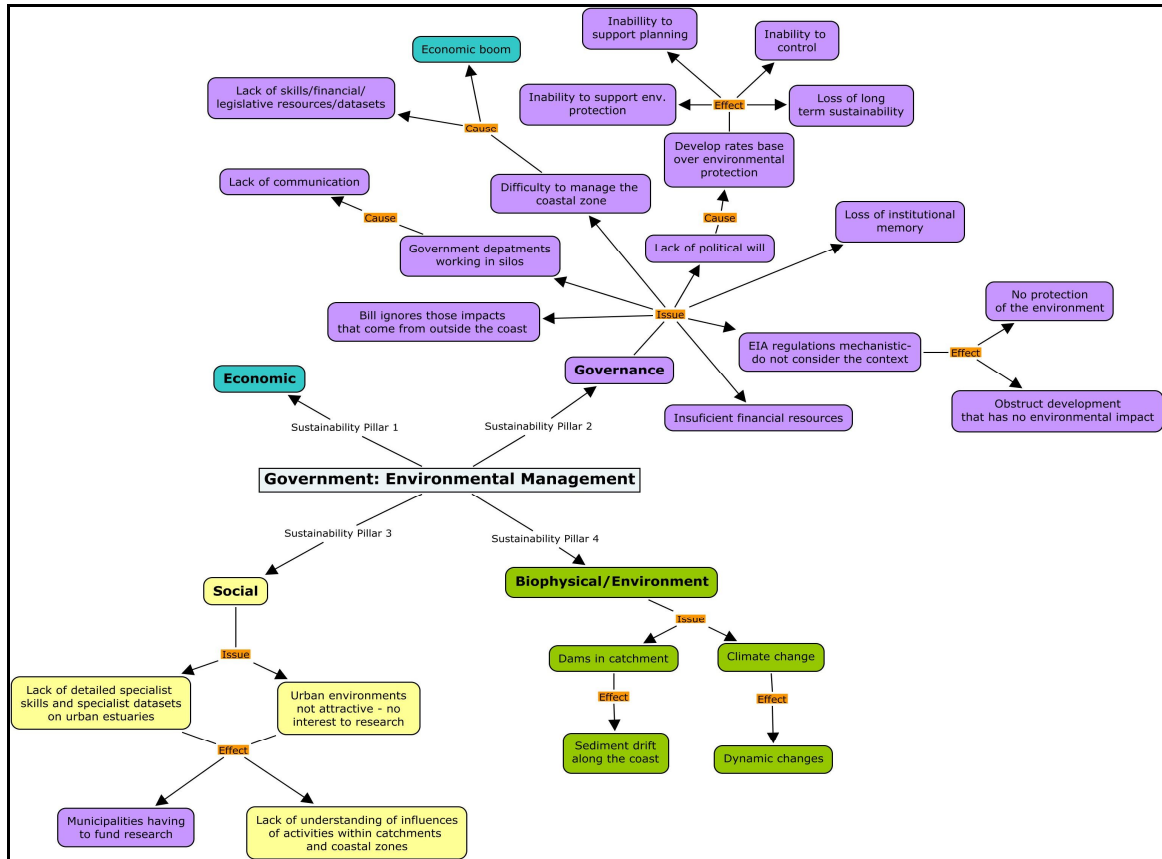


Figure 13: Concept map of the Head of Environmental Management, eThekweni Municipality.

In this section, tables have been used to give structure to information generated by this research. This section also reveals how and why concept maps have been used: to explore the interconnected nature of the various issues and to draw a link between the issues raised and the positionality of the various respondents in respect of their professional role. The following sections consider issues relevant to each pillar of sustainability in more detail.

6.2 THE ECONOMIC PILLAR

Economic issues are typically described as ‘end impacts’. The economic pillar is used as a benchmark with which to quantify impacts emanating from the other three pillars of sustainability. The respondents generally described economic issues as quantifiable negative impacts caused by issues arising from the other pillars of sustainability, and hence

is seen as an ‘end impact’. It is for this reason that the majority of economic issues are reflected upon in the other pillars of sustainability. There were however two economic issues identified by respondents that were seen to be the ‘cause’ to other problems (Table 5).

Table 5: Economic concerns of coastal stakeholders

ISSUE	DESCRIPTION	SECTOR	FUNCTION
The pursuit of achieving increased rates base (2) ²⁴	Increased rates base is achieved through the promotion of development by municipalities. This places more pressure on services as well as the natural environment.	Government (1) ²⁵	Policy
		Parastatal (1)	Research
Development of marine aquaculture (1)	Hormones and antibiotics used in marine aquaculture have negative environmental impacts.	Civil Society (1)	Environmental NGO

The first issue highlights the cross-cutting nature: local authorities are seen to pursue an increased rates base through promoting development and which, according to these respondents, takes precedence over other considerations. These considerations include whether the local authority has the capacity and resources to match this development with critical services provision such as water, as well as to protect remaining biodiversity or ‘green belts’. The pursuit of increased rates base, according to Table 6 (Governance), is a consequence of a lack of political will: there is a lack of influence or willingness at a political level to address environmental concerns. This is ultimately a governance issue and it therefore highlights the cross-cutting nature of this particular issue relating to the coastal space.

An example of the perception of an economic ‘end impacts’ is given by the concept map of the Business Portfolio Manager for Futureworks (Figure 14). This concept map is constructed from the perspective of an environmental consultant that specialises in the field of environmental economics.

²⁴ This figure reflects the total number of times that a particular issue was raised.

²⁵ This figure reflects the total number of respondents per sector that raised that particular issue.

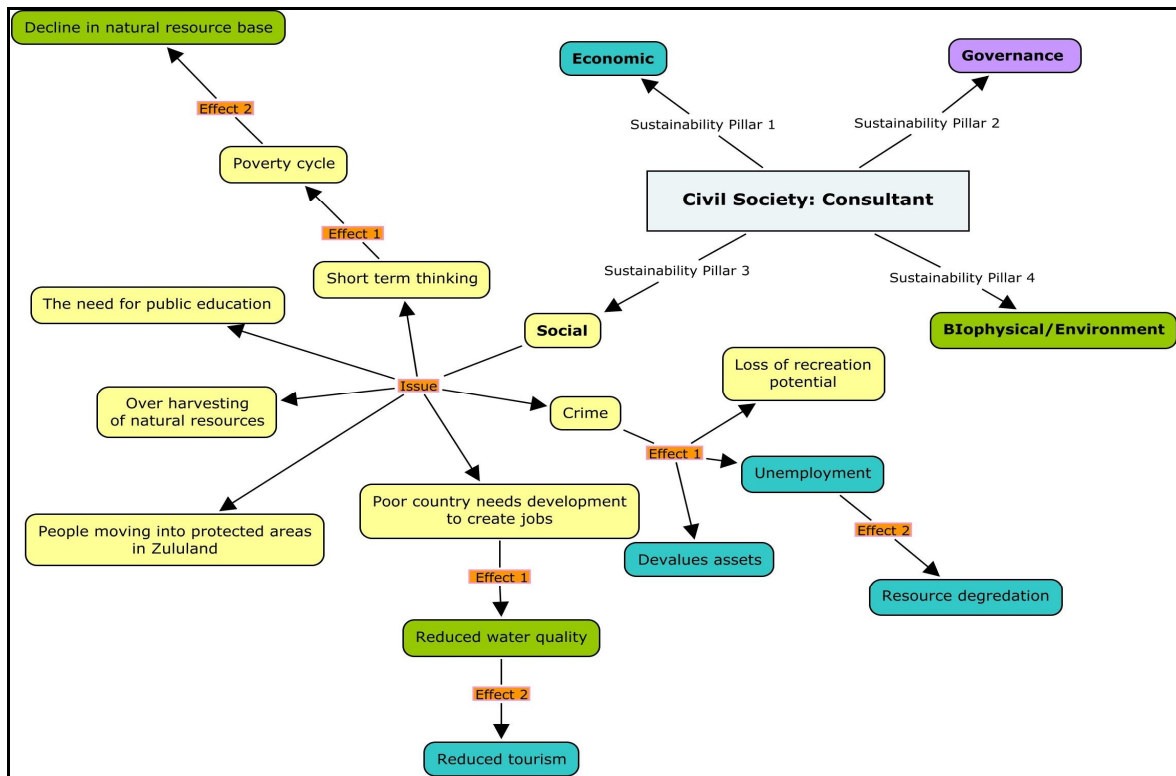


Figure 14: Concept map of the Business Portfolio Manager, Futureworks.

All issues that had no relation to the economic sphere were removed to facilitate clarity. According to the Business Portfolio Manager for Futureworks, negative economic impacts emanate from the social pillar. For example, South Africa is currently using development as a ‘vehicle’²⁷ to create jobs to alleviate poverty. However, one of the consequences of increased development is pollution and pollution in turn negatively impacts upon water quality (environmental pillar).

The reduction of water quality ultimately leads to a negative economic impact, e.g. a loss in tourism derived revenue (Business Portfolio Leader, Futureworks: 13/12/07). This is further substantiated in section 7.3 in relation to Blue Flag status. Crime, through a number of avenues, was identified by the same respondent as being a driver of negative economic impacts. Crime reduces the tourism potential of a region and as such tourism-based employment is lost. Unemployment effectively leads to the overexploitation and degradation of coastal resources (people are forced to harvest more from the land and sea) which in turn negatively impacts on biodiversity. It was also indicated that crime negatively impacts on recreation potential (people cannot walk by themselves along the beach in the evening in Durban) as well as devaluing assets such as coastal property.

²⁷ This ‘vehicle’ may formally be recognised as the Accelerated and Shared Growth Initiative of South Africa (ASGISA).

Through exploring issues through the chain of events of cause and effect, it is evident that the impacts of such issues are not bound to a particular pillar of sustainability, but that such impacts may originate from issues arising from different pillars. The pillars of sustainability are interlinked.

6.3 THE GOVERNANCE PILLAR

Key governance issues are identified in Table 6 below. The most common issue identified under the pillar of governance was that of the inability and ineffectiveness of governing authorities to effectively manage and plan for development along and within the coastal zone. The significance of such an issue is reflected in the fact that not only was this issue raised across a broad spectrum of functional groups²⁸, but that all functions of the government sector featured prominently in the identification of this issue.

Table 6: Issues identified within the governance pillar of sustainability

ISSUE	DESCRIPTION	SECTOR	FUNCTION
Ineffective management and planning for development (15)	Inappropriate and ineffective coastal land use planning and management prescriptions resulting in the un-sustainable development of the coastal zone.	Civil Society (7)	Consultant (3)
			Environmental NGO (2)
			Research (1)
			Planner (1)
		Government (5)	Environmental Management (2)
			Planner (1)
			Policy (1)
Parastatal (3)	Surveyor General (1)		
Inefficient, ineffective and conflicting legislation (13)	Legislation is mechanical and does not recognise contextual matters. Legislation is fragmented, conflicting and is applied inconsistently. As a result, it has led to much uncertainty which ultimately leads to the detriment of the environment.	Government (5)	Research (3)
			Environmental Management (2)
			Surveyor General (1)
			Policy (1)
		Civil Society (5)	Planner (1)
			Consultant (3)
			Environmental NGO (1)
		Parastatal (3)	Research (2)
			Environmental Management (1)
		Exclusionary management prescriptions and associated legislation (8)	Coastal regulations and management prescriptions are not contextual, they do not work in terms of systems complexity. Insufficient attention is directed towards broader scaled issues
Planner (1)			
Government (3)	Environmental Management (3)		

²⁸ This issue was raised by the greatest range of functions, on a par with the second issue of ‘inefficient, ineffective and conflicting legislation’ out of any issues identified across all four pillars of sustainability.

	that are directly related to the welfare of the coastal zone and dependable communities.	Parastatal (2)	Research (2)
Government departments work in silos (7)	Government departments work independently which is caused by a lack of communication as well as the perception of the need to protect their own interests. A lack of collaboration and information sharing results in duplication, inefficiency and a failure to coordinate planning in a holistic manner. This ultimately leads to inappropriate development.	Government (4)	Environmental Management (3)
			Surveyor General (1)
		Civil Society (2)	Environmental NGO (1)
			Planner (1)
		Parastatal (1)	Research (1)
Lack of political will (7)	There is a lack of political will and the pursuit of alternative agendas. This is especially evident in the pursuit of increasing the rates base through opting for development over environmental protection.	Government (4)	Environmental Management (2)
			Surveyor General (1)
			Planner (1)
		Civil Society (2)	Consultant (1)
		Parastatal (1)	Research (1)
Lack of resources (7)	A lack of resources, primarily skills and financial. This effectively reduces the capacity of coastal managers to maintain and promote sustainable coastal development.	Civil Society (4)	Consultant (2)
			Environmental NGO (2)
		Government (2)	Environmental Management (2)
		Parastatal (1)	Research (1)
Enforcement (4)	There is a lack of enforcement and control regarding activities that pose a threat to the integrity of the coastal environment.	Government (2)	Environmental Management (2)
		Parastatal (1)	Environmental Management (1)
		Civil Society (1)	Environmental NGO (1)
Indecision and lack of accountability (4)	There is uncertainty as to who has what responsibility. This lack of accountability hinders attempts of integration and ultimately leads to environmental degradation.	Civil Society (2)	Planner (1)
			Consultant (1)
		Government (1)	Environmental Management (1)
		Parastatal (1)	Research (1)
Lack of education (3)	Insufficient mechanisms in place to promote the education of coastal stakeholders regarding the wise use and management of coastal resources.	Civil Society (2)	Environmental NGO (2)
		Government (1)	Environmental Management (1)
Loss of institutional memory (1)	Loss of specialists results in the loss of institutional memory.	Civil Society (1)	Consultant (1)
Lack of maintenance of service provision infrastructure (1)	Antiquated technologies, cutting expenses and lack of maintenance of infrastructure leads to the gradual deterioration of service provision facilities. This deterioration is exacerbated by sea level rise which in turn ultimately results in greater levels of pollution.	Government (1)	Environmental Management (1)

Closely related to the issue of ineffective management and planning for development is the issue of inefficient, ineffective and conflicting legislation. This issue is identified by just as many sectors, again with a strong representation from the government sector. The broad spectrum in relation to sector and function with which these two issues are identified not only highlights the significance of these particular issues, but it is also reflective of the complexity and interconnectedness of these two issues both within the governance pillar and across different pillars of sustainability. For example, the privatisation of coastal land and subsequent inappropriate development (reflecting inefficient management and planning for development, lack of enforcement as well as a lack of resources) result in the subdivision of land into smaller, more fragmented units. This not only reduces the potential to promote biodiversity (environmental pillar) through the establishment of a network of conservation areas as green belts, but it also results in reduced access (due to the presence of walls and fences, especially from gated estates, see Plate 10) along the coast. This in turn negatively impacts upon people that depend on coastal resources for their livelihoods (social pillar). Although privatisation may contribute to a loss of access, the contribution of crime (social pillar), either directly or indirectly to the loss of access to the coast, cannot be discounted (again, the need for walls and fences).

Poor planning may also impact on the economy. For example, development that is allowed too close to the HWM ultimately requires the establishment of sea defence mechanisms. These sea defence mechanisms require constant maintenance. This translates in to an economic burden with indefinite timeframes imposed on local municipal authorities. Similarly, through artificialising and fixing the coast through development, the aesthetic appeal and the 'sense of place' associated to the coast is lost. This in turn impacts negatively on the tourism sector. Poor planning may be directly responsible, but more pervasive issues such as lack of political will also play a role in this. This 'pervasiveness' is reflected by the broad spectrum of government functions which raised this issue. Additionally, the issue of poor planning decisions may also be linked to the issue of a lack of accountability. This research argues that until local authorities are able to 'pin-point' and hold a specific entity accountable in respect of planning decisions, inappropriate development will continue unabated.

The issue of exclusionary management prescriptions raises the concern of scale. This is summarised by the Business Portfolio Manager, Futureworks (13/12/07) who indicates that

the coastal zone is ‘nebulous’ and that by developing and applying legislation to the legally defined coastal zone, is the same as isolating an integral part of a dynamic and complex system and forcing it ‘into a box’. This research reveals that many issues have both a direct and indirect impact on the legally defined coastal zone but may fall outside this ‘legislative box’. As such, these issues, or whatever may be causing them are not directly addressed by coastal legislation, even though they may be addressed by other environmental legislation and policy. Examples of this include pollution that emanates from shipping lanes, catchments and inappropriate development. Although these sources of pollution may fall outside of what has been defined as the coastal zone, they have severe cross-cutting impacts on spaces that constitute the coast. In this context it is suggested that legislation needs to be applied in a contextual manner as issues, such as pollution, are relative to coastal management prescriptions. This research argues that coastal legislation, or at least legislation that directly links to the sensitivities of coastal regions in relation to pollution management, should become applicable to municipalities that share catchments, even though these municipalities may be situated outside of what is legally defined as the coastal zone. It is interesting to note that within the governance sector, this issue was raised only by environmental managers and was not raised by any representatives from planning or policy functions. Due to the strategic level of this particular issue, it should ideally be resolved by planners and policy makers. Thus the absence of this issue from planning and policy circles is cause for some concern.

6.4 THE SOCIAL PILLAR

Table 7 reveals that the main concerns identified in this research under the social pillar of sustainability are a lack of education and insufficient scientific enquiry, over-harvesting of coastal resources and user conflicts. Ignorance and a lack of scientific enquiry are identified as issues by a wide range of functional groups. The functional groups that have identified these issues fall mainly within the sector of civil society, with a strong representation from the consulting industry.

Table 7: Issues identified within the social pillar of sustainability

ISSUE	DESCRIPTION	SECTOR	FUNCTION
Ignorance & insufficient scientific enquiry (9)	We do not fully understand the coastal zone as part of a larger system nor do we understand the impacts of our actions on such a system. This is attributed to a lack of education, a shortfall of scientific enquiry and a questionable ability to learn from such information.	Civil Society (6)	Consultant (3)
			Research (1)
			Environmental NGO (2)
		Parastatal (2)	Parastatal: Research (2)
		Government (1)	Environmental Management (1)
Over harvesting of coastal resources (9)	Coastal resources are being exploited and unsustainably utilised. This is primarily being driven by poverty as well as exploitation of coastal resources for personal gain.	Civil Society (4)	Consultant (4)
		Parastatal (3)	Research (2)
			Environmental Management (1)
		Government (2)	Surveyor General (1)
Planner (1)			
User conflicts (6)	There are user conflicts that take place within the coastal zone. This is primarily a result of the many services that the coastal environment provides, the subsequent competition amongst coastal stakeholders to exploit such services and lack of clarity surrounding rights and responsibilities over the use of these services.	Civil Society (3)	Consultant (2)
			Planner (1)
		Parastatal (2)	Research (1)
			Environmental Management (1)
		Government (1)	Environmental Management (1)
Lack of social responsibility (5)	There is a lack of social responsibility in realising our custodianship role over the environment as well as a lack of social responsibility towards respecting the needs of coastal communities that depend upon the coast for their livelihoods.	Parastatal (2)	Parastatal: Research (1)
			Environmental Management (1)
		Civil Society (2)	Consultant (2)
		Government (1)	Environmental Management (1)
Crime (4)	The impacts of crime are felt across a broad spectrum. Crime effectively limits the potential with which society can harness services provided by the coastal environment.	Civil Society (2)	Environmental NGO (1)
			Consultant (1)
		Government (1)	Surveyor General (1)
		Parastatal (1)	Research (1)
Pressure on the coast due to population growth (3)	Coastal regions are becoming overpopulated. This is resulting in increased pressure on coastal resources as well as an increase in user conflicts.	Civil Society (3)	Environmental NGO (1)
			Consultant (2)

Time frames and social memory (3)	The time frames with which we base the planning of our actions is short sighted. Similarly, social memory is selective.	Government (2)	Policy (1)
			Environmental Management (1)
		Consultant (1)	Consultant (1)
Lack of access (2)	Access to the coastal zone is being reduced as a result of privatisation of coastal land as well as over/inappropriate development.	Government (1)	Environmental Management (1)
		Civil Society (1)	Environmental NGO (1)

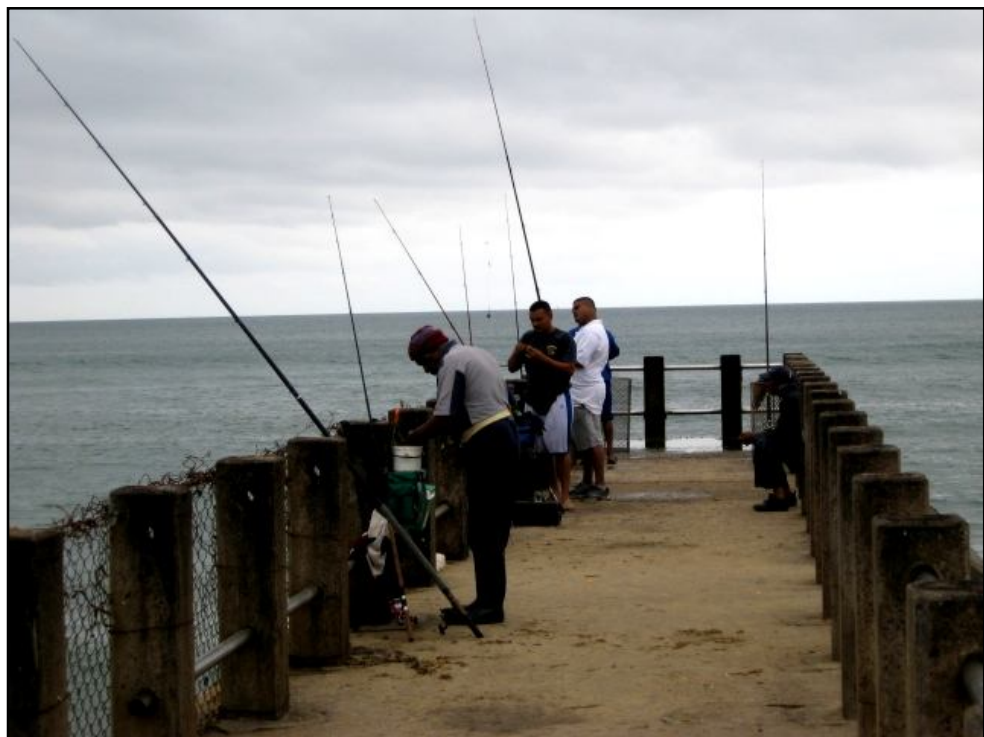
Although the main issue of education and insufficient scientific enquiry as well as the over-harvesting of resources are categorised within the social pillar of sustainability, the role of governance as a contributory factor underlying these issues cannot be discounted. Although these two themes are identified as the two major issues relating to the social pillar, respondents did not elaborate as to the cause of such issues. Through logical deduction, the role of governance systems in addressing issues such as lack of education and the subsequent lack of mechanisms in place to drive this education must be recognised. The lack of mechanisms in place to promote education to address the ‘ignorance’ issue can be questioned further: is this a consequence of a lack of resources within the governing sector?

As already noted, the two issues (ignorance and over-harvesting) are primarily raised by civil society, mainly within the consulting sector. Although the significance of these issues may be played down in respect of the consulting industries low power ratings (Appendix 6) as determined by Celliers *et al* (2007), it is argued that consultants are in effect powerful actors in shaping the process and direction of environmental decision making. This is as a result of the growing role the consulting industry is playing in response to a widespread lack of capacity in the government sector. The substantial power that the consulting industry is beginning to acquire indicates that the issues raised by this sector of civil society are significant and require intervention.

For the issue of user conflicts, two major causes are identified. Firstly, coastal regions provide a variety of ecosystem services. It is acknowledged that the variety of services in itself is not the cause of user conflicts, but emerges as a result of a number of other, more complex issues. User conflicts are compounded by the growing density of coastal populations and the subsequent increased demand and competition for these services. The

practice of baptisms and sacrifices, for example, has been identified as a conflicting issue within the coastal zone. Such practices may firstly be offensive to others, and secondly, such practices may lead to the reduction of the water quality. This in turn may impact upon the ability of beaches to maintain or achieve Blue Flag status. Fishing is also implicated in a conflictual setting (Plate 6). There is conflict between fishers and surfers, specifically along Durban's beach front. The waste left by fishers also negatively impacts upon the tourism industry, not only for the aesthetic appeal but also the standard of hygiene. Again, this in turn negatively impacts upon the ability of municipalities to maintain Blue Flag status. The loss of Blue Flag status reduces the potential of beaches to attract visitors and ultimately results in substantial economic losses (Kelly, cited in Carnie, 2008). The practice of baptisms and sacrifices as well as fishing, as means towards sustaining livelihoods, are fundamental human rights. Conflict resolution in this case is complex and relates to the management of the space in which these activities take place.

Plate 6: Fishing is often at the centre of conflict between other beach users along Durban's beach front.



The second compounding factor for user conflicts is the issue of legislative complications (and the resulting confusion over rights and responsibilities) that arise due to the dynamic nature of coastlines (this issue will be discussed in more detail in section 6.5.)

Although a lack of access has been identified by the least amount of respondents as a primary issue, access to the coastal resources was identified on several occasions as being a negative ‘end impact’. This research also shows that a loss of access to the coast is a consequence of a number of factors. Primary factors identified in this research include the privatisation of coastal land, the increasing market value of land with a view of the sea²⁹, as well as the prevalence of crime. The impact of crime is far reaching in its effect on all four pillars of sustainability.

6.5 THE BIOPHYSICAL/ENVIRONMENTAL PILLAR

This section identifies all those activities that have negative biophysical impacts on the coastal space (Table 8). These activities are typically a consequence of broader governance, social and economic issues.

Table 8: Issues identified within the environmental pillar of sustainability

ISSUE	DESCRIPTION	SECTOR	FUNCTION
Pollution (13)	Pollution is caused by many sources and has negative impacts, both directly and indirectly on all four pillars of sustainability. Major sources include sewerage, effluent from pipelines and discharge from catchments. Sources may be way beyond what is legally defined as the coastal zone.	Government (5)	Planner (1)
			Environmental Management (2)
			Surveyor General (1)
			Policy (1)
		Civil Society (5)	Consultant (3)
			Environmental NGO (2)
		Parastatal (3)	Environmental Management (2)
Parastatal: Research (1)			
Dams, sand winning and dune mining (9)	The construction of river impoundments as well as sand winning, effects hydrological regimes and sediment dynamics. This results in general environmental degradation but more specifically, it contributes to the erosion of beaches and thus damage to infrastructure.	Government (3)	Environmental Management (2)
			Planner (1)
		Parastatal (3)	Environmental Management (1)
			Research (2)
		Civil Society (3)	Research (1)
			Planner (1)
			Environmental NGO (1)

²⁹ Refer to Hamilton, J. 2007 for a more detailed analysis of the appreciation of coastal property, and the mechanisms that drive this appreciation.

Inappropriate development (8)	Effects of inappropriate development are felt at a broad scale. Such effects span the four pillars of sustainability and are primarily a result of illegal development, over development and development that outstrips the provision of services. Such development is a reflection of a lack of capacity and political will within governing departments.	Civil Society (4)	Environmental NGO (2)
			Consultant (1)
			Research (1)
		Parastatal (3)	Research (2)
			Environmental Management (1)
		Government (1)	Environmental Management (1)
Clearing coastal vegetation and destabilising the dune cordon (7)	Loss of coastal vegetation is primarily a result of development, opening up sea views and agriculture. This also results in the destabilisation of dunes damaging coastal ecosystems as well as coastal infrastructure.	Government (3)	Planner (1)
			Environmental Management (1)
			Surveyor General (1)
		Civil Society (3)	Consultant (1)
			Planner (1)
		Parastatal (1)	Research (1)
Climate change and sea level rise (6)	Climate change is essentially causing the sea level to rise, resulting in erosion. This in turn is having a negative impact on the infrastructure, the economy and aesthetics.	Government (3)	Environmental Management (2)
			Policy (1)
		Civil Society (2)	Environmental NGO (1)
			Consultant (1)
Development too close to the high water mark (5)	Development takes place too close to the HWM. This is primarily driven by market forces and the subsequent value of having sea views. Developing too close to the HWM results in increased pollution loads on the coast, decline in aesthetic appeal and increased vulnerability of coastal infrastructure to coastal erosion and storm surge events.	Government (2)	Surveyor General (1)
			Planner (1)
		Civil Society (2)	Consultant (1)
			Planner (1)
		Parastatal (1)	Research (1)
		Drainage of wetlands and estuaries (3)	Drainage of wetlands and estuaries takes place primarily as a result of the need to prevent agricultural land from becoming inundated, a general uncertainty and lack of clarity in policy as well as a lack of education.
Environmental Management (1)			
Government (1)	Policy (1)		
Dynamic coastlines and legislative complications (3)	The ambulatory nature of the HWM results in legislative and cadastral complications.		
		Surveyor General (1)	
		Civil Society (1)	Consultant (1)

Negative impacts from recreation (3)	Recreational activities may lead to the degradation of ecosystems. There has to be a trade off between limiting peoples' rights and the protection of those ecosystems within which the recreational activities take place. This may also result in the loss of conservation ethic within civil society.	Government (2)	Environmental Management (1)
			Surveyor General (1)
		Civil Society (1)	Consultant (1)
Dredging (2)	Dredging has a negative impact on both water quality and biodiversity.	Government (1)	Surveyor General (1)
		Parastatal (1)	Environmental Management (1)
Negative impacts of shark nets and shark attacks (2)	Shark nets result in by-catch of other species and thus have a negative impact on biodiversity. Shark attacks have a negative impact on tourism.	Parastatal (1)	Research (1)
		Civil Society (1)	Environmental NGO (1)
Species extinction (1)	Extinction of species is caused by a variety of different factors. These may include the degradation of estuaries and nurseries, climate change, the degradation of catchments and the over exploitation of marine resources.	Government (1)	Policy (1)

This research indicates that there are feedbacks that emanate from negative impacts on biophysical systems. For example, inappropriate development too close to the HWM displaces ecosystems, such as dune cordons. These dune systems provide regulatory services in their ability to buffer infrastructure against storm surge events. Development too close to the HWM, which has displaced natural ecosystems, is at risk from erosion and storm surge events (Chief Scientist, Natal Sharks Board: 21/11/07). The same applies to the drainage and loss of wetlands (Table 8) as wetlands absorb the energy of flood events and reduce the destructive potential of such events. Through the loss of these ecosystems and their services, the risk of infrastructure and society at large to environmental perturbations is increased. Resilience to environmental perturbations is thus reduced. Although this increased exposure to risk may be attributed to poor planning, poor planning may in turn be a consequence of ineffective governance, lack of capacity within government to regulate such activities or a lack of political will to prevent such actions from taking place. This example highlights the cross-cutting nature of such challenges applicable to the coastal space.

Based on the issues listed in Table 8, pollution is identified as the most severe threat to the coastal space. The issue of pollution is raised by respondents representing all the government functions interviewed in this research. The broad spectrum of functions that raised this particular issue indicates that the footprint of mechanisms that contribute to the problem of pollution is extensive. For example, pollution may be a result of ineffective regulations, insufficient enforcement, lack of social responsibility, lack of maintenance of service provision infrastructure and a lack of resources. Similarly, the effects of pollution are felt across just as great a spectrum. This broad ‘footprint’ of impact is highlighted in Figure 15 and 16.

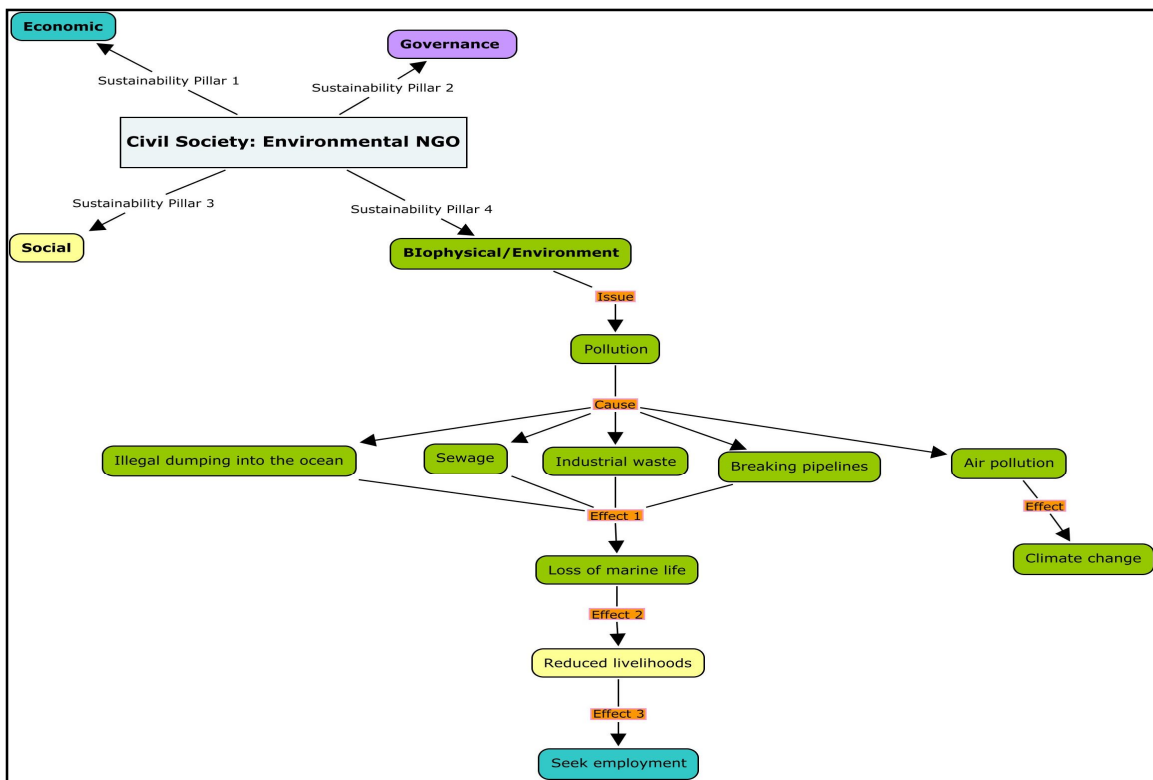


Figure 15: Concept map of the chairman of South Durban Community Environmental Alliance.

The major impacts of pollution as reflected between these two concept maps are identified as being negative impacts on human health, biodiversity, aesthetics, tourism and the economy. Considering the broad footprint of both issues that lead to pollution as well as the impacts that pollution has, pollution may be used as an indicator of a society’s capacity and willingness to achieve the broader imperative of achieving increased degrees of sustainability. A heavily polluted system would indicate that such a society at large is failing in its capacity and political will to become sustainable.

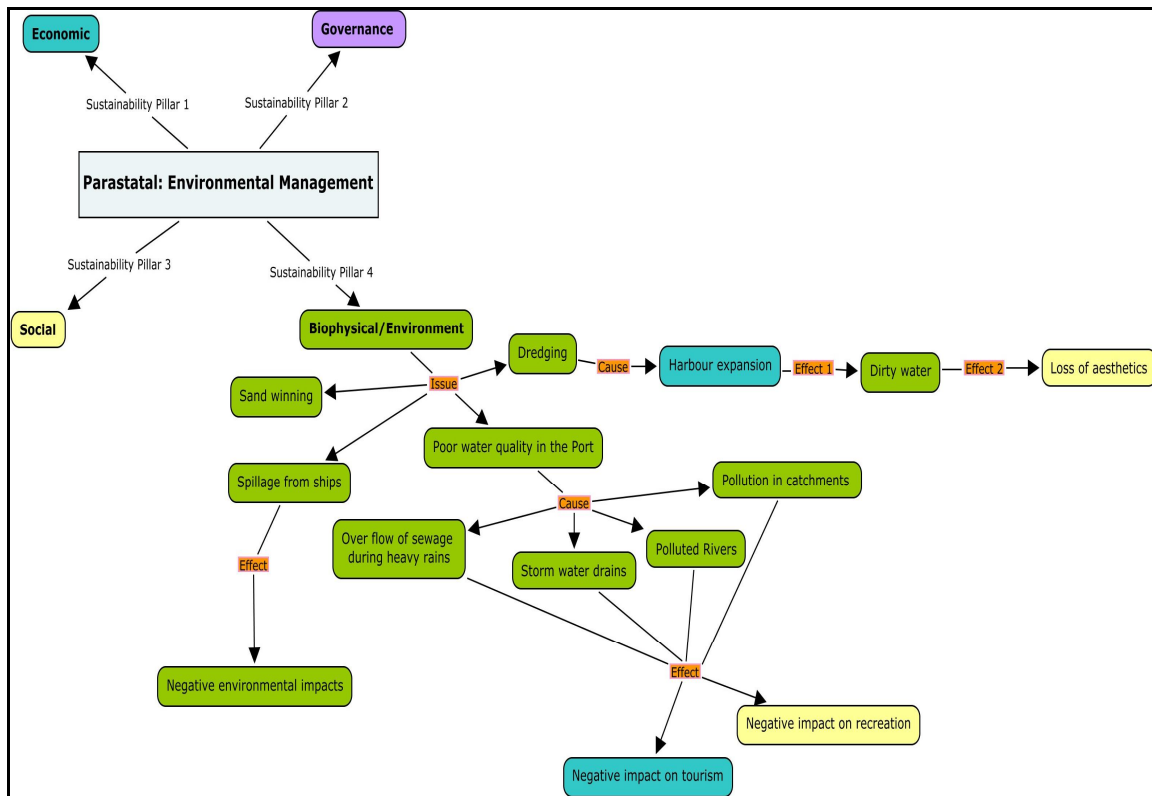


Figure 16: Concept map of the Environmental Manager: National Ports Authority.

The issue of pollution is a reflection of the non-sustainability of economic, social and governance systems. The impact of pollution, however, also provides an indication of the interconnectedness of biophysical systems. This interconnectedness is similarly evident in the second most highly rated issue, namely that of dams, sand winning and dune mining. As indicated in Table 8, these activities interfere in sediment dynamics which in turn has broad negative impacts. For example, dams in catchments effectively act as sediment traps. This translates into reduced sediment loads transported by rivers to the sea and as such less sediment gets recycled back to the beach. The ‘mushrooming’ of dams within catchments is therefore contributing towards the starvation of beaches of sediment. As a consequence of this, increased rates of erosion are being experienced and infrastructure is being subjected to increased degrees of risk from erosion and storm surge events (Senior Planner, eThekweni Municipality: 15/11/2007). Although negative impacts may arise as a result of the construction of dams, the presence of dams cannot be held accountable for these impacts. It is those processes that influence the construction of dams that are the real issues. For example, is the construction of dams, which leads to environmental degradation, a consequence of: ineffective management and planning for development, insufficient scientific information and research, the need for development as a means

towards alleviating poverty, or is it a combination of all? These are critical questions which highlight the interconnectedness and the complexity of relations between the four pillars of sustainability.

Although the issue of ‘dynamic coastlines and legislative complications’ (Table 8) is only raised by three respondents, this research argues that this issue underpins many of the broader issues identified in this chapter. The dynamic nature of coastlines is attributed to processes of erosion and accretion, which are responsible for the ‘shifting’ nature of the HWM and LWM. Legislation that represents rights and responsibilities of coastal stakeholders is guided by the position of the HWM and LWM as defined by absolute space. However, absolute demarcations cannot reflect these dynamics and this leads to ‘legislative complications’. The disjuncture that arises when boundaries determined by absolute space are overlaid against a dynamic environment is reflected in previously identified issues. These include: conflicting legislation (Table 6), indecision and lack of accountability (Table 6), user conflicts (Table 7) and development in relation to the HWM (Table 8). The description column in these tables provides more insight to the linkage between these issues and the ‘dynamic coastlines and legislative complications’ issue. The profile of this particular issue also needs to be raised considering the respondents (and their influential positions) that identified this particular issue. These respondents included the Surveyor General: Department of Land Affairs as well as the Deputy Director: Marine and Coastal Management. As discussed in section 5.4, the mandate of the Surveyor General is the ‘protector of rights’. The position of the Surveyor General in respect of this mandate, as well both respondents’ dependence upon clarity over where jurisdictional responsibilities lie (and the boundaries that determine this), raises the significance of this issue.

6.6 CONCLUDING REMARKS

Through the process of constructing the concept maps (Appendices 4.1 – 4.19) as well as Tables 5 to 8, information has been collected, interpreted and analysed in this research. It must be noted that as every attempt was made to portray a realistic and precise data set, the emphasis of this research is to provide an indication of the complexity of coastal zones in terms of the contextual settings and relational spaces. Whatever methods are used and

whichever researcher undertakes to determine what exactly constitutes the coastal zone, the results will always indicate that the coastal zone is implicated in a complex network of interconnected spaces. The strength of this argument is substantiated by the fact that conceptions of each respondent interviewed display the same pattern of complexity and interconnectedness.

Although the various issues have been categorised according to their relation to one of the four pillars of sustainability, such classification is used with the intent to highlight that in reality, such issues do not occur in a vacuum: there are always linkages to 'external' factors. This chapter shows that through the chain of events of cause and effect, the nature of relations becomes an intricate web of connections that are enmeshed across the four pillars of sustainability. This complexity has been uncovered through an analysis of multiple stakeholder conceptions of the coastal space. The analysis of these conceptions as a 'collective wisdom' enables a more holistic and realistic perspective of what constitutes the coastal space. Not only does this chapter reveal that the coastal space is a complex system in terms biophysical functionality, it also reveals that socio-economic systems become merged within this complexity (Figure 12 to 15).

Through exploring this complexity and identifying some of the major issues pertaining to the coastal zone, the foundation is set for the next chapter: identifying the relational spaces that construct the coastal zone, and exploring how such spaces become relative to coastal management prescriptions. The identification of these relational spaces is critical given the emphasis being placed on integrated coastal management. This research argues that it is the recognition of these relational spaces in management approaches and legislative frameworks that will result in stronger degrees of sustainability within coastal regions.

CHAPTER 7: IDENTIFYING RELATIONAL COASTAL SPACES

7.1 INTRODUCTION

This chapter identifies those spaces that are relevant to the management of the coastal zone. The elements that constitute coastal spaces are drawn from the issues as identified in the previous chapter. In order to substantiate the presence of these spaces and what they consist of, these spaces are examined through the lens of external case studies. The use of case studies also assists in identifying elements that would not typically be associated to a particular space. To exemplify: one of the issues identified in the previous chapter under the governance pillar, was 'Inefficient, ineffective and conflicting legislation' (Table 6). In terms of the perceived space of risk, the aforementioned issue is seen by the respondents as having no relevance. However, through the examination of a case study regarding the storm surge event that took place in KZN in 2007, one of the major obstacles to overcome and deal with the impacts and risk associated to the storm surge event (i.e. administrative procedures to follow for the installation of physical protective measures, insurance matters etc.) is the 'ineffective and conflicting legislation' (see section 7.2 for more detail). Thus the issue of 'ineffective and conflicting legislation' represents an element of the 'space of risk'. Although provision is beginning to be made by coastal planners for determining those areas that are in physical danger from storm surge events by means of the establishment of setback lines, the space of risk is more complex. It requires legislative frameworks to be in place to effectively manage the consequences in the event that property is damaged or lost due to storm surge events. There are other elements that collectively make up the space of risk, but these will be discussed in more detail later in the chapter.

The results of this research indicate that there are multiple coastal spaces, and the scale of these spaces is extensive. These spaces represent core areas in relation to coastal management that need to be addressed. This is not only to promote sustainable coastal development, but to promote increased levels of sustainability at large. Although a host of relational spaces may be identified and described, this research focuses on five spaces as a means of applying the concepts developed in this thesis to the coastal zone. These spaces

were selected based upon both contemporary issues surrounding coastal management, as well as being representative of the four pillars of sustainability. Discussing all the spaces relating to the management of the coastal zone would have resulted in the scope of this research being extended beyond what is deemed acceptable for a degree of Master thesis and hence the significant spaces have been identified and explored and are considered to adequately substantiate the argument made in this research. The spaces are the space of risk, the space of pollution, the economic space and the social space.

7.2 A SPACE OF RISK

Risk, in the context of this research, may be defined as the potential threat of sea level rise and/or storm surge events to damage or destroy coastal infrastructure. Drawing from the issues identified in the previous chapters, the space of risk includes aspects such as the construction of river impoundments (that lead to beach erosion), climate change and sea level rise as well as those mechanisms that result in development too close to the HWM³⁰. Through the examination of the storm surge event that took place in 2007 in KZN (Plate 7), these, and additional elements, are identified as constituting the space of risk.



Plate 7:
Destruction in
Ballito (KZN)
caused by the
March 2007 storm
surge event.

³⁰ These mechanisms include ineffective management and planning for development, insufficient scientific information, lack of political will and development as a means to alleviate poverty.

This case study shows, that in a biophysical sense, the space of risk may be determined based upon the position of exposed infrastructure in relation to the height of the land above sea level. In light of the March 2007 storm event in KZN, and considering that the height of the waves reached in excess of 8 m, it is suggested that, and in a simplistic sense, anything seaward of the 10 m contour is effectively at risk in storm surge events (Figure 17).



Figure 17: The 10 m contour of Durban CBD and surrounds effectively identifies the geographical area at risk (seaward of red line) from sea level rise and storm surge events.

Although it is estimated that such storm events that generate waves in excess of 8 m may only take place once every 10 to 12 years (Mather, 2007), the influence of climate change and the rapid rate at which coastal areas are being urbanised, provides good reason for the identification of coastal risk areas for land-use planning. In this context, the physical

impacts associated with the space of risk may be confined to parameters based primarily upon elevation³². If the space of risk is based upon the parameter of the 10 m contour, the physical space of coastal risk, extends inland beyond 100 m from the HWM in certain areas. This is especially evident in estuarine areas. However, and according to the ICM Act, is that the 100 m boundary, within urban regions, represents the landward limit of the so called ‘coastal zone’.

As this case study shows, in considering the indirect impacts that sea level rise and/or storm surge events may have on the livelihoods of coastal communities, the space of risk transcends from the physical space of the area as determined by the position of contour lines and enters the domain of management structures. In this context, the space of risk may be defined as any activity or impact that may relate to the proactive or reactive mitigation of sea level rise and/or storm surge events. In this sense, and using the KZN storm event as an example, the space of risk is implicated within governance structures and processes. The ability with which the impacts of such events are able to be mitigated is strongly dependent upon the effectiveness of governance structures that are in place. This may exist in the form of the establishment and implementation of coastal development guidelines as a proactive approach, or the establishment of disaster management programmes as a reactive mechanism.

As the space of risk, and its impact and influence, extends beyond that sphere defined as the coastal zone, it is argued that the ability of ‘designated’ coastal legislation (which is confined to the legal coastal strip) to deal with and to address risk related matters is inadequate. This is highlighted by Mather (2007: 13) who describes the sequence of events that took place after the March 2007 storm surge event in KZN. A description is given as to the measures that affected parties (property owners whose property was damaged by, or under threat to storm surge events) undertook to mitigate and prevent further damage to property from the sea:

“Many private landowners have repeatedly asked for direction and assistance, to no avail after the March [storm surge] event. In the face of this confusing situation, some private landowners

³²Although elevation above means sea level may be used as the key indicator to determine infrastructure at risk from storm surge events, there are other attributes that may influence the degrees of risk to storm surge events. In a biophysical sense these may include near shore bathymetry, the location of infrastructure in relation to predominant storm swell direction (i.e. infrastructure may be sheltered within bays) and the composition of the beach substrate.

have taken the opportunity to use whatever remedy....without reference to any of the authorities. Many landowners have nevertheless complied with the requirements of Section 30 of NEMA but, being unsure of the requirements, have instead of undertaking the work and then making the application, have sent in their Section 30 applications with proposals of what they intend to do. In amongst the private individuals, authorities and municipal groupings entered the insurance companies. This resulted in the four groups not only being confused as to what and how to address the erosion effects, but actively contributed to divergent views on what should be done. The insurance companies were prepared to pay to rebuild the lost structures. However, the private landowners were caught between the authorities and the insurers if they went ahead with the repairs. There was no guarantee that the authorities would accept the repairs and therefore the landowner could be instructed to remove the intervention. If this happened, the insurance companies had made it clear to the insured that they would not pay a second time”.

Similarly, and reflecting the incapacity of legislative mechanisms to capture and effectively manage risk (associated to the March 2007 storm surge event), the following paragraphs were taken from personnel correspondence with Omar Parak, Coastal Programmes and Projects Management for the KZN Department of Agricultural and Environmental Affairs (04/09/08):

“We still have not got around dealing with the immediate disaster management related issues from an environmental perspective (note that any construction or earth moving activity within 100 m of the high water mark requires a basic assessment). A case in point: you have a house that's being undermined by the sea - you want to use sand bags, NOW!! -what legislation/regulations guides one to act in the appropriate way, from an environmental perspective?? Please note that you cannot and SHOULD NOT act in terms of Section 30 of NEMA (Control of Emergency Incidents) as this section wasn't intended to cover natural disasters....you can see the dilemma we face!!! I'm comfortable that we have effective cover in dealing with matters post-disasterbut during the disaster there is little direction at hand...and it's during this time that the bad environmental decisions are made, e.g. throwing boulders on the beach to limit further erosion!

Section 41 2(o) of the Disaster Management Act does allow the Premier to make regulations (in our case for EMERGENCY environmental management, e.g. sand bags etc.) and ideally that's the route we should be following. But how long does this take and will this take? In my opinion, it would be easier if DEAT amends the NEMA S30 to include responding to natural disasters...so that we ensure the environment is not compromised further by bad decisions parties might take in responding to the immediate incident!”.

These examples illustrate that the space of risk not only flows across boundaries that serve to indicate where the coastal zone is (in some areas the storm surged beyond 100 m from the HWM), but also across multiple disciplines. This issue links directly with the Governance issue identified in Table 6 (section 6.3): ‘inefficient, ineffective and conflicting legislation’. It reflects the ‘un-preparedness’ and incapacity of legislation to deal with such events. Thus the space of risk includes the government’s capacity to develop legislation that is contextual, flexible and recognises the threat of environmental perturbations and associated risks. The ability to lessen the degree to which coastal communities are subject to risk is therefore dependent upon a variety of factors and disciplines, and how effectively these disciplines perform, both independently and as a network. As such disciplines are drawn into managing and mitigating risk, the space of risk expands and becomes a broad-scaled space consisting of multiple and interrelated disciplinary functions. The need to mitigate the negative impacts of ‘natural’ disasters on society is therefore linked to the concept of resilience. This example highlights the role of governance in promoting increased degrees of resilience within social-ecological systems (Plate 8).



Plate 8: Milnerton Club House in Cape Town during the August storm surge event, 2008. Infrastructure at risk from storm surge events is a country-wide issue.

As indicated in 2.4.1 of Chapter 2, reduced degrees of resilience to natural disasters (in this case a storm surge event) may not only be a result of the inappropriate location of infrastructure (in a simplistic sense, too close to the HWM), but also due to broader-scaled issues such as governance structures that are ill-equipped to manage these events. As Holling and Meffe (1996) indicate, and as evident in this example, the inflexibility of bureaucratic systems is a major contributor towards undermining society's ability to cope with such disasters. The rigidity of such bureaucracies may be attributed to the inexperience of such legislative mechanisms to deal with events such as these which are out of the norm. The severity of the March 2007 storm surge event is a pertinent example. This reflects Holling and Meffe's (1996) argument of command and control whereby problems are assumed to be one-dimensional and do not cross scale temporally or spatially, and that when the *a priori* of certainty is not met there are negative social, economic and environmental implications. In this instance, the *a priori* of certainty was challenged due to the 'out of the norm' intensity of the storm surge event. This was reflected in the lack of preparedness of legislation and reactive mechanisms to deal with such a crisis. According to Holling and Meffe (1996) such crises become unavoidable consequences under the rigid approach of command and control. This is significant considering that such events are likely to increase in frequency and intensity due to climate change (Mather, 2007). To proactively respond to these events and their unpredictability, adaptive management techniques should be investigated and exercised within governance structures (Holling and Meffe, 1996). Within this framework of adaptive management, and to evolve 'in-sync' with changes in environmental and social systems, the 'return loop' of the adaptive management cycle should ideally take place within shorter time horizons.

The case study of the March 2007 storm event shows multiple links with the issues identified in the previous chapter. This indicates that the space of risk is not only determined based upon the position of infrastructure in relation to the 10 m contour (physical elevation), but that the space of risk contains elements that are predominantly situated within the governance pillar of sustainability. These elements include the need for effective management and planning for development³³, clear and concise legislation to deal with such events, legislation and regulations that are more expansive and which address broader scaled issues such as minimising the interference in sediment dynamics

³³ This includes identifying adaptation strategies for climate change and the predicted increase in frequency and intensity of storm surge events and disaster management programmes.

and flow regimes within catchments and political will that will effect change for the current inappropriate locations and patterns of development.

7.3 A SPACE OF POLLUTION

This research identifies the space of pollution as the area (and those processes) that contribute to, and facilitates the accumulation of substances that are harmful to people or the natural coastal environment (Plate 9).



Plate 9: Pollution in the Umgeni River catchment, Durban, KZN. This pollution ultimately ends up in the coastal zone causing negative socio-economic and environmental impacts.

The extent of the biophysical space of pollution effectively extends to the geographical limits of catchments as well as the surrounding seas (Figure 18). Catchments may be defined as “the land area situated between two watersheds or landform ridges, drained by a common river valley system” (eThekweni Municipality, 2002: 14). Catchments become a critical component in terms of pollution as it is estimated that 70% of marine pollution originates from land-based activities (Australian Fishing Management Authority, 2000,

cited in Binns *et al*, 2003). Activities that take place within catchments, and that may cause pollution, therefore become connected to the healthy functioning of the coastal zone.

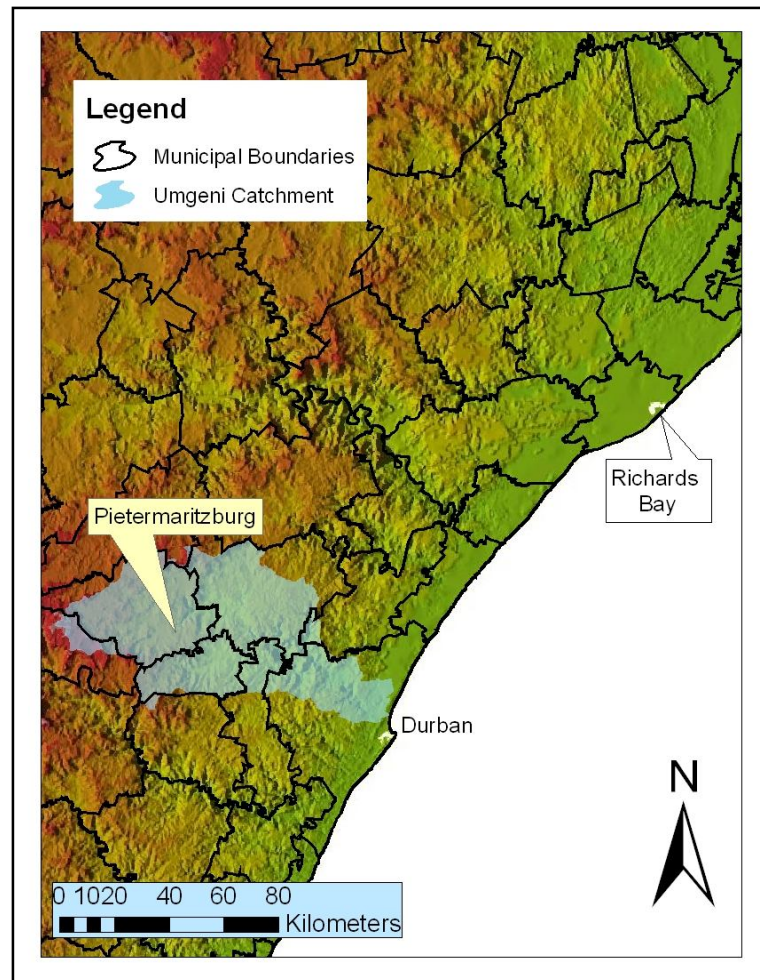


Figure 18: The extent of the Umgeni River catchment as a representation of the biophysical extent of the space of pollution.

As already noted, the biophysical space of pollution is reflected in the extent of catchments. The previous chapter showed that there are multiple and diverse aspects that collectively contribute, either directly or indirectly, to the problem of pollution. In this regard, the space of pollution includes aspects such as ineffective regulations, insufficient enforcement, insufficient resources, lack of social responsibility and lack of maintenance of service provision infrastructure. This research has used the case study of Blue Flag beaches in Durban to determine/identify those elements that constitute the space of pollution. This case study also identifies elements that were not conventionally considered to be part of the space of pollution.

Articles published by *The Mercury* newspaper were the main source of information for this case study. Blue Flag is an internationally accredited programme that is designed to

promote improved degrees of safety, cleanliness, good seawater quality, the provision of clean amenities and environmental standards in the management of beaches (Carnie, 2007; Kelly, cited in Carnie, 2008). Recently, the majority of Durban's beaches have lost their Blue Flag status³⁵, the primary cause of which has been identified as poor seawater quality due to pollution. At the time that this article was printed (14 March, 2008), the city of Durban had lost four out of its six blue flags and it is suggested that one of the remaining flags will be removed due to the persistence of poor water quality (Carnie, 2008).

Factors contributing to the poor water quality may be attributed primarily to faecal contamination (Carnie, 2008). The locations of sources of sewage are situated both within and at great distances from the defined coastal zone. Such sources include raw sewerage entering rivers from informal settlements within catchments, illegal connections between sewerage and storm water systems, sewerage spills and poor treatment at several of eThekweni municipal sewerage works (Graham, Kelly and Mather, cited in Carnie, 2008). Although such biophysical issues may be listed as objects in physical absolute space which cause deteriorating water quality, any attempt to investigate the root of the problem uncovers mechanisms that implicate the space of pollution within a complex set of 'less easily discernable' and broader scaled issues. The space of pollution in this way incorporates elements across the four pillars of sustainability. Through the Blue Flag case study, it is evident that the space of pollution is largely situated within the pillar of governance.

For example, the issue of raw sewerage entering rivers from informal settlements within catchments may be perceived as far removed from having an impact on the integrity of the coastal zone. However, and according to Carnie (2008), such issues have serious negative impacts on the integrity of the coastal zone. This is reflected in the inability of Durban to maintain Blue Flag status for many of its beaches. The impacts of these seemingly far removed sources of pollution on the coastal zone 'unsettles' the coastal zone definitions and the influence that the nature of such definitions, and the associated bounded legislation, may have on how effectively coastal areas may be managed. Although it may make sense to confine and define the coastal zone to a narrow strip based upon administrative capacity, as indicated by the example of the biophysical space of pollution,

³⁵ During the completion of this research, eThekweni Municipality withdrew from the Blue Flag programme.

the coastal zone is a much broader region. In this sense, coastal zones, to capture the space of pollution, should be defined (or at least legislative provision should be made) based upon the extent of catchments. This is in line with the desired approach of systems thinking and the consideration of scale as vital ingredients towards achieving increased degrees of sustainability. Instead however, coastal legislation focuses on that definition that portrays the coastal zone as a relatively narrow strip and does not extend to processes or activities that occur outside of this defined strip, even though such activities have significant negative impacts on the very area that the legislation is ‘designated’ to protect. Considering this, the issue of ‘exclusionary management prescriptions and associated legislation’ identified in section 6.3, Table 6: Governance, becomes an element of the space of pollution.

Although Chapter 6 focuses on identifying issues and discusses relations between issues on a more detailed scale, the following quotes from Blue Flag articles have been used to draw a parallel with (and thus further substantiate) the issues identified under each of the four pillars of sustainability (Tables 5, 6, 7, and 8 in Chapter 6). These issues are seen to collectively constitute the space of pollution.

According to Neil McLeod, Head of Water and Sanitation, eThekweni Municipality:

“Pollution from rivers flowing into the sea will only end when everyone is able to dispose of sewerage in a safe manner – the provision of basic sanitation to more than 250 000 families who did not have this service in 2000 is expected to be achieved by 2013, at a cost of R1.5 billion. This means rolling out more than 20 000 a year” (McLeod, 2008:7).

Based upon this statement, an inference may be drawn between the trends in pollution levels and the lack of resources as well as the lack of maintenance of service provision infrastructure as identified within the governance pillar of section 6.3, Chapter 6. Similar sentiments, especially with regard to the lack of maintenance of service provision infrastructure, are voiced by Mark Graham, an independent river scientist. Graham (quoted in Carnie, 2008:1) suggests that “eThekweni Municipality is largely responsible for the current poor condition of many rivers”. This is primarily attributed to the failure of eThekweni Municipality to repair burst sewer pipes as well as sub-standard management of some waste water treatment plants (Graham, cited in Carnie, 2008). Following from this,

Carnie (2008:1) poses the following question: “So what has gone wrong [loss of many of Durban’s Blue Flags]? Has there been a sudden or isolated problem with sewerage contamination along the coastline, or is this the result of a progressive and widespread deterioration in waste water management?”

These concerns and questions relate directly to the pillar of governance, but more specifically, highlight the issue of ineffective management and planning for development and a lack of maintenance of service provision infrastructure. In respect of mechanisms that may be driving such issues, the lack of resources, especially skills, cannot be ignored. The lack of these skills, according to Turton (2008), effectively translates into a declining level of ‘technical ingenuity’ and this may be defined as “the capacity of a nation to develop technical solutions to problems being driven by exogenous changes” (Turton, 2008:6). This lack of technical ingenuity is especially severe in the energy and water sector (Turton, 2008). The impacts resulting from sub-standard service provision are being exacerbated by the drive to achieve an economic growth rate of 6% per annum. According to Homer-Dixon (2000, cited in Turton, 2008), this is resulting in an ‘ingenuity gap’ and our need for technical solutions to sustain this growth is growing exponentially whilst the capacity to deliver those solutions is declining exponentially.

As indicated by the above examples, the issue of pollution is more complex than a simple ‘leak in the pipe’. Through the lens of the Blue Flag case study, and as similarly evident in Chapter 6, it is apparent that the cause of pollution is enmeshed in multiple sectors. Within the Blue Flag case study, governance is largely responsible for the issue of pollution, especially faecal contamination. To solve the issue of pollution in respect of maintaining Blue Flag status, complex and multiple cross-scaled issues need to be addressed. Although emphasis is placed on the need to maintain a healthy and productive functioning ecosystem as the baseline objective, the implications of failing to achieve such a target are far reaching. Again, as evident in the space of risk, the space of pollution is not necessarily confined to biophysical areas/processes contained within catchments. The space of pollution becomes pervasive within those sectors heavily dependent upon healthy environments. For example, the loss of Blue Flag Status due to faecal contamination is a significant concern to sectors such as tourism, sport and recreation and sustainable coastal livelihoods. The space of pollution therefore shares connections with multiple sectors (Wakelin, 2008). Alternatively, and based upon the findings of this research and the Blue

Flag case study, the argument can be made that these sectors such as tourism, sport and recreation. are indirectly and negatively impacted upon as a consequence of a lack of resources, ineffective management and planning for development and a lack of maintenance of service provision infrastructure from government structures.

Ultimately the space of pollution extends to the economic sector and may be reflected through the measurement of economic loss. An example of this is given in a study whereby the Council for Scientific and Industrial Research in 2004 undertook an evaluation of the monetary worth of Blue Flag status at Margate Beach, KZN. It was estimated to amount to between R19 million and R24 million per year. If this same calculation is used to extrapolate the loss of Blue Flags for Durban (due to pollution) in respect of tourism revenue, it amounts to approximately R100 million (Kelly, cited in Carnie, 2008).

This section has used the Blue Flag case study to substantiate those issues identified in the previous chapter that contribute to pollution. Through the lens of this case study elements that constitute the space of pollution have been identified. Based upon this research, the space of pollution not only extends to include the physical expanse of catchments, but it also includes multiple elements situated primarily within the governance pillar of sustainability. These elements include ineffective management and planning for development, ineffective and exclusionary regulations, lack of enforcement, lack of maintenance of service provision infrastructure and a shortage of resources. Although a lack of social responsibility has also been identified as constituting an element of the space of pollution, social responsibility can also be linked to the governance pillar of sustainability. This is argued from the perspective that government is responsible for driving education and playing an important role in installing socially responsible behaviour.

7.4 A SPACE OF BIODIVERSITY

The space of biodiversity has been used to represent the environmental pillar of sustainability. As indicated in Chapter 6, there are multiple issues that span the social, economic and governance pillars of sustainability that have negative environmental

impacts. The space of biodiversity, as a critical component of the environmental pillar, is examined here through the lens of the eThekweni Municipalities *Biodiversity Report* for 2007. Biodiversity, as defined by the eThekweni Municipality, is the “variety of different landscapes, ecosystems, communities, species (micro-organisms, plants and animals) and genetic variability among individuals within each species” (eThekweni Municipality, 2002:28).

Biodiversity is an important component as many of the coastal issues identified in Chapter 6 either result in the degradation of natural systems, or interfere with natural processes and thus negatively impact on biodiversity. As such the space of biodiversity is broad and is situated across all four pillars of sustainability. A significant issue that is implicated in, and thus forms an element of the space of biodiversity, is the pursuit to achieve an increased rates base through development (and the subsequent loss of potential to conserve remaining green belts). Those mechanisms that drive the desire to economically benefit from an increase in rates also become implicated in the space of biodiversity. These elements include a lack of political will, population growth and the subsequent increased pressure on natural resources/biodiversity.

The eThekweni Municipality *Biodiversity Report* (2007) has identified six core threats to biodiversity within the eThekweni Municipal Area. To substantiate the coastal issues identified in this research that constitute the space of biodiversity, they are linked to the threats as determined by eThekweni Municipality. The following points from one to six list the major threats to biodiversity according to the *Biodiversity Report* (2007). Under each threat are sub-points. These sub-points are examples of issues that have been extracted from the sustainability tables from the previous chapter and used to explore in finer detail the threats to biodiversity in coastal regions. The pillar of sustainability to which they are associated are indicated in the brackets. The threats are as follows:

1) Land transformation and habitat destruction:

- i) The pursuit of achieving increased rates base (economic);
- ii) Ineffective management and planning for development (governance);
- iii) Lack of political will (governance);
- iv) Lack of enforcement (governance);

- v) Ignorance and insufficient scientific enquiry (social);
- vi) Dams, sand winning and dune mining (environment);
- vii) Inappropriate development (environment);
- viii) Clearing coastal vegetation and destabilising the dune cordon (environment), and
- ix) Drainage of wetlands and estuaries (environment)

2) Un-sustainable levels of utilisation:

- i) Over harvesting of coastal resources (social);
- ii) Pressure on the coast due to population growth (social), and
- iii) Ignorance and insufficient scientific enquiry.

3) Land, air and water pollution:

- i) Pollution (environmental);
- ii) Ineffective management and planning for development (governance);
- iii) Lack of maintenance of service provision infrastructure (governance);
- iv) Shortage of resources (governance), and
- v) Lack of social responsibility (social)

4) Alien species invasions:

- i) No associations drawn to this threat.

5) Climate change/disruption:

- i) Climate Change and sea level rise (environment)

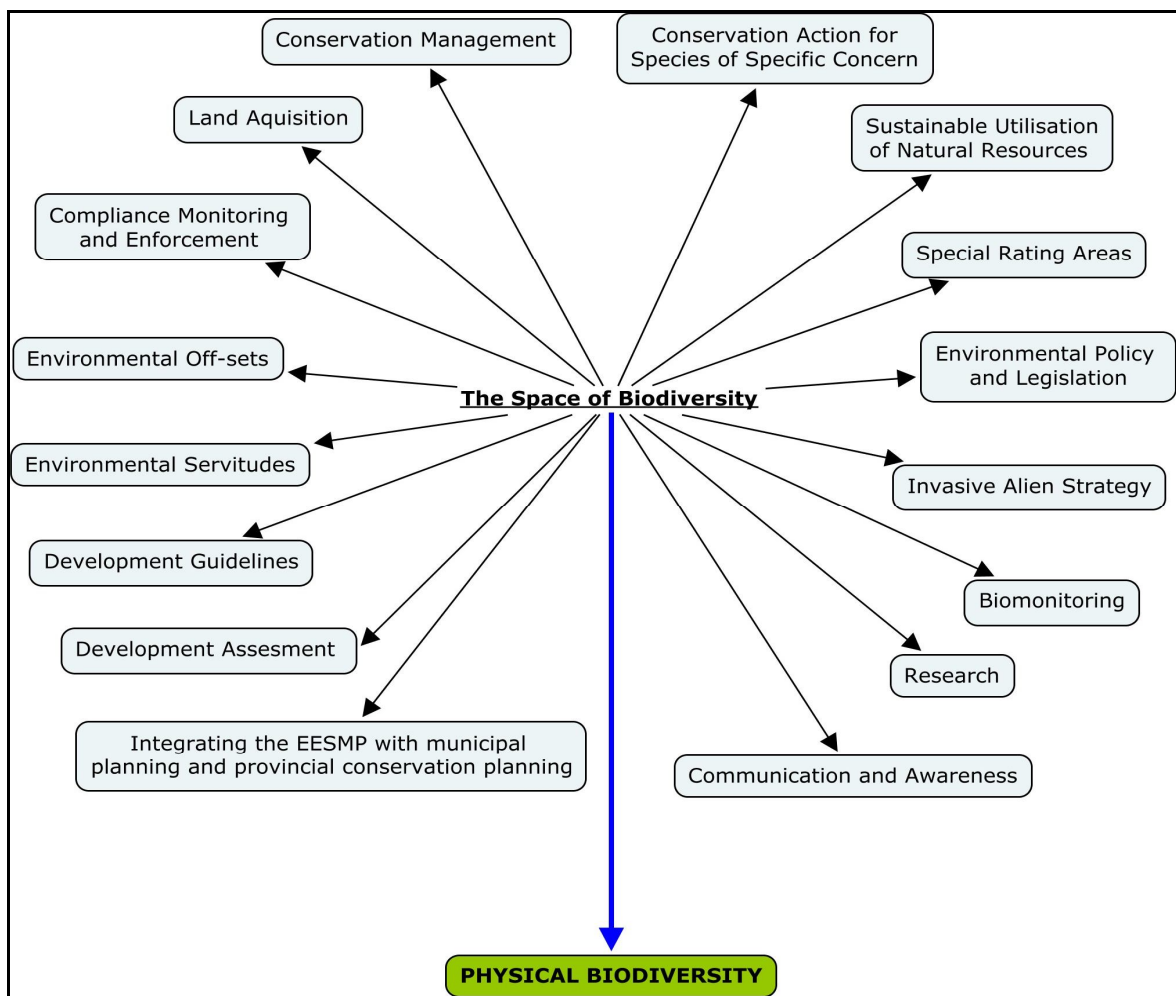
6) Inadequate conservation management:

- i) Ineffective management and planning for development (governance);
- ii) Shortage of resources (governance), and
- iii) Lack of political will (governance)

These associations substantiate the issues identified in this research as collectively constituting the space of biodiversity. The above associations also reflect the space of biodiversity as an expansive space that spans the four pillars of sustainability. This ‘expansiveness’ is similarly highlighted in the *Biodiversity Report (2007)*. In order to address the loss of biodiversity and associated ecosystems services from such threats, the eThekweni Municipality has formulated the eThekweni Environmental Services

Management Plan (EESMP). The EESMP forms part of eThekweni Municipalities Integrated Development Plan and aims to “protect and enhance the remaining significant ecosystems and biodiversity in the eThekweni Municipal Area in order to secure a sustained supply of a broad range of high quality environmental goods and services for our residents and visitors” (eThekweni Municipality, 2007: 5).

In order to achieve the goal of the EESMP, the EESMP sets out a 16 point implementation strategy (Figure 19). Through a general overview of the implementation strategy, it is necessary to engage with a variety of activities and to put various mechanisms in place to achieve the biophysical ‘ideal’ of sustained biodiversity. Some of these activities and mechanisms include the development of environmental policy and legislation, compliance monitoring and enforcement, research and development guidelines to name a few.



(Source: Adapted from eThekweni Municipality Biodiversity Report, 2007)

Figure 19: The space of biodiversity.

This research indicates that achieving biodiversity on the ground is dependent upon a host of activities and their abilities to achieve their objectives. The collective map of activities represents and maps the ‘space of biodiversity’ in a holistic sense. The 16 points of the implementation strategy have been identified as they address issues that are connected to the loss of biodiversity.

7.5 THE ECONOMIC SPACE OF THE COASTAL ZONE

This section examines the coastal zone through an economic perspective and explores the economic activities that arise due to the attributes of the coastal environment. The economic space has been examined through the lens of the *Amended Final Environmental Impact Report* (Report) on the proposed Small Craft Harbour (SCH)³⁶ in Durban’s Point Precinct area. The SCH is being used as a vehicle to stimulate Durban’s inner city and broader economy through increasing the rates of revenue and property values in the Point Precinct area (Nel *et al*, 2003, cited in Amended Final Environmental Impact Report, 2007). It is proposed that this area, which has been subject to neglect and subsequent crime and decay, will be rejuvenated through such an initiative. As such, it is hoped that urban deterioration will be reversed and the city’s economic base will be strengthened (Nel *et al*, 2003, cited in Amended Final Environmental Impact Report, 2007).

Through the lens of the SCH, the economic space of the coast may be defined on a two-tier basis. Firstly, it may be described as all those activities (for example eco-tourism) that directly benefit economically from ecosystems services as provided by the immediate coastal environment. Ecosystems services most relevant to the immediate environment surrounding the SCH include that of food production³⁷, recreation³⁸ and cultural³⁹ services. It is important to note that it is these services, as provided by the coastal environment, that support the very foundation that enables the development of the SCH to take place.

³⁶ The proposed SCH development has since been declined by the KZN Department of Agricultural and Environmental Affairs based upon the recommendations of the EIA. This decision was however upheld by the HOD and is currently under review.

³⁷ Food production is defined by the eThekweni Municipality Biodiversity Report (2007:9), as: “Primary production of food, e.g. fish, crops and fruit by non-commercial farming”;

³⁸ Recreational services defined as “Providing opportunities for recreational activities, e.g. eco-tourism, sports, fishing, swimming and outdoor recreational activities”, and

³⁹ Cultural service defined as “providing opportunities for aesthetic, educational, spiritual & scenic views, environmental education, research opportunities, sense of place & an attractive living environment”.

Without these services, there would be no foundation to support the SCH as the SCH is dependent upon these services for its economic viability. Based upon this 'primary' economic space, the secondary economic space may in turn be defined. The secondary economic space is defined as those indirect economic benefits, or losses, arising as a consequence of the development of the SCH (more detail of the categories used to measure the various impacts is provided in Appendix 8). According to the Report, these indirect benefits, or losses, are measured and reflected in the GDP, Gross Geographic Product (GGP), the creation of jobs, loss of income from water sports activities (as a consequence of the loss of recreational space by the proposed development) as well as the contribution of the SCH to eThekweni's rates base (Centre for Economic Training in Africa, 2006, cited in the Amended Final Environmental Impact Report, 2007).

It is evident that through the indirect economic impacts, the footprint of the economic space emanating from the SCH is apparent at a scale beyond that of the immediate environment of the SCH. The economic space (the influence of the SCH on the GGP and GDP) is therefore influential at a provincial and national scale respectively. This economic space is however a product of those ecosystem services provided by the natural environment on which the SCH is dependent upon.

Similarly, and to give an indication of the degree and extent of the economic impact (i.e. job creation), it is estimated that the SCH as part of the larger Point Precinct Development area upon completion will sustain employment of between 4,500 and 7,100 permanent jobs within the hotel, retail and office developments (Centre for Economic Training in Africa, 2006, cited in the Amended Final Environmental Impact Report, 2007). It is important to recognise that these figures (and the 'size' of the economic footprint) exclude the potential of job creation and other economic contributions that may arise from the tourism industry. It is expected that the contribution of the tourism industry to employment and to the general economy will be significant, as the development of marinas and small craft harbours typically attracts tourism related activities (Centre for Economic Training in Africa, 2006, cited in the Amended Final Environmental Impact Report, 2007).

As indicated in section 6.2 of Chapter 6, economic impacts (assessed by monetary values) are used as the penultimate indicator for assessing the impact of an activity. This similarity is shared with the SCH. The use of the economic pillar to determine the impacts and the

feasibility of the SCH substantiates the economic space as being an ‘end impact’. Although the SCH has not yet been developed, economic impacts are forecasted and the results (based upon monetary values) are used as one of the key indicators to determine the feasibility of the project. It is important to note that the secondary economic space identified (in the form of the impacts of the SCH on various aspects of the economy) is ultimately dependent upon the presence of the ecosystem services. The SCH therefore may be seen as a conversion mechanism for economic upliftment, whereby the value of local ecosystems services are harnessed through the development of the SCH, and magnified to broader scaled economic imperatives. This reflects the commercialisation and commodification of the natural environment.

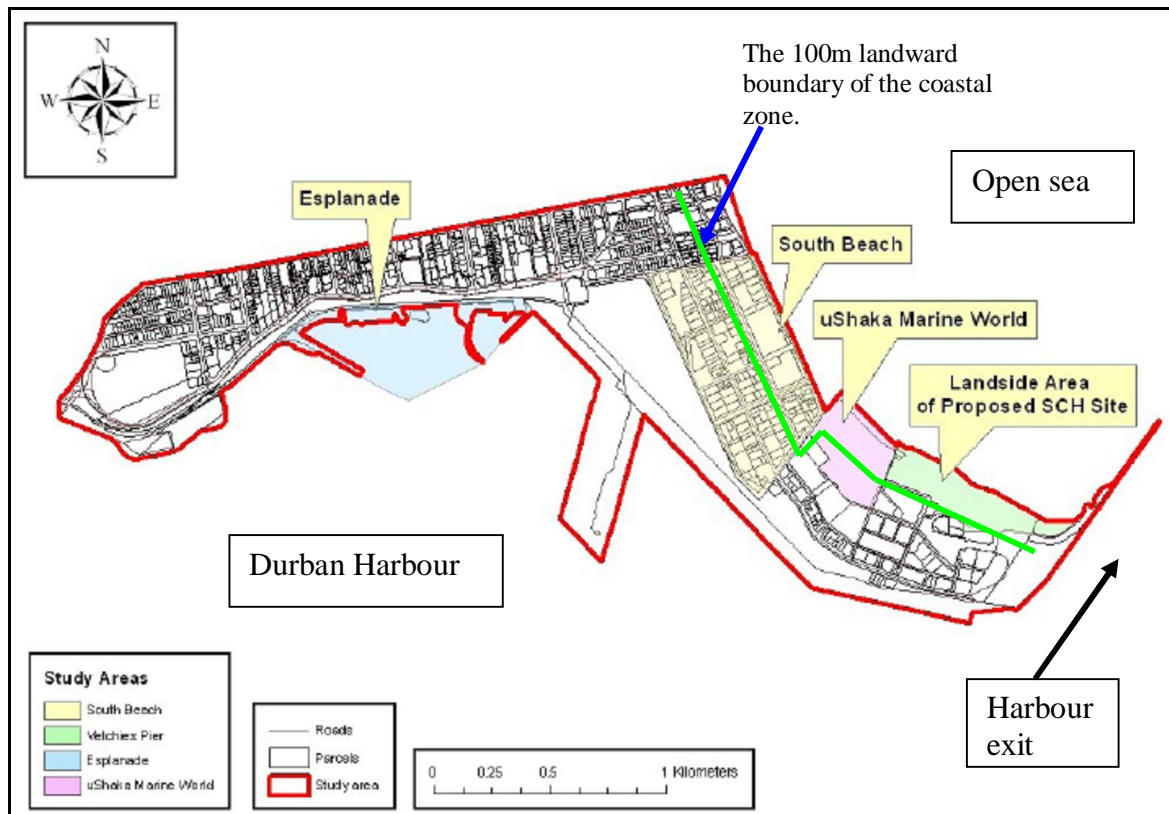
7.6 A SOCIAL SPACE

The social space is a space that constitutes social relations and networks. Aspects of the social space include quality of life (livelihoods), equity, identity, participation and empowerment (Oelofse, 2009b). Many of these aspects surface in the social issue of a lack of access, as identified in Table 7 of Chapter 6.4. The social space, and in particular the issue of lack of access, will be examined through the lens of the SCH. This will take the form of initially examining the composition and the extent of the social space that may arise as a consequence of the proposed SCH development, followed by a more detailed examination of the issue of a lack of access.

Within the case study of the SCH, the composition and the ‘extent’ of the social space may be defined based upon the extent of the ‘social impact zone’ emanating from the proposed development of the SCH. The ‘social impact zone’ or the social space, according to the Amended Social Impact Assessment (SIA) on the SCH, is spatially not confined to the proposed SCH site itself, but which in effect extends to two broader scales of impact. These scales include the South Beach/Addington and Esplanade area and the broadest scale of impact being set at the extent of jurisdiction of the eThekweni Municipality (Scott *et al*, 2007, cited in the Amended Final Environmental Impact Report, 2007).

As a geographic reflection of the second scale (South Beach, Addington and Esplanade) at which these social impacts are expected to be experienced, authors of the SIA of the SCH

identified and demarcated a study area (Figure 20). The extent of the demarcated study area was set at a scale to capture the social impacts arising from the proposed development of the SCH. Although an activity such as the proposed SCH may take place within the legally defined coastal zone, the extent of the study area indicates that the proposed SCH will have impacts that extend beyond this zone. There is therefore a broader scaled social space that is relational to activities that take place within the legally defined coastal zone.



(Source: Scott *et al*, 2007)

Figure 20: The areas of Durban's inner city forming part of the social profile against the 100m landward boundary of the coastal zone.

Although coastal legislation may be tailored to address such impacts (these impacts will be listed later on in this section) arising from activities and/or developments that are situated within the legally defined coastal zone, the jurisdiction of coastal legislation, i.e. the Sea Shore Act or the proposed ICM Act, is tied to the legal definition as defined by absolute space. Coastal legislation is therefore unhelpful in addressing and mitigating those impacts arising at broader scales, even though the causes to those impacts may originate from within the defined legal space.

The very existence of the SCH, as discussed in section 7.5, is ultimately dependent upon the presence of ecosystem services provided by the natural environment. Due to the link of these services to the sea, such services may be classified as coastal ecosystem services. The proposed SCH development is seen as a vehicle to harness these services, but the process of harnessing these services to promote economic development may have several impacts. As indicated in section 7.5, the impacts may be felt across a broad spectrum, ranging from the natural, economic and the social environment. With regards to the latter, it is argued that a new coastal social space will be created through the development of the SCH as a consequence of the existence of coastal ecosystem services. However, this proposed new coastal space will effectively be superimposed upon, and will replace an existing coastal social space that has different attributes and characteristics, that are also linked to coastal ecosystem services present in the area of the proposed site of the SCH. The SIA identifies several social impacts⁴⁰ that may arise as a consequence of the proposed development of the SCH. Some of these impacts identified include the following:

- i) Loss of recreational use due to the physical alternation of Vetch's bight caused by the development of the SCH;
- ii) Loss of space for learners that utilise the calm conditions as a result of this alternation;
- iii) Loss of sense of place represented by historical identity;
- iv) The displacement of social ills to surrounding areas;
- v) Congestion as a result of the expected increase in traffic volumes;
- vi) Conflict as a consequence of overcrowding, and
- vii) Lack of, or reduced access to the beach due to privatisation and subsequent increased security measures (Scott *et al*, 2007, cited in the Amended Environmental Impact Report, 2007).

Although similarities may be drawn between several of these impacts and the various issues as identified in Chapter 6 of this research, the example that will be used here to draw a parallel is that of the impact/issue of 'lack of access'.

⁴⁰ The extent and nature of these impacts as social spaces are thematically represented in the conclusion (Chapter 8) of this research.

The SIA raises concerns over the loss of public access to benefit from coastal ecosystem services as a consequence of poor planning and design of the SCH development. The concern is that through privatisation and the subsequent ‘air of elitism’ that may arise, public access to the beach may become restricted (Scott *et al*, 2007, cited in the Amended Environmental Impact Report, 2007). This example of a coastal social issue provides substantiation and links directly into one of the themes identified in this research, that of a ‘lack of access’ (Table 7 of section 6.4). Based upon the collective feedback from the various respondents on identifying coastal issues, this issue of access was summarised as follows: access to the coastal zone is being reduced as a result of privatisation of coastal land as well as over/inappropriate development.

Although three scales of impact have been identified by the Report (the immediate vicinity of the SCH, South Beach/Addington/Esplanade and the eThekweni Municipality), the Report also makes provision for identifying social impacts arising from the SCH on a local, national and international scale (Appendix 10). The Report indicates that the extent of the impact of reduced access to the beach effectively extends across all three scales. The mechanism reflecting the national scale of impact is represented by the experience of holiday makers from inland and the communication or conveyance of this experience back on home soil and within national networks, i.e. possible feedback of a negative experience (relating to access) to tourism operators. This negative publicity may in turn have economic repercussions.

The issue of reduced access in terms of the tourist experience is substantiated by the Manager of Research from Tourism KZN. Frequent references by this respondent are made on the negative impact of development and privatisation for gaining access to the beach, especially in areas such as Salt Rock along KZN’s north coast (Plate 10 and 11):

“But I know that most of the coastal zone area, the beach area, the high water mark area...is supposed to be accessible to the public, it is supposed to be the preserve of South African citizens. You can’t alienate part of the coast...I don’t think that is legal. I mean a lot of Ballito you actually can’t get to the beach. I had to take somebody to Salt Rock the other day and I drove for kilometres and kilometres on that road that goes parallel to the ocean and all I saw was high walls, there is no way to get to the beach, even though by law you are supposed to have access” (Research Manager: Tourism KZN, 27/09/07).

The lack of access to the beach creates a coastal social space: a social space that has negative implications, as not only is the tourism sector impacted upon by the lack of access, but this issue has negative implications for coastal communities that depend upon coastal resources for their livelihoods as well. Such a coastal issue therefore has a large 'social impact footprint'. With reference to Plate 10 and 11, and due to the nature of the remaining access points in terms number and width, such access points may also be more easily controlled by individuals and/or groups.

Plate 10: Access to the beach in Salt Rock (KZN) reduced as a consequence of high density strip development and the associated high walls and security fences.



Plate 11: Access points that are present are few and far between, with little space for amenities such as toilets and showers.



This research has identified that a lack of access is an important coastal matter and that the footprint of this issue is extensive. This issue has been substantiated through the lens of the SCH as in terms of the SIA, similar concerns are raised regarding the impact of privatisation and development on access. The importance of this issue is reflected in the fact that the ICM Act makes specific provision for improving and regulating access to coastal resources (ICM Act, 2008). Through elevating the issue of access to national legislation, the loss of access (as has happened in Salt Rock due to strip development), will be prevented from recurring in other locations on the South African coastline. The question however arises as to how will the ICM Act ensure that access points are either protected and/or established, but where such access points, due to the extent of development taking place along the South African coastline, now fall outside of the legally defined coastal zone?

7.7 CONCLUDING REMARKS

This chapter has shown that there are multiple spaces that become relevant to the management of the coastal zone. The spaces identified include the space of risk, the space of pollution, space of biodiversity, an economic space and a social space. Although it is the intent of the legal definition to provide a physical anchor space by which legislation can be guided, the scale of the various coastal spaces identified extend beyond what is legally defined as the coastal zone. In this sense a parallel may be drawn to the case study of the RNNP Hotel. As space becomes relative and measured in terms of time and cost in the process of identifying who the relevant stakeholders are, so too does space become relative in determining the extent of the coastal zone. Is the coastal zone that narrow strip 100 m from the HWM, or is it that broader area at risk from flooding from storm surge events? Similarly, is the coastal zone that narrow strip, or does it extend to include catchments that effectively channel and contribute pollution to Durban's beach front? These are examples that highlight the contextual nature in which the coastal space needs to be conceptualised and thus managed.

This chapter has shown that it is necessary to develop management and legislative frameworks that operate at broader, more inclusive scales. These more expansive scales are necessary not only to recognise those spaces that operate at scales beyond the physical

definition of the coastal zone, but also to acknowledge the connections between the various spaces. This more holistic approach is necessary to capture relational spaces rather than focussing on scales (and the resultant exclusion of these relational spaces) created through the use of legal definitions as defined by absolute space. The identification of these relative and relational coastal spaces ‘unsettles’ the conventional manner in which coastal zones are defined and managed as absolute, physical spaces. As such, this research proposes a new way of thinking that identifies and acknowledges these relative and relational coastal spaces.

CHAPTER 8: CONCLUSION

This research has revealed the key human induced pressures and issues facing coastal regions in KwaZulu-Natal, South Africa, which are reflective of coastal challenges in other local and international coastal spaces. These pressures, in terms of their intensity and severity, are applicable to environmental systems in general. However, these pressures play out in specific ways and with specific management challenges in the coastal zone. Given the physical characteristic of 'coastlines' being the interface between land and sea masses, such regions offer significant socio-economic potential and hence are under intense development pressure. As a consequence of this 'nexus' of socio-economic activity and opportunity, global trends indicate that there is an intense concentration of human population growth and activity in the coastal zone. This translates into increased demand and pressure on coastal resources, which requires specialised management approaches.

It is in light of such pressures that this research has explored ways and means to achieve, or at least initiate, an investigation into different approaches that encourage increased degrees of sustainability within coastal socio-economic and environmental systems. At a broad scale, it is argued that to achieve the desired degrees of sustainability, it must be acknowledged that social and ecological systems are inherently linked, and that management structures and their methodologies recognise these linkages. However, there has been little progress in investigating interactions between socio-economic and ecological systems as systems in themselves (Berkes *et al*, 1998).

This research has applied concepts of space, as well as systems theory, to gain a deeper understanding of the degree of complexity and interconnectedness between the four pillars of sustainability within the coastal zone. The level of connection between different systems within the coastal zone, as explored in this study, is reflected in the following example. Lack of capacity for coastal management at a provincial level results in the delegation of decision-making to local authorities to plan for development. Economic interests at the local authority level results in the development of the coastal zone as the authorities pursue an increase in their rates base, as opposed to the conservation of remaining 'green belts' (Regional Coordinator, Wildlife and Environment Society of South Africa: 23/11/07). The loss of these green belts, or 'natural' ecosystems, has various impacts: the coastal seascape or viewshed (Whithead, 2004) is negatively impacted upon

by development, coastal aesthetics and the 'sense of place' is lost which in turn negatively impacts on tourism (Research Manager, Tourism KZN: 27/09/07). The loss of green belts also reduces the potential of environmental systems to provide important ecosystem services. This includes the ability of ecosystems to act as a buffer to 'absorb' environmental perturbations such as storm surge events (Senior Planner, eThekweni Municipality: 15/11/07). The loss of this service results in damage to coastal property and requires long term protection in the form of sea defence mechanisms. These mechanisms, such as sea walls, require continual investment and maintenance, which effectively translates into an economic burden with indefinite time-frames imposed on local authorities (City of Cape Town, 2008). Although simplistic, this example highlights the interconnectedness of socio-economic and environmental systems.

Berkes *et al* (1998) argue that social and ecological systems need to be studied as systems in themselves, while Braun (2008) argues that there is an increasing shift from dualistic to a relational ontology within the study of society and environmental relations. This research shows, however, that there are still dominant dualistic approaches within mainstream natural resource management. This is especially reflected in the command and control approach. Management prescriptions of this approach are founded in, and guided by, positivist applications of physical absolute space which are typically embedded within the language of planners, architects engineers and developers. In this ordered and structured representation of the world, the linkages between socio-economic and environmental systems as complex 'entities' are either played down or not acknowledged. The management prescriptions are therefore based upon a fragmented informant base: a base that focuses on the empirical analysis of part of a system and which assumes that dynamics can be understood in respect of the predictable interaction between elements of a system (Braun, 2008).

Under the approach of command and control, the solution to the inability to understand complexity and uncertainty surrounding the functioning of socio-ecological systems, is to control such systems. Control mechanisms are reflected in the development of legislation and regulations which are geared towards restricting variation within systems: witness the inflexibility of bureaucratic systems, the construction of canals to reduce variation in rivers and the prevalence of mono-culture practices (Holling and Meffe, 1996). The need to control this variation, or to avoid circumstances where the *a priori* of certainty is not met,

is an attempt to streamline the processes towards achieving production goals (Berkes *et al*, 2003).

This research argues that the command and control approach that is underpinned by positivistic applications of science, and its assumption and use of physical absolute space, is effectively reinforcing the nature-society divide and creating a dualistic ontology. The practice of restricting variation of environmental systems is seen as key towards driving this polarisation between nature and society and the ‘pathology’ of this approach is reflected in the loss of resilience within social systems. The loss of resilience is critical as this is fundamental to the social pillar of sustainability (Oelofse, 2009b).

This research has also focused on the conceptualisation of space and the various spatial languages used to understand the polarisation of social and ecological systems. This study argues that the exclusive use of abstract concepts of physical space, as embedded within planning and scientific discourses, to spatially demarcate the coast as a ‘zone’, is one such mechanism of dividing social and ecological systems. The classification and containment of part of a system in physical space under the rubric of the term ‘coastal zone’ is socially constructed space. A physical space has been created and which suggests a self-standing entity. Although the creation of this space may be deemed necessary to support a directed and focused approach to coastal zone management, these management mechanisms and processes are anchored to the confines of that absolute space. These processes and mechanisms are not static and fixed, but are rather shaped by and shape relational spaces that challenge the creation of the legally defined coastal zone as a specific ‘thing’ or a ‘place’. As this research has shown, there are multiple relational spaces that interrelate and which are connected to, and ‘flow’ through the boundaries of this place. This is supported by Massey (1994, cited in Jackson, 2006:200) who asserts that places are “characterised by porous boundaries and inter-connections rather than by fixed identities and impenetrable borders”. This research has shown that the use of absolute space, to isolate the coastal zone as a management unit, is a representation of this ‘impenetrable border’ which effectively severs and discounts the importance of other connections. Thus, the use of an abstract space, as a product of planning and scientific discourse, does not reflect the complexity of socio-ecological systems (Oelofse, 2009a).

Given these arguments it is necessary to reflect on what these relative and relational spaces may look like and what they may contain. Figures 21 to 27 reveal examples of thematic representations of multiple connections and relations of coastal spaces.



Figure 21: The HWM defined as an absolute space.



Figure 22: The HWM rather as an 'envelope of mobility'.

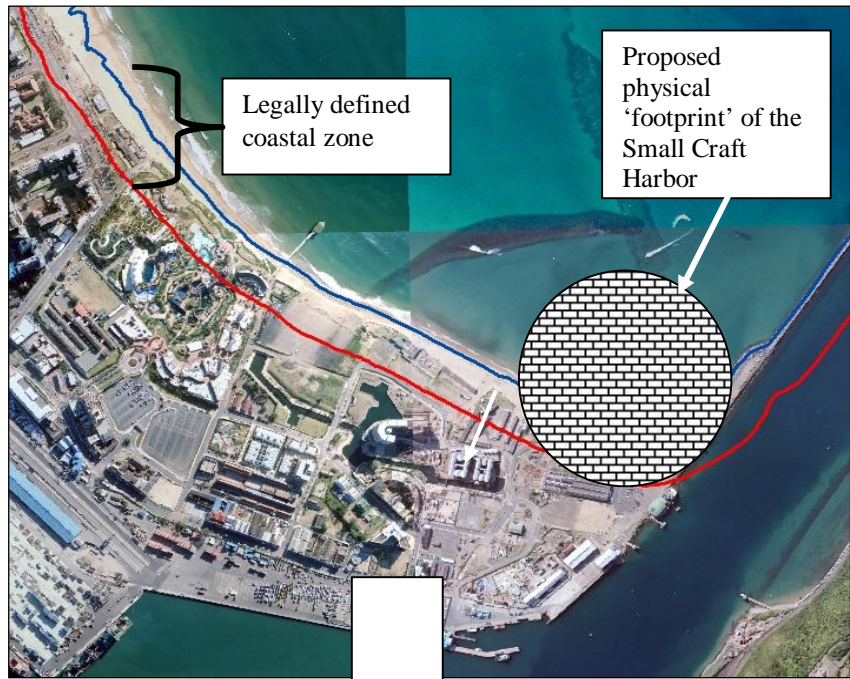


Figure 23: The coastal zone as defined within an absolute space.

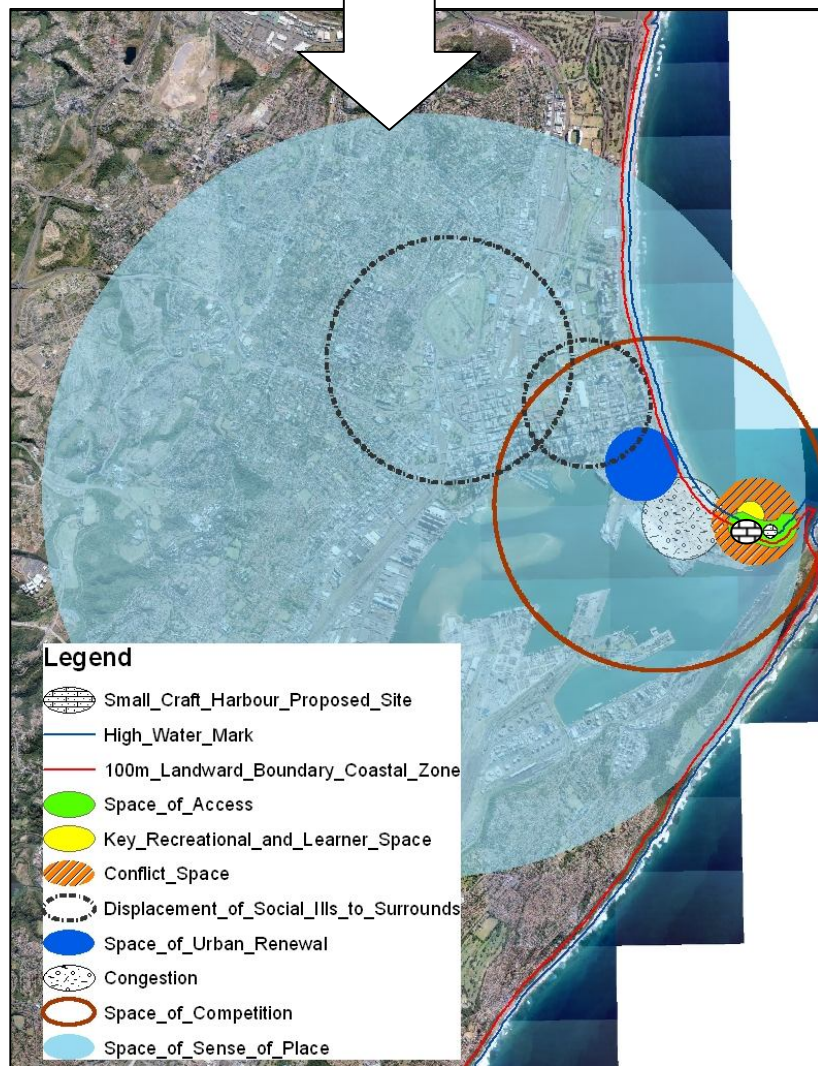


Figure 24: The multiple coastal social spaces that arise as consequence of the proposed development of the SCH.

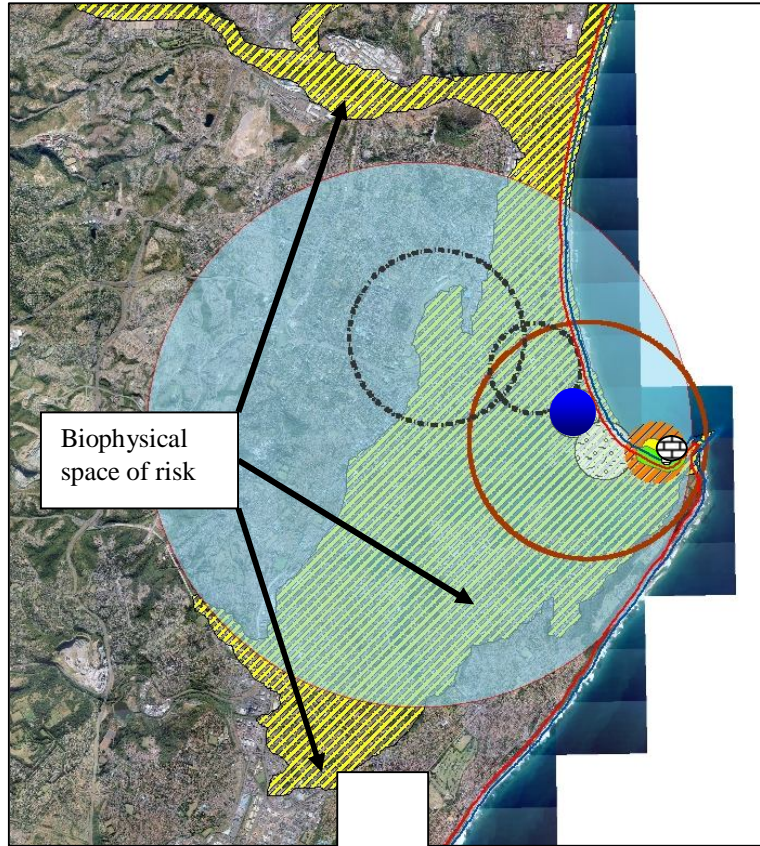


Figure 25: The biophysical space of risk overlaid with multiple social spaces.

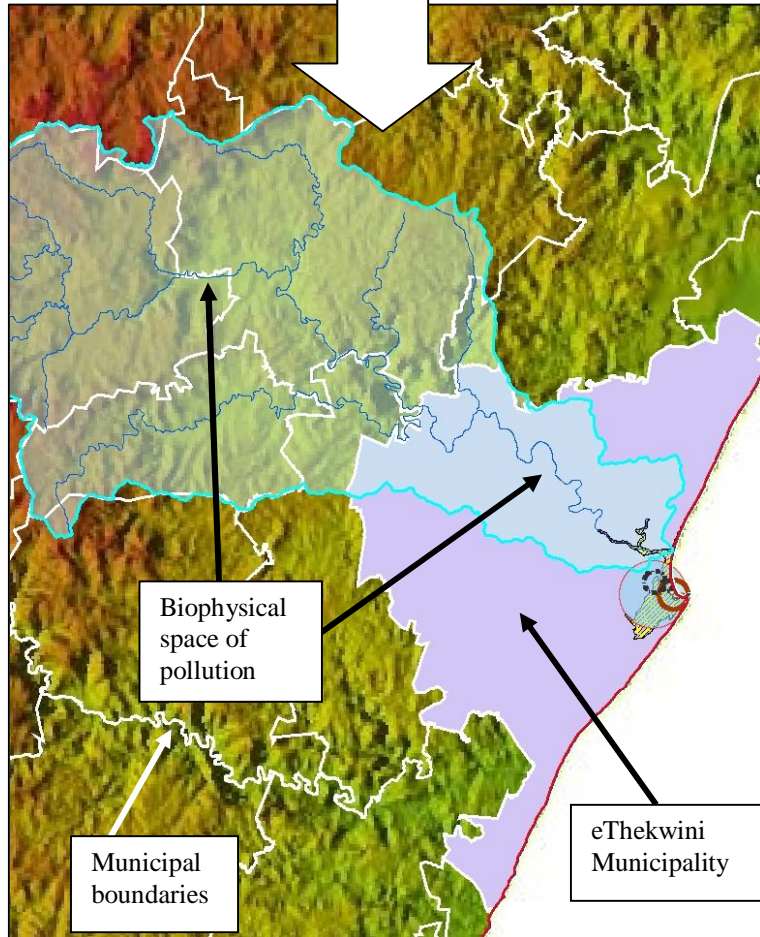


Figure 26: The Umgeni River catchment reflecting the biophysical space of pollution overlaid with the space of risk and the various social spaces.

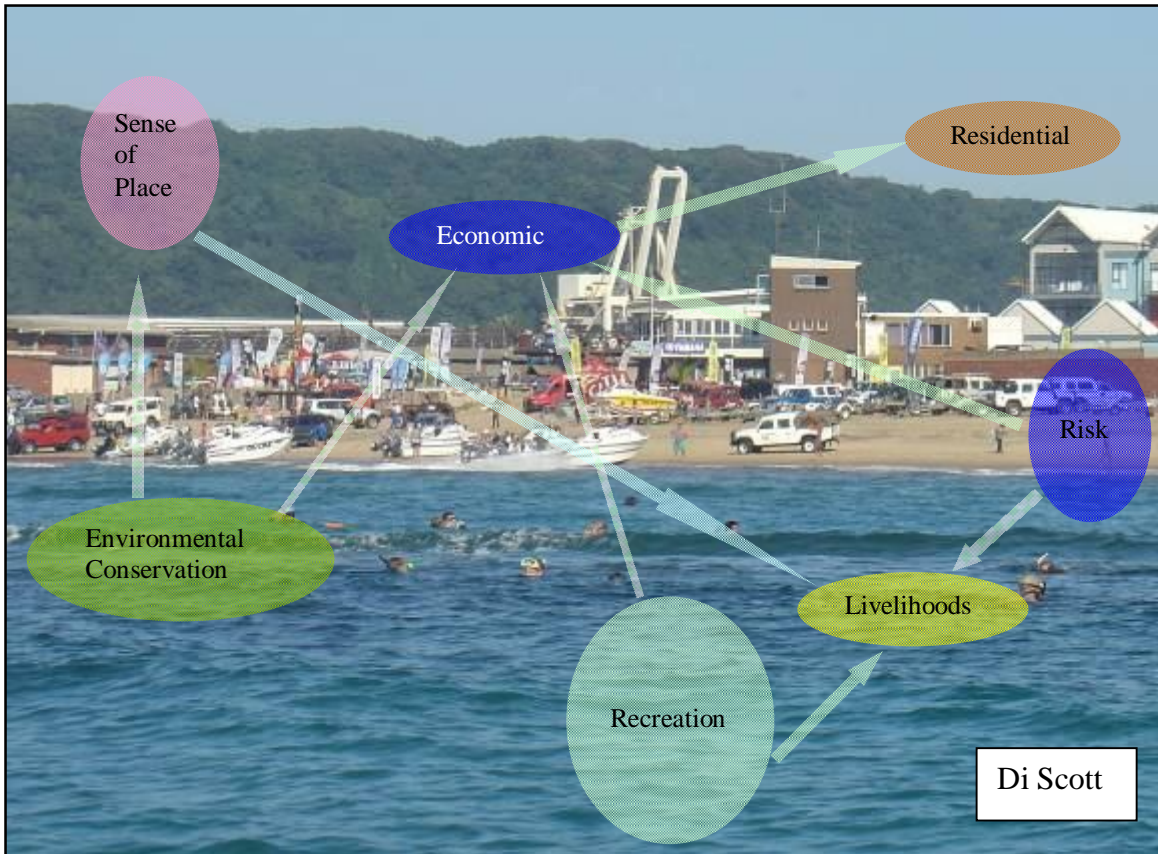


Figure 27: Vetch's Bite reflecting the multiple and interrelated coastal spaces.

From the above thematic images, it is evident that the 'coastal zone' consists of a multiplicity of different relational spaces. Although these thematic representations have focused on the coastal space, the presence of a 'multiplicity of spaces' is all-encompassing: "We are thus confronted by an indefinite multitude of spaces, each one piled upon, or perhaps contained within the next: geographical, economic, demographic, sociological, ecological, political, commercial, national, continental, global. Not to mention nature's (physical) space, the space of (energy) flows and so on" (Lefebvre, 1974, cited in Oelofse, 2009a).

The exclusive use of absolute space to define the coastal zone creates a fragmented and therefore 'non-representative' space. The implications of this are that management prescriptions for this space are limited and contained, which effectively does not allow for the relationship between social and ecological systems to be recognised and integrated into management systems. This is supported by Berkes *et al* (1998:4) who argues that "...social and ecological systems are in fact linked, and that the delineation between social and natural systems is artificial and arbitrary". In the case of coastal regions, this 'delineation'

is driven though the use of absolute space to demarcate the coastal zone, which is problematic as Tuan (1997, cited in Hubbard *et al*, 2004:5) argues “people do not live in a framework of geometric relationships, but a world of meaning”. This ‘artificialness’ is highlighted in biophysical systems whereby natural processes do not recognise, and are not restricted by, the position of absolute or socially constructed boundaries (Leach and Kitchingman, 2005).

The use of alternative concepts of space, that reflect a multitude of connections, enables deeper understanding of the coastal zone and its complexity. From the examples of relational spaces identified, through an analysis of the lived experiences and real perceptions of multiple coastal stakeholders, and as indicated by the thematic representations, this research has shown that the coastal space consists of a ‘fabric’ of interwoven relational spaces. This substantiates Massey’s (1994, cited in Jackson, 2006) argument that “a real recognition of the relationality of space points to a politics of connectivity”. This research opens and reveals the politics of connectivity through exploring multiple relational spaces in the coastal zone.

It is imperative that, to achieve increased degrees of sustainable practice, management approaches and the methodologies that inform these approaches, factor in this connectivity and complexity. In this regard, and in order to re-acknowledge links between social and ecological systems, alternative management prescriptions and the associated frameworks of legislation and regulations need to be investigated. This research argues that the approach of adaptive management is more effective in managing the complexity and fluidity that characterise socio-ecological systems and the spaces that connect elements in these systems. The ability of adaptive management to cope with fluidity and complexity is primarily a result of its capacity to co-evolve with social-ecological systems change. A key mechanism that enables this are the feedback loops. As Olsen *et al* (2006) indicate: each feedback loop, as a representation of a ‘management cycle’, expands to capture issues that were not previously prioritised, or were not identified during the initial research. This may be interpreted as a management system that strives to generate a more holistic understanding of social-ecological systems, and as such give more informed decisions based upon this expanded perception.

Through using a relational concept of space, a more holistic awareness and understanding of social-ecological fluidity and complexity is generated. This provides an enabling framework not only to assist in the identification of previously unidentified issues, but it also enables the identification of issues that may evolve over time, or which are connected to each other. As a consequence of identifying these connections in both time and space, a greater understanding of the intricacies of the relationships between the four pillars of sustainability, as they are interwoven across the multiple spaces, is possible. It is only when management prescriptions, and the science that informs these prescriptions, align themselves to alternative spatial languages that cater for this 'multi-dimensionality', that the more desired degrees of sustainability will be achieved.

This research, at a broad scale, has explored and applied theoretical concepts of space and social-ecological systems, with the goal of identifying ways in which greater sustainability may be achieved. Although this research has focused on the 'coastal space', the arguments made in this research are generally applicable to the broader social-ecological interface. This is especially so where natural resources offer significant socio-economic and developmental potential. This research has developed a theoretical argument which should become an important foundation for further research into coastal management, as it has linked two different theoretical frameworks, namely space and social-ecological systems.

As discussed in the methodology, the professional role of the researcher has resulted in the dissolution of the objective boundary between the researcher and the subject matter. The positionality of the researcher as an 'insider' within the field of coastal management is seen as an important strength to this research. The researcher, based upon practical experience within the field of coastal resource management, has been ideally positioned to gauge the integrity of the data generated. This positionality has also meant that the researcher has actively shaped the outcomes of this research, which given its interpretive approach, is a positive outcome. However, it also must be recognised that it may be less objective. From this perspective, important questions arise in response to the outcomes of this research, which primarily relate to the practical application of the concepts generated in this study. A critical question is how the transition can be achieved between current management structures to more adaptive approaches, especially considering that legislative frameworks are firmly entrenched and aligned within current approach of command and control? The use of absolute space to demarcate the coastal zone is seen as a means to

provide clarity over rights and responsibilities of coastal stakeholders. The use of absolute space is also seen as a mechanism that polarises social and ecological systems. A second question is what practical mechanisms can be developed that will achieve a balance between clearly defining the rights and responsibilities of coastal stakeholders whilst simultaneously catering for social-ecological dynamics? These are critical questions for re-establishing links between social and ecological systems and thus generating higher degrees of sustainability. This thesis has provided the point of departure for exploring these issues in more detail by proposing that space and social-ecological systems thinking is fundamental to the sustainable management of coastal systems.

REFERENCES

Acheson, J.M., Wilson, J.A., and Steneck, R.S. (1998) Managing Chaotic Fisheries in Berkes, F., Folke, C. and Colding, J. (eds.) *Linking Social and Ecological Systems: Management practices and social mechanisms for building resilience*, Cambridge University Press, United Kingdom.

Berger, G., Andrew, F., Hines, F. and Johns, R. (2001) Ecological Modernisation as a basis for environmental policy: Current environmental discourse and policy and the implications of environmental supply chain management, *The European Journal of Social Science*, 14(1) 55-72.

Berkes, F., Folke, C. and Colding, J. (eds.) (1998) *Linking Social and Ecological Systems: Management practices and social mechanisms for building resilience*, Cambridge University Press, United Kingdom.

Berkes, F., Colding, J. and Folke, C. (2003) *Navigating Social Ecological Systems*, Cambridge University Press, United Kingdom.

Binns, A., Rajabifard, A., Collier, P.A. and Williamson, I. (2003) Issues in Defining the Concept of a Marine Cadastre for Australia, *University of New Brunswick Meeting on Marine Cadastre Issues*, University of New Brunswick, Canada.

Binns, A., Rajabifard, A., Collier, P.A. and Williamson, I. (2004) *Developing the Concept of a Marine Cadastre: An Australian Case Study*, Department of Geomatics, University of Melbourne, Melbourne.

Bless, C. and Higson-Smith, C. (1995) *Fundamental Social Science Research Methods An African Perspective*, Juta, Cape Town.

Braun, B. (2008) Environmental issues: Inventive life, *Progress in Human Geography*, 32 (5): 667-679.

Centre for Economic Training in Africa (2006) *Proposed Small Craft Harbour, Economic Impact assessment Main Report*, Durban Point Development Company, Durban.

Celliers, L., Bulman, R., Breedske, T. and Parak, O. (2007) Institutional Mapping of Integrated Coastal Zone Management in KwaZulu-Natal, South Africa, *Ocean Yearbook: Environmental and Coastal Management* 21 (2007): 365-403.

Celliers, L. Colenbrander, D. and Duthie, T. (2008) *Progress towards integrated coastal management in KwaZulu-Natal, South Africa: is the harvest ready?* Unpublished paper, Oceanographic Research Institute, Durban.

Cinderby, S. (n.d.) *Participatory Geographic Information Systems (GIS): The future of environmental GIS?* Stockholm Environmental Institute, University of York, United Kingdom.

City Of Cape Town (2008) *Delineation of the proposed Coastal Protection Zone for the City of Cape Town*, Draft report, Environmental Resource Management Department, City Of Cape Town, Cape Town.

Clark, J.R. (1996) *Coastal Zone Management Handbook*, Lewis Publishers, U.S.A.

Cloke, P., Philo, C. and Sadler, D. (eds.) (1991) *Changing Approaches to Human Geography: An Introduction to Contemporary Theoretical Debate*, Chapman, London.

Colenbrander, D. (2006) *Applying International Certification Approaches to Small and Medium Sized Enterprises within the Forestry Industry of KwaZulu-Natal, South Africa*. Unpublished Honours Thesis, University of KwaZulu-Natal, Durban.

Collier, P.A, Leahy, F.J. and Williamson, I.P. (2001) Defining a marine cadastre for Australia, *A spatial Odyssey: 42nd Australian Surveyors Congress*, 25 – 28 September 2001, Brisbane, Australia.

Council for the Environment (1989) *A Policy for Coastal Zone Management in the Republic of South Africa, Part One: Principles and Objectives*, Council for the Environment, Pretoria.

DEAT (Department of Environmental Affairs and Tourism) (2000) *White Paper: Sustainable Coastal Development in South Africa*, Government Press.

DEAT (2006) *The Integrated Coastal Management Bill, A brief guide to assist the public participation process*, Government Press, Roggebaai.

eThekwini Municipality (2002) *Durban Environmental Services Management Plan*, eThekwini Municipality Press, Durban.

eThekwini Municipality (2005) *Draft eThekwini Coastal Management Strategy, Version 4*, eThekwini Municipality Press, Durban.

Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, CS, Walker, B., Bengtsson, J., Berkes, F., Colding, J., Danell, K., Falkenmark, M., Gordon, L., Kaspersen, R., Kautsky, N., Kinzig, A., Levin, S., Mäler, K., Moberg, Ohlsson, L. Olsson, P., Ostrom, E., Reid, W., Rockström, J., Savenije, H. and Svedin, U. (2002) *Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations*, Norstedts Tryckeri AB, Stockholm.

French, P. (2004) The changing nature of, and approaches to, UK coastal management at the start of the twenty-first century, *The Geographical Journal* 2 (170): 116-125.

Gattrell, A. C., (1991) *Concepts of Space and Geographical Data*, Longman, Harlow.

GESAMP (Group of Experts on the Scientific Aspects of Marine Environmental Pollution) (1990) *The State of the Marine Environment*, UNEP, Blackwell, Oxford.

Gibbs, D., Longhurst, J. and Braithwaite, C. (1998) 'Struggling with sustainability': weak and strong interpretations of sustainable development within local authority, *Journal of Environmental Planning and Management*, 30 (8):1351 – 1364.

Glavovic, B. C. (2000) A New Coastal Policy for South Africa, *Coastal Management*, 28: 261 – 271.

Glavovic, B.C. (2006) The evolution of coastal management in South Africa: Why blood is thicker than water, *Science Direct, Ocean and Coastal Management*, 49 (2006): 889-904.

Glavovic, B. C. and Boonzaier, S. (2007) Confronting Coastal Poverty: Building sustainable coastal livelihoods in South Africa, *Science Direct, Ocean and Coastal Management*, 50 (2007): 1-23.

Glazewski, J. and Haward, M. (2005) Towards Integrated Coastal Area Management: A Case Study in Co-operative Governance in South Africa, *The International Journal of Marine and Coastal Law*, 20 (1): 66-84.

Government Gazette (2006) *Publication of National Environmental Management: Integrated Coastal Management Bill for General Comment*, Government Press, Pretoria.

Graber, P.H.F. (2005) Coastal Boundaries in Schwartz, M. L. (ed.) *Encyclopaedia of Coastal Science, Encyclopaedia of Earth Sciences Series*, Springer, Netherlands.

Harris, T.M., Weiner, D., Warner, T.A and Levin, M.R. (1995) *Pursuing Social Goals Through Participatory Geographic Information Systems: Redressing South Africa's Historical Political Ecology*, Guildford Press, U.S.A.

Harvey, D. (1969) *Explanation in Geography*, Edward Arnold, United Kingdom.

Harvey, D. (1997) Contested cities: social process and spatial form, in Jewson, J. and MacGregor, S. (eds.) *Transforming Cities*, Routledge, London.

Harvey, D. (2006) *Space as a key word*, Verso, London.

Hauck, M., and Sowman, M. (2004) *Waves of Change: Coastal and Fisheries Co-Management in South Africa*, Juta Academic, Cape Town.

Hilborn, R. and Ludwig, D. (1993) The Limits of Applied Ecological Research, *Ecological Applications*, 3(4): 550-552.

Hinrichsen, D. (1990) *Our Common Seas: Coasts in Crisis*, UNEP, Earthscan, London

Hubbard, P., Kitchin, R. and Valentine, G. (eds.) (2004) *Key Thinkers on Space and Place*, SAGE Publications, United Kingdom.

Holling C.S. and Meffe K.G. (1996) Command and Control and the Pathology of Natural Resource Management, *Conservation Biology* 10 (2): 328 – 337.

Institute of Marine and Environmental Law (2007) *Recent Developments in Environmental Law and Governance in South Africa*, University of Cape Town, Cape Town.

Institute of Natural Resources (2002) *Draft principles, criteria, indicators and standards for sustainable forest management of natural forests and plantations in South Africa*. Executive Summary, INR, Scottsville.

Institute of Natural Resources (2003) *KZN Coastal Management Programme: Terms of Reference for the Coastal Working Group*, INR, Scottsville.

Jackson, P. (2006) Thinking Geographically, *Geography*, 91(3): 199-204.

Johnson, R., (1983) *Philosophy and Human Geography*, Longman Group, London.

Kidd, M. (2008) *Environmental Law*, Juta & Company Ltd, Cape Town.

Kitchen, R. and Tate, N. J. (2000) *Conducting Research into Human Geography: Theory, Methodology and Practice*, Prentice Hall, Essex.

Law, E., Londt, H., Neal, M., and Ramasar, V., (1998) *Space: The New Frontier, An Innovative Tool for (Re) Defining Stakeholders*, Unpublished paper, Department of Geographical and Environmental Sciences, University of Natal.

Leach, J. and Kitchingman, A. (2005) *Natural Boundaries*, Department of Geomatics, University of Melbourne, Australia.

Le Tissier, M.D.A., Buddemeier, R., Parslow, J., Swaney, D.P., Crossland C.J., Smith, S.V., Whyte, H.A.Y., Dennison, W.C., Hills, J.M. and Kremer H.H. (eds.) (2006) *The role of the coastal ocean in the disturbed and undisturbed nutrient and carbon cycles – A management perspective*. LOICZ, Geesthacht, Germany.

Mann Borgese, E. (2000) The economics of the common heritage. *Ocean and Coastal Management*, 43: 763-779.

Mather, A. A. (2007) Coastal Erosion and Sea-Level Rise: Are municipalities ready for this? *71st Institute of Municipal Engineers Conference*, 23 – 26 October, 2007, Durban.

McFadden, L., Nichols, R.J., Vafeidis, A. and Tol, S.J. (2007) A Methodology for Modelling Coastal Space for Global Assessment, *Journal of Coastal Research* 23 (4): 911-920.

Novak, J. D. and Cañas A.J., (2006) *The Theory Underlying Concept Maps and How to Construct Them, Technical Report*, Institute for Human and Machine Cognition, Cmap Tools, Pensacola.

Oelofse, C. (2008) Tutorial Three, Human Environments, School of Environmental Sciences, University of KwaZulu-Natal, Durban.

Oelofse, C. (2009a) *Environmental spaces: the intersection of society, space and environment in Knysna, southern Cape*, PhD Thesis, Final Draft, University of KwaZulu-Natal, Durban.

Oelofse, C. (2009b) Sustainable Development, Sustainable Schools Workshop, 26 May 2009, University of KwaZulu-Natal, Durban.

Oelofse, C., Scott, D, Oelofse, G, and Houghton, J. (2006) Shifts in Ecological modernization in South Africa: Deliberation, innovation and institutional opportunities, *Local Environment*, 11 (1): 61-78.

Olsen, S.B., Sutinen, J.G., Juda, L. and Grigalunas, T.A. (2006) *A Handbook on Governance and Socioeconomics of Large Marine Ecosystems*, Coastal Resource Centre, University of Rhode Island, Rhode Island.

Permanent Committee on GIS Infrastructure for Asia and Pacific (2004) International Workshop: *Administering the Marine Environment-Spatial Dimensions*, Department of Survey and Mapping, Malaysia

Philo, C. and Wilbert, C. (2000) *Animal Spaces, beastly places: New Geographies of human-animal relations*, Routledge, London.

Pickles, J. (1995) *Representations in an Electronic Age: Geography, GIS, and Democracy*, Guilford Press, New York.

Rajabifard, A., Binns, A., and Williamson, I. (2005) *Administering the Marine Environment-the Spatial Dimension*, Centre for Spatial Data Infrastructure and Land Administration, Department of Geomatics, University of Melbourne, Melbourne.

Schindler, D.W. (1987) Detecting Ecosystems response to anthropogenic stress, *Canadian Journal of Fisheries and Aquatic Sciences* 44 (1): 6-25.

Schwartz, M. L. (ed.) (2005) Encyclopaedia of Coastal Science, *Encyclopaedia of Earth Sciences Series*, Springer, Netherlands

Scott, D., Oelofse, C., Scott, K., and Houghton, J. (2007) *Amended Social Impact Assessment of the proposed Small Craft Harbour report*, Durban Point Development Company, Durban.

Turton, A. (2008) *Three Strategic Water Quality Challenges that Decision-Makers Need to Know About and How the CSIR Should Respond*, CSIR, Pretoria.

Whitehead, J. (2004) *Wilderness as a mechanism for sustaining coastal quality in South Africa*, unpublished Master's Thesis, University of KwaZulu-Natal Press, Durban.

Williamson, I., Rajabifard, A. and Strain, L. (2005) *Marine Cadastres – Challenges and Opportunities for Land Surveyors*, Centre for Spatial Data Infrastructure and Land Administration, Department of Geomatics, University of Melbourne, Melbourne.

UNEP (United Nations Environmental Programme) (2005) *Assessing Coastal Vulnerability: Developing a Global Index for Measuring Risk*, UNEP/Earthprint, United States.

UNEP (United Nations Environmental Programme) (2006) *Africa Environment Outlook 2, Our Environment, Our Wealth*, Progress Press, Malta.

US Commission on Marine Science, Engineering and Resources (1969) in van den Bergh, C.J.M and Nijkamp, P. (1997) *Global Environmental Change, Local Land Use Impacts and Socio-economic Response Strategies in Coastal Regions: Serie Research Memoranda (2)* University of Amsterdam, Holland.

van den Bergh, C.J.M. and Nijkamp, P. (1997) *Global Environmental Change, Local Land Use Impacts and Socio-economic Response Strategies in Coastal Regions: Serie Research Memoranda (2)*, University of Amsterdam, Holland.

World Wide Web

Atkins (2004) *ICZM in the UK: A Stocktake, Final Report*, DEFRA, United Kingdom.
<http://www.defra.gov.uk/environment/water/marine/uk/iczm/stocktake/section1.pdf>
(04/09/2007)

Cornell University Law School (2008) Official Website.
http://www.law.cornell.edu/uscode/16/usc_sec_16_00001453----000-.html
(04/08/2008)

Endangered Wildlife Trust (2007) *Considering Coasts in the EIA Process*.

<http://www.eiatoolkit.ewt.org.za/process/coasts.html>

(25/07/2007)

Johnson, B. L. (1999) The Role of Adaptive Management as an Operational Approach for Resource Management Agencies, *Conservation Ecology* 3(2).

<http://www.consecol.org/vol3/iss2/art8/>

(21/06/2007)

Mottier, V. (2005) The Interpretive Turn: History, Memory, and Storage in Qualitative Research, *Forum: Qualitative Social Research* 6(2), Article 33.

<http://www.qualitative-research.net/index.php/fqs/article/viewArticle/456/972>

05/11/09

Oceanographic Research Institute (2008) Official Website.

<http://www.ori.org.za>

(20/10/2008)

Republic of South Africa (1989) *Environmental Conservation Act, Act 73 of 1989*.

<http://www.acts.co.za/enviro/index.htm>

Republic of South Africa (2008) Integrated Coastal Management Bill.

<http://www.info.gov.za/documents/index.htm>

Republic of South Africa (2004) *National Environmental Biodiversity Act, Act 10 of 2004*.

<http://www.info.gov.za/documents/index.htm>

Republic of South Africa (1998) *National Environmental Management Act, Act 107 of 1998*.

<http://www.info.gov.za/documents/index.htm>

Republic of South Africa (1998) *Marine Living Resources Act, Act 18 of 1998*.

<http://www.info.gov.za/documents/index.htm>

Republic of South Africa (1996) The Constitution of the Republic of South Africa, 108 of 1996.

<http://www.info.gov.za/documents/index.htm>

South African Cities Network (2009) Official Website

<http://www.sacities.net>

(28/03/2009)

South African Coastal Information Centre (2007) *General Legislation for the Management of the Coastal Environment*.

<http://sacoast.uwc.ac.za/education/resources/legislation/general-legislation.htm#Sea-shore%20Act>

(11/09/2007)

South African Info (2008) *Spatial Development Initiatives*.

http://www.southafrica.info/doing_business/economy/development/sdi.htm

(03/12/2008)

South African Government (2008) Official Website

<http://www.info.gov.za/asgisa/>

(20/09/2008)

State of Delaware, The. (2008). Official Website.

<http://delcode.delaware.gov/title7/c070/index.shtml>

(04/08/2008)

World Bank (2007) *Coastal and Marine Management*

<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTCMM/0,,menuPK:407932~pagePK:149018~piPK:149093~theSitePK:407926,00.html>

(06/09/2007).

Media

Carnie, T. (2007) KZN scoops the greatest share of season's blue flag, *The Mercury, Edition 1*, 1 November 2007, Durban.

Carnie, T. (2008) Water courses awash with sewerage: Safety threat to city rivers, *The Mercury, Edition 2*, 31 January 2008, Durban

Carnie, T. (2008) Red flag for blue flag beaches, *The Mercury, Edition 1*, 14 March 2008, Durban

Carnie, T. (2008) Denial will ensure continued pollution, *The Mercury, Edition 1*, 19 March 2008, Durban.

Carnie, T. (2008) Time running out to rescue blue flags in time for 2010, *The Mercury, Edition 2*, 7 May 2008, Durban.

Carnie, T. (2008) Sutcliff objects to press presence, *The Mercury, Edition 1*, 16 May 2008, Durban.

McLeod, N. (2008) City working hard to improve quality of beaches, *The Mercury, Edition 1*, May 2, 2008.

Wakelin, J. (2008) Regaining lost blue flags a must, *The Mercury, Edition 1*, 12 May, 2008, Durban.

Personal Correspondence

Parak, O. (2008) E-mail correspondence regarding NEMA regulations, 04/09/08.

Appendix 1: Euclid's Postulates

1. "A straight line segment can be drawn joining any two points.
2. Any straight line segment can be extended indefinitely in a straight line.
3. Given any straight lines segment, a circle can be drawn having the segment as radius and one endpoint as centre.
4. All Right Angles are congruent.
5. If two lines are drawn which intersect a third in such a way that the sum of the inner angles on one side is less than two Right Angles, then the two lines inevitably must intersect each other on that side if extended far enough. This postulate is equivalent to what is known as the Parallel Postulate".

Source:

<http://www.math.harvard.edu/~ctm/home/text/class/harvard/113/97/html/euclid.html>

(07/06/07)

Appendix 2: Provincial Coastal Committee Terms of Reference

KZN Coastal Management Programme:
Terms of Reference for the
Coastal Working Group
March 2003

Institute of Natural Resources
Private Bag X01
Scottsville
3209
Contact Person: Duncan Hay
tel: 033-3460796
fax: 033-3460895
email: hay@nu.ac.za



Terms of Reference

Name

KwaZulu-Natal Coastal Working Group (KZN CWG)

Geographic Area

KwaZulu-Natal Coast.

Status

The KZN CWG is an interim structure that will operate until such time as the Provincial Coastal Committee for KwaZulu-Natal has been established by the MEC of the Province in terms of the planned Coastal Management Act.

Objective

The objective of the KZN Coastal Working Group is to promote sustainable coastal development - involving a balance between material prosperity, social development, cultural values, spiritual fulfilment and ecological integrity, in the interests of the current and future generations of KwaZulu-Natal.

Functions

The functions of the KZN CWG with regards to coastal and marine issues are:

Monitor, advise and influence national, provincial and local policy and legislation formulation.

Identify governmental and non-governmental coastal stakeholders in the Province.

Promote and facilitate integration, cooperation and coordination between all governmental and non-governmental stakeholders.

Promote education and awareness with regard to coastal management issues amongst all stakeholder groups.

Promote, facilitate and identify research and information collection initiatives (eg coastal databases).

Promote and advise on stakeholder capacity building and empowerment.

Monitor, advise on and promote integrated planning and management processes.

Monitor and advise on the control of, and compliance with policy and legislated implementation procedures.

Communicate information on coastal policy and management.

Promote sustainable coastal development and tourism.

Promote initiatives that contribute to poverty alleviation.

Membership

Membership of the KZN CWG should be drawn from government departments, statutory bodies and parastatals that play a role in coastal management; and sectors of Civil Society with a stake in coastal management.

Government	
Organisation	Components Represented
Department of Agriculture and Environmental Affairs	Coastal Management Unit Environmental Impact Assessment

	Directorate Agriculture (Engineering and Soil Conservation)
Department of Traditional and Local Government Affairs	Northern Regional Office of Local Government Coastal Regional Office of Local Government Traditional Affairs
Department of Economic Development and Tourism	Economic Development
National Department of Environmental Affairs and Tourism	Coastal Management Office
National Department of Water Affairs and Forestry	KwaZulu-Natal Region
National Department of Land Affairs	KwaZulu-Natal Region
National Department of Public Works	Asset Management Division
District Municipality	Ugu District Municipality eThekweni Unicity (coastal engineering and planning) Ilembe District Municipality Uthungulu District Municipality Umkhanyakude District Municipality
South African Police Services	
Kwanaloga	
Statutory Bodies and Parastatals	
KZN Wildlife	Coastal Region
Natal Sharks Board	
Greater St Lucia Wetland Park Authority	
Provincial Planning and Development Commission	
KZN Tourism Authority	
Amafa	
SA Ports Authority	
National Ports Operations	
Sectors of Civil Society	
Criteria for Membership	Sectors
There are many sectors than should be represented on the CWG. Unfortunately most sectors are not organised into single provincial representative bodies. To promote inclusivity any civil society organisations that have a provincial focus (as a opposed to a local focus) can become a member. Civil Society organisations wishing to become members of the CWG can apply for membership using the attached membership form.	Environmental Sector Community Sector Research Sector Business Sector Labour Sector Mining Sector Agricultural Sector Tourism Sector Recreational Users Sector Provincial Forums/Partnerships

In addition the chairs of any regional Coastal Working Group should be members of the KZN CWG. Finally the KZN CWG will be able to co-opt experts on to the Working Group on a temporary basis to advise on specific issues.

Responsibilities of members

People are members of the Coastal Working Group in their capacity as a representative of their organisation. Since they are members in a representative capacity they have the following responsibilities:

Attendance of the Coastal Working Group meeting on a regular basis.

In the event that the member being unable to attend the meeting arrangements should be made for an alternative representative from the organisation to attend.

Provision of regular reports to the Coastal Working Group on the coastal activities of their organisation that are of Provincial interest.

Reporting back to the members of their organisation regarding issues that arose in the Coastal Working Group that are of significance to the organisation.

Mode of Operation

Chair

The KZN CWG is chaired by the head of the Provincial Coastal Management Unit of the Department of Agriculture and Environmental Affairs.

Meetings

Meetings are held every second month.

Sub-committees

The KZN CWG can establish sub-committees on either a permanent or temporary basis to deal with issues that required more detailed attention.

Administration and Support

The Coastal Management Unit is responsible for convening the meetings of the KZN CWG, the recording and distribution of minutes, and other tasks associated with the administration of the KZN CWG.

Costs

The Provincial Department of Agriculture and Environmental Affairs bears the costs associated with convening the meetings of the KZN CWG⁴¹. Individual members are responsible for the costs associated with their own attendance and participation in the KZN CWG. The Provincial Coastal Co-ordinator has the discretion to fund the S&T costs of any non-governmental organisation who it is felt should attend the meeting and as is unable to fund its own attendance.

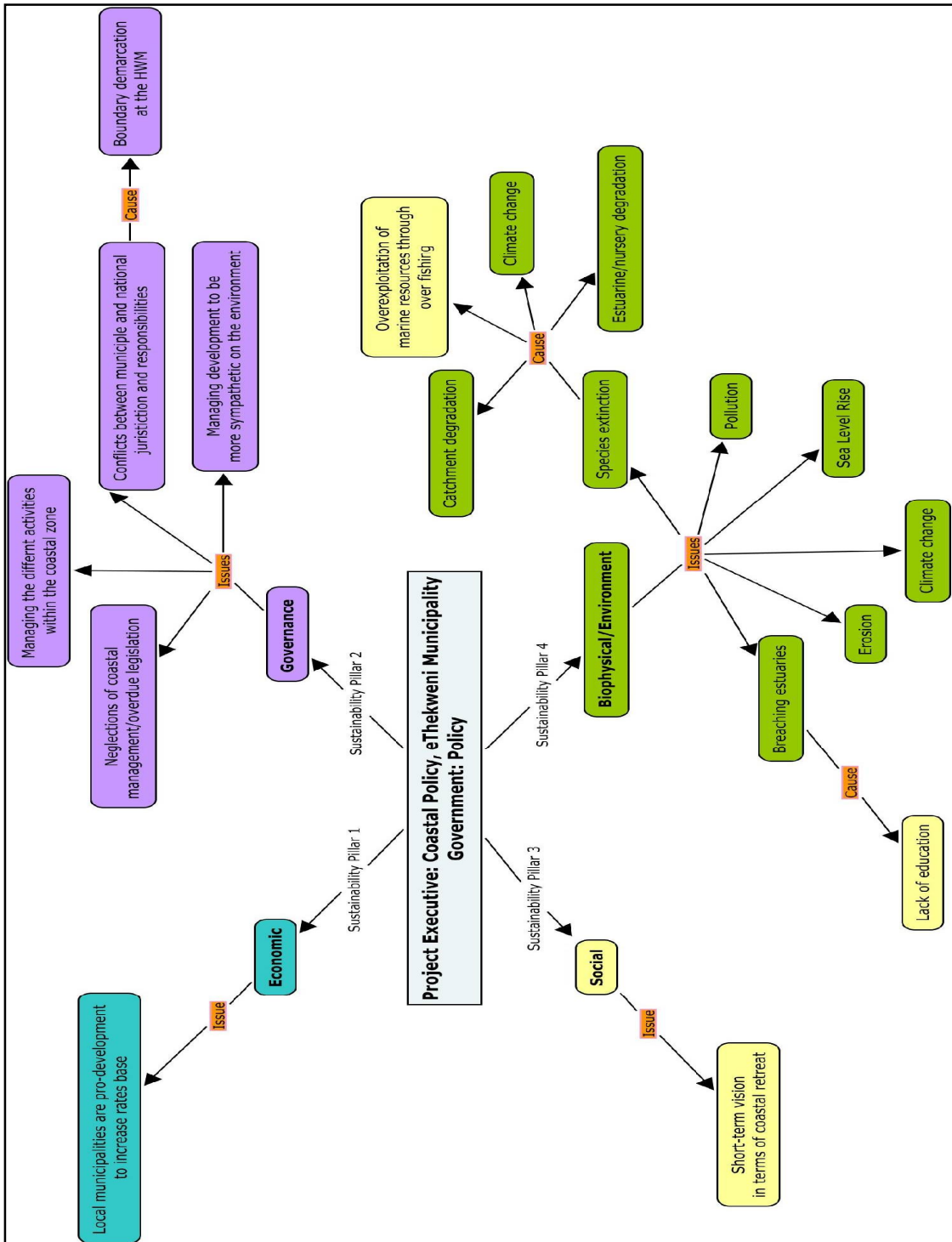
⁴¹ While the DFID funded Sustainable Coastal Livelihoods Programme is operational it will be contributing to the costs associated with holding the CWG meetings.

Appendix 3: The Questionnaire

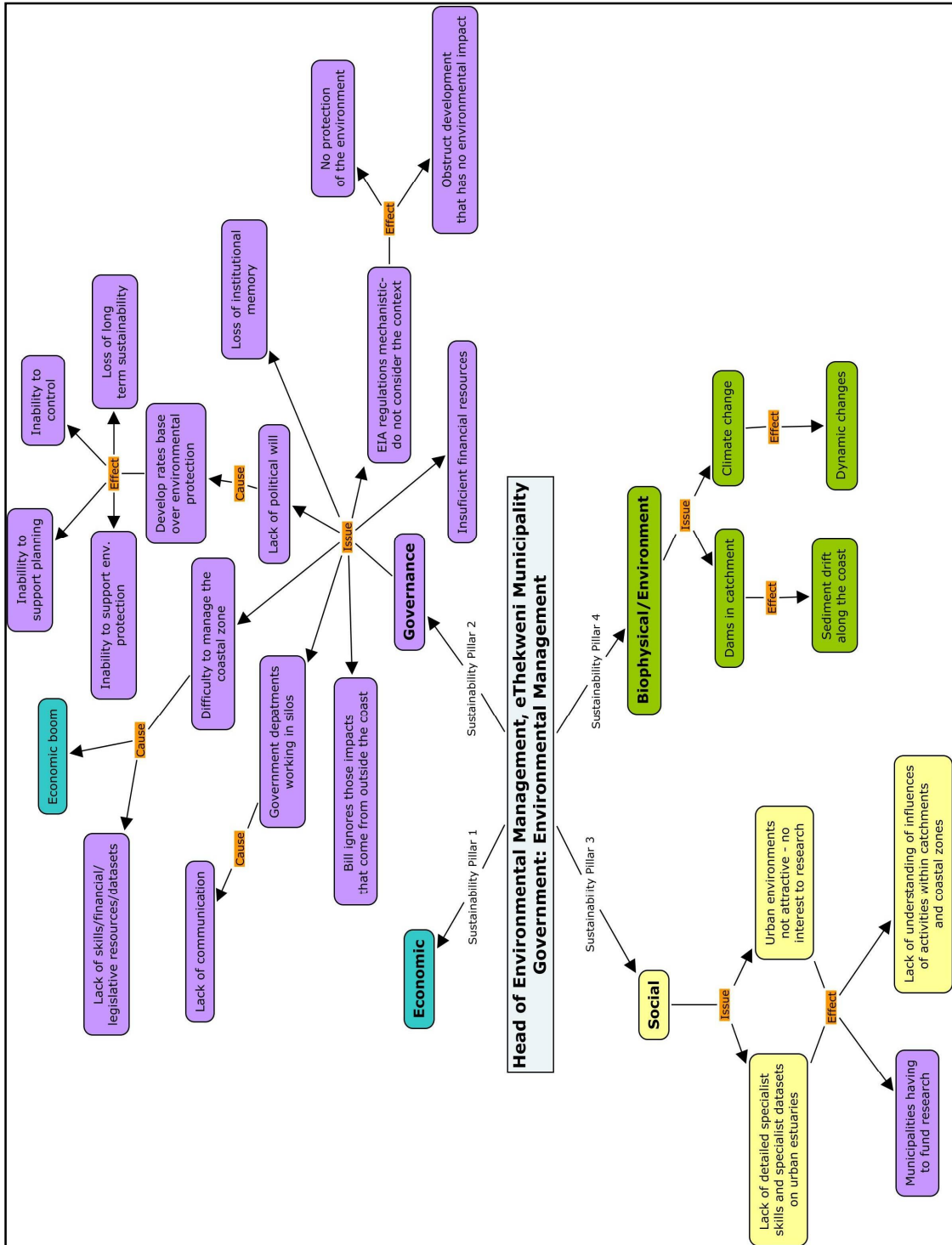
- 1) Does your position have any relevance to coastal management? Explain.
- 2) In your own opinion, please can you define what is meant by the term “coastal zone”?
- 3) How is the coastal zone defined legally and in terms of policy?
- 4) Does this definition have any affect on the way that you work with/manage the coastal zone?
- 5) Do you consider yourself to be a coastal stakeholder and why?
- 6) What value does the coastal zone hold to you - both in your profession and to you personally?
- 7) What components would you include in a definition of the coastal zone and why?
- 8) Do you think it is necessary to demarcate the coastal zone? Explain.
- 9) What, in your opinion, are the major issues/challenges facing the management of the coastal zone?
- 10) Do these issues have a direct impact upon you and/or your work? What are they and how do they impact upon you/your work?
- 11) How would you address these issues?
- 12) What activities do you think have a negative impact on the coastal zone? Why?
- 13) What is your training?

Appendix 4: Concept Maps

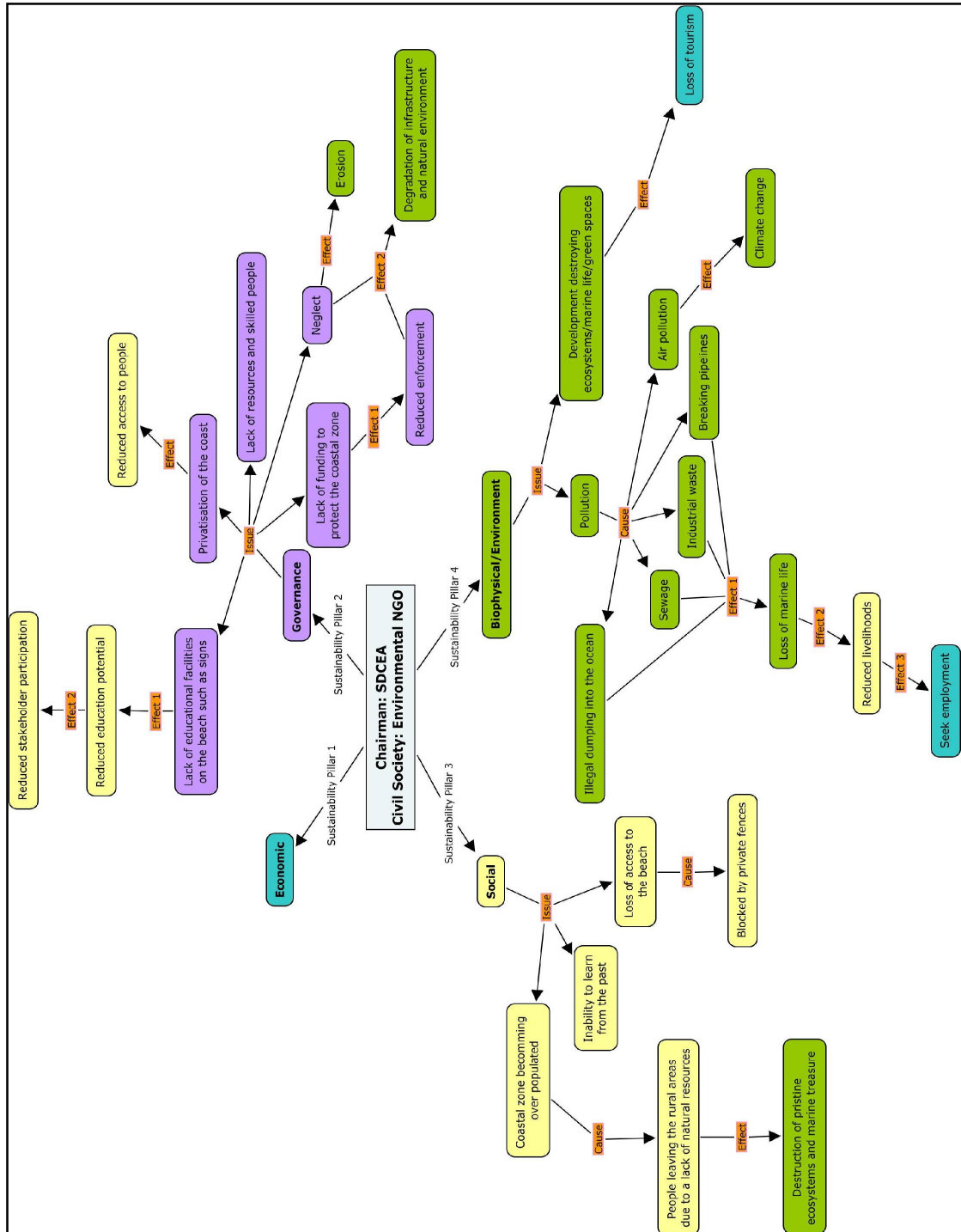
4.1: Project Executive: Coastal Policy, eThekweni Municipality



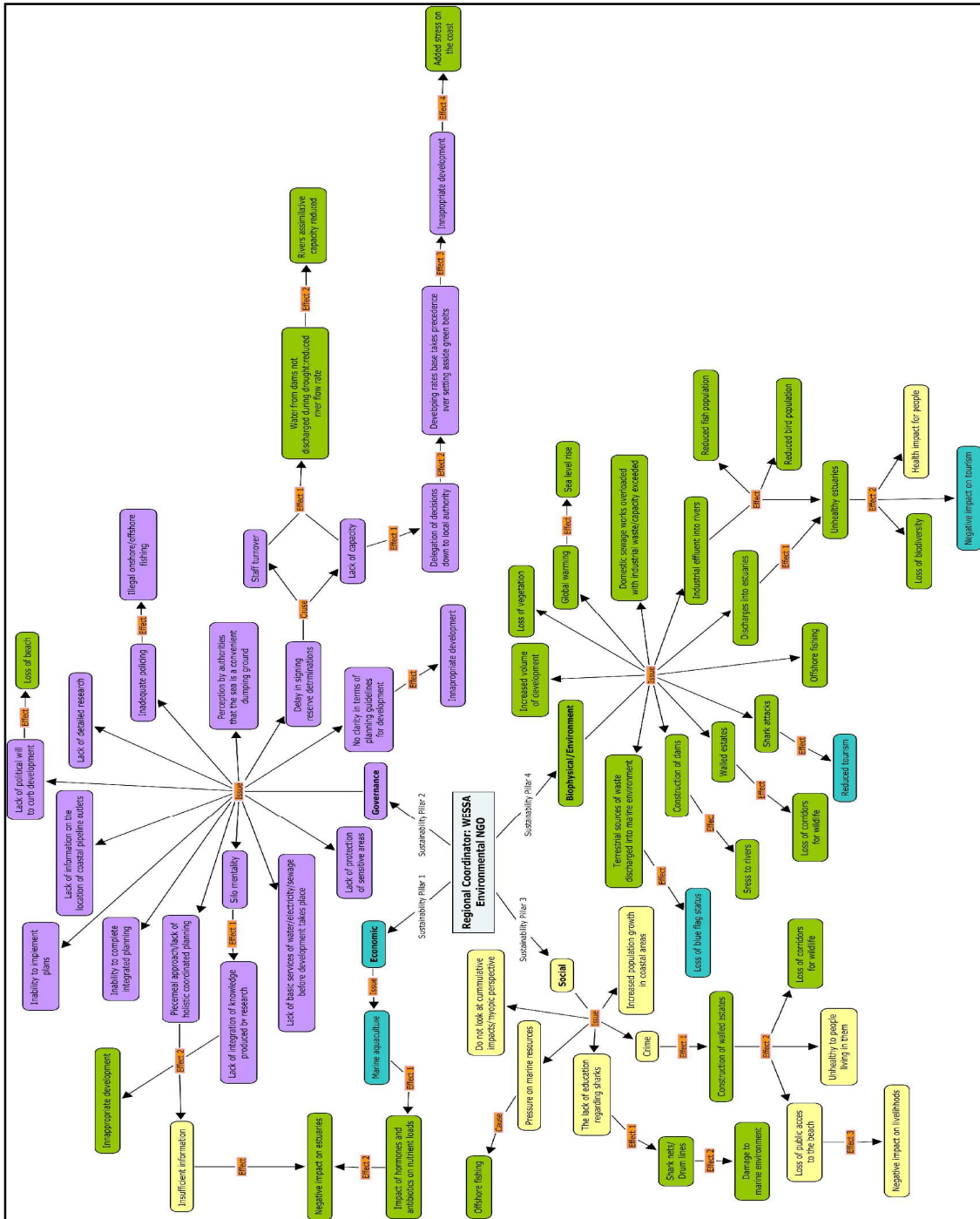
4.3: Head of Environmental Management: eThekweni Municipality



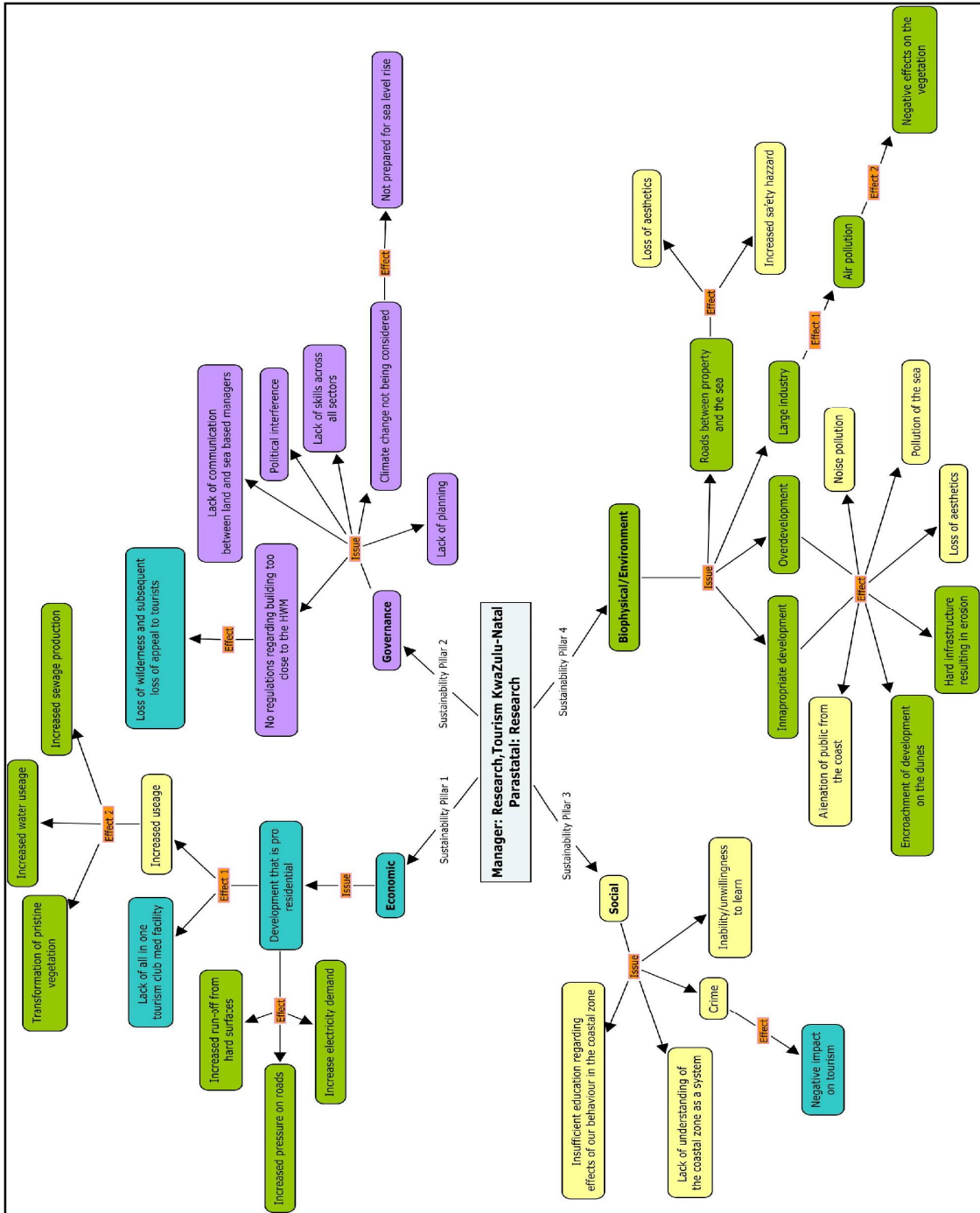
4.4: Chairman: South Durban Community Environmental Alliance



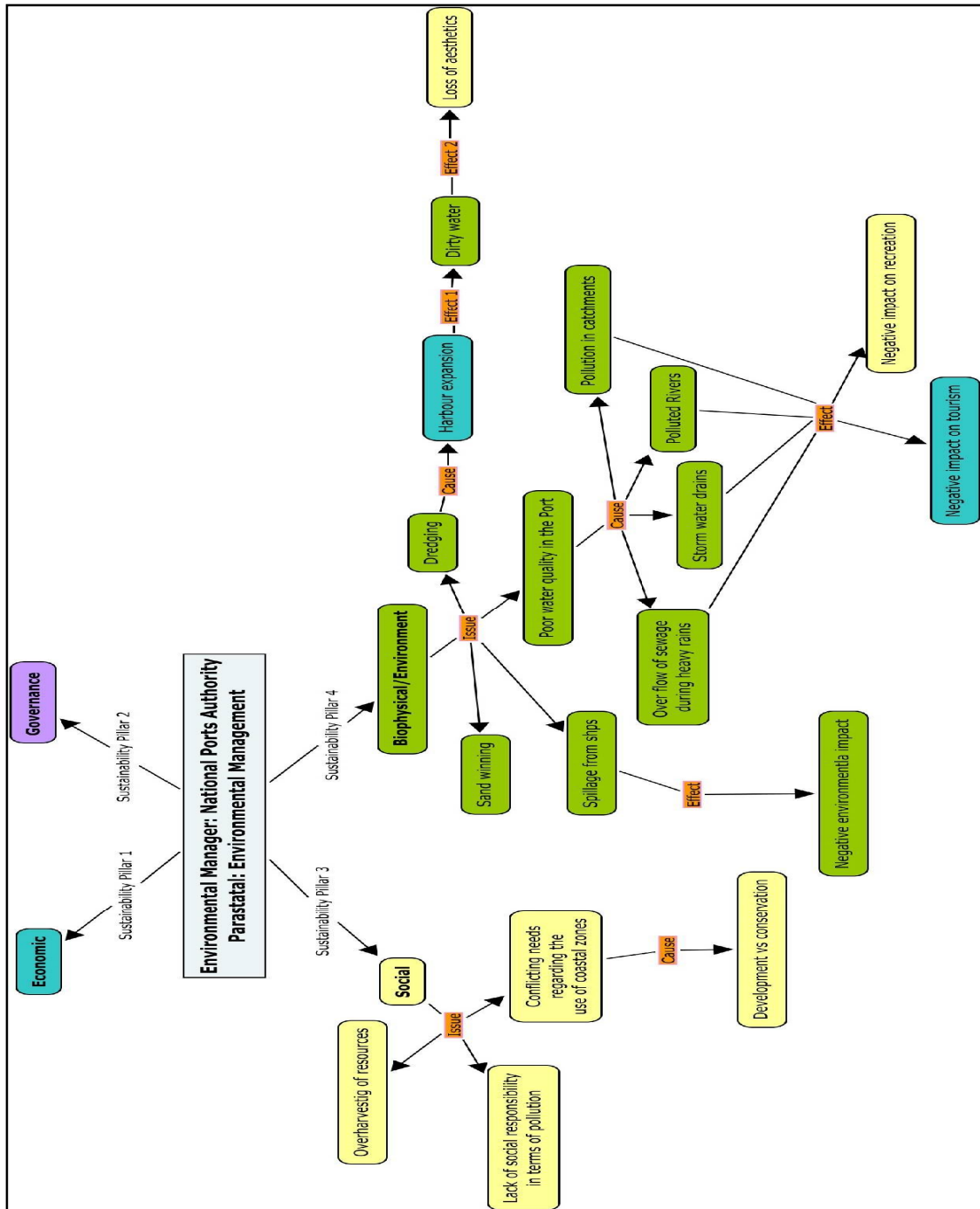
4.5: Regional Coordinator: Wildlife and Environment Society of South Africa



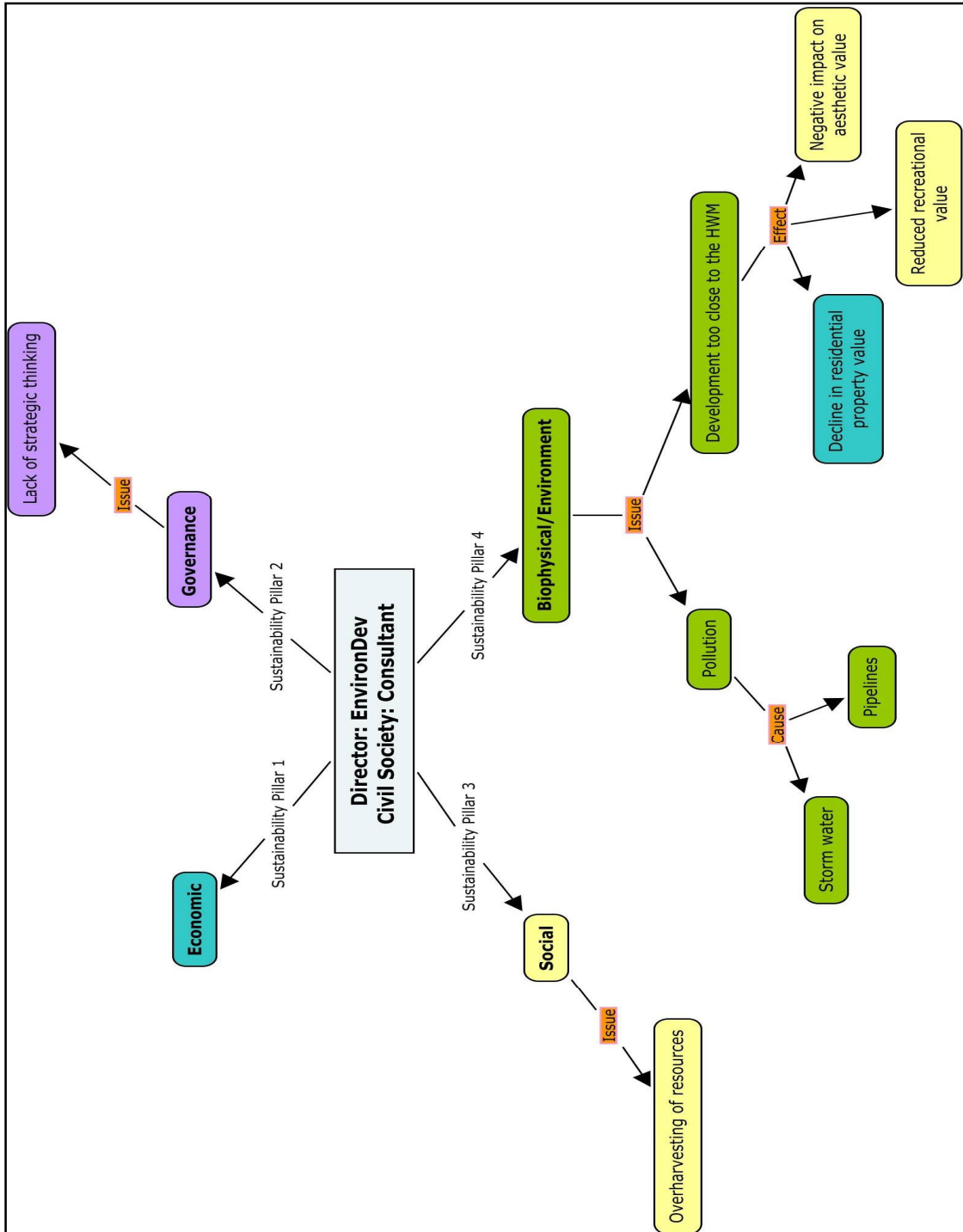
4.6: Manager: Research, Tourism KwaZulu-Natal



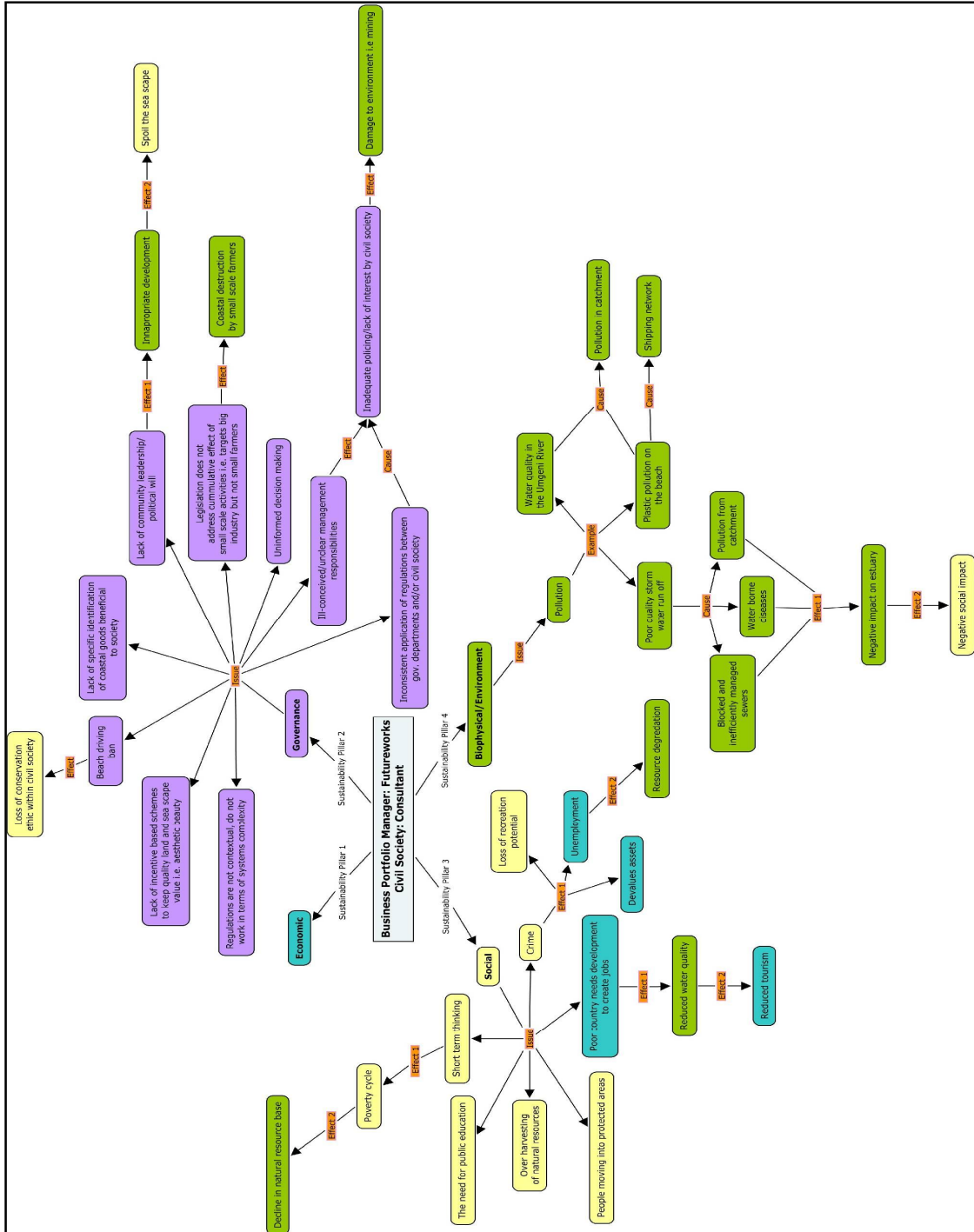
4.7: Environmental Manager: National Ports Authority



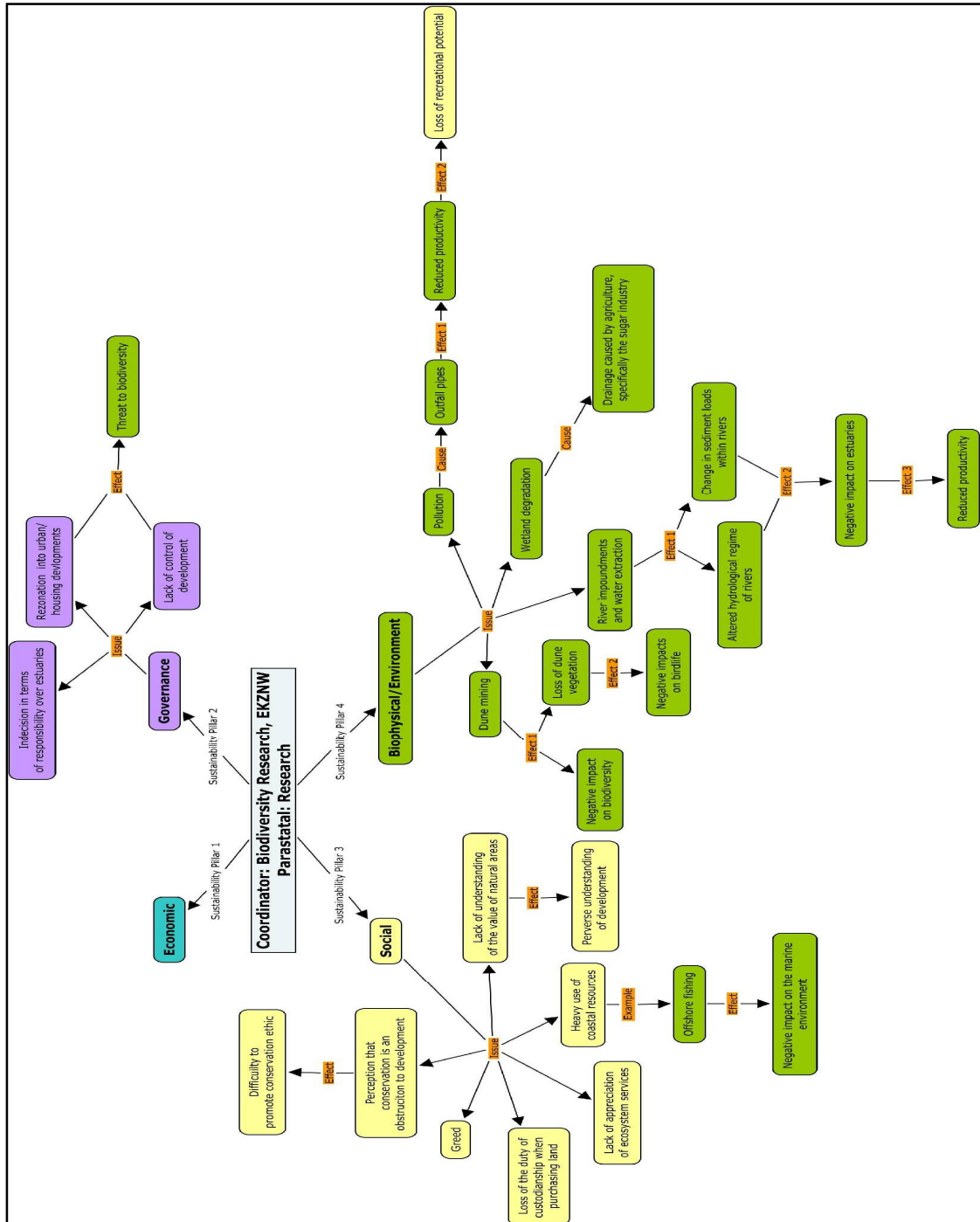
4.8: Director: EnvironDev



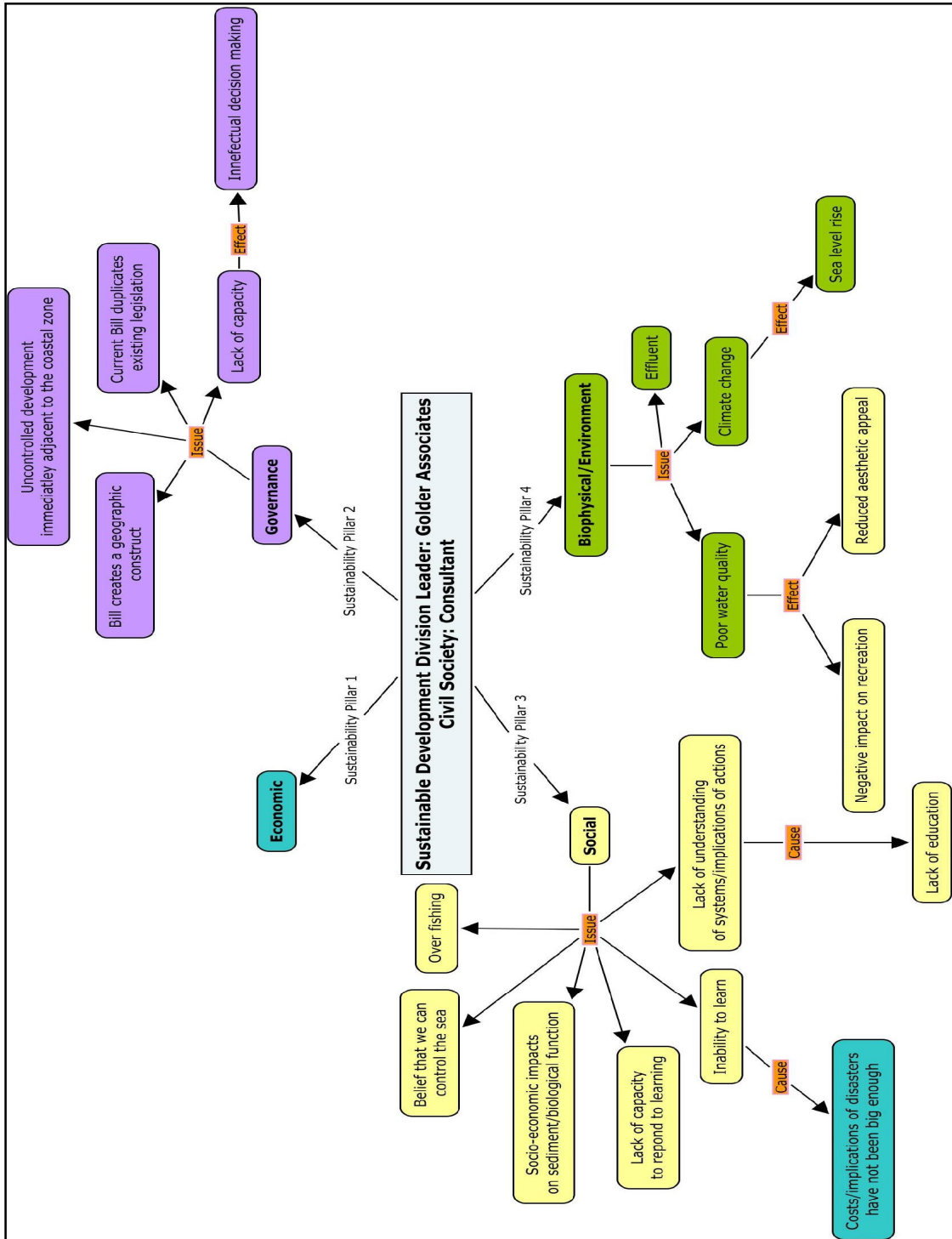
4.9: Business Portfolio Manager: Futureworks



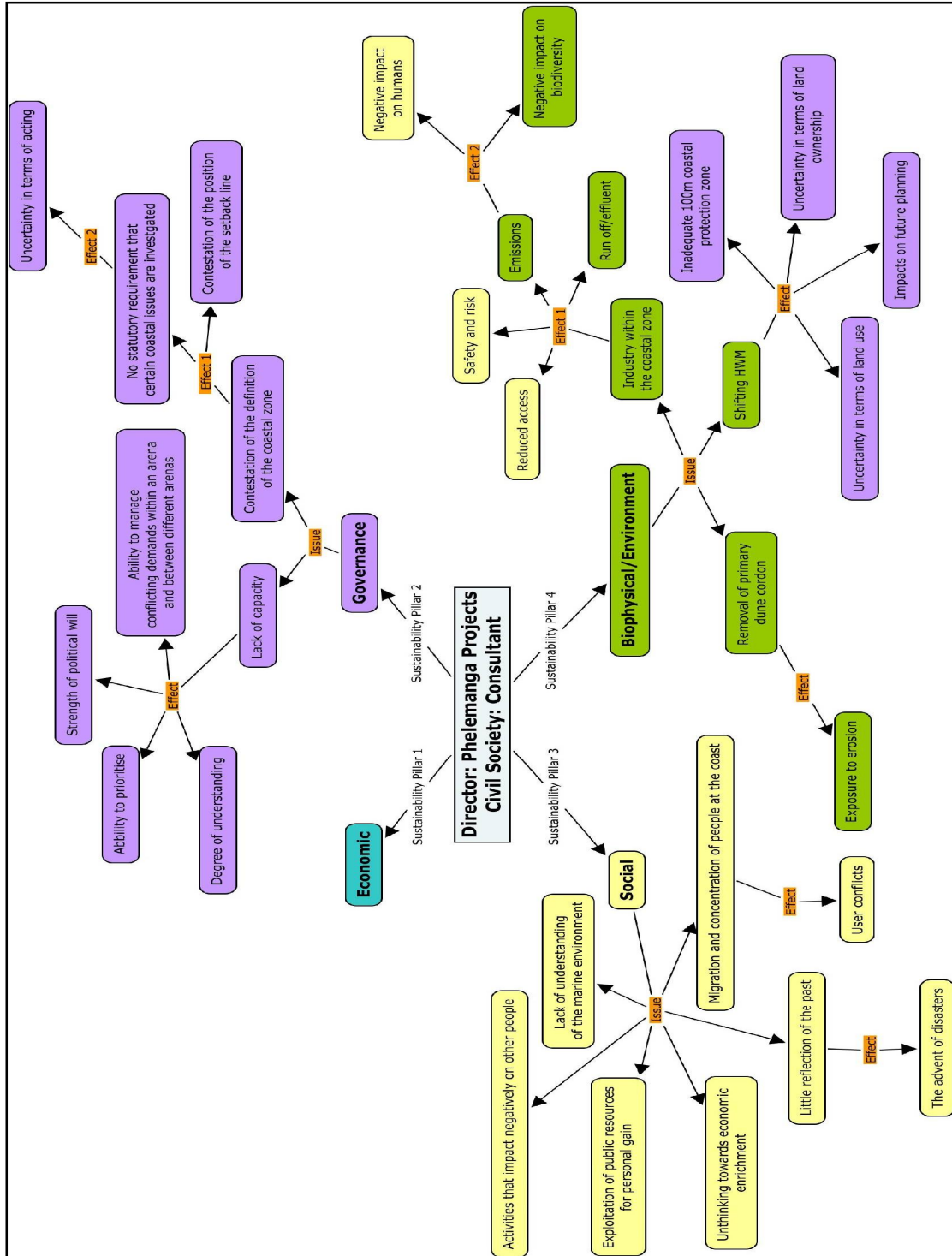
4.11: Coordinator: Biodiversity Research, Ezemvelo KwaZulu-Natal Wildlife



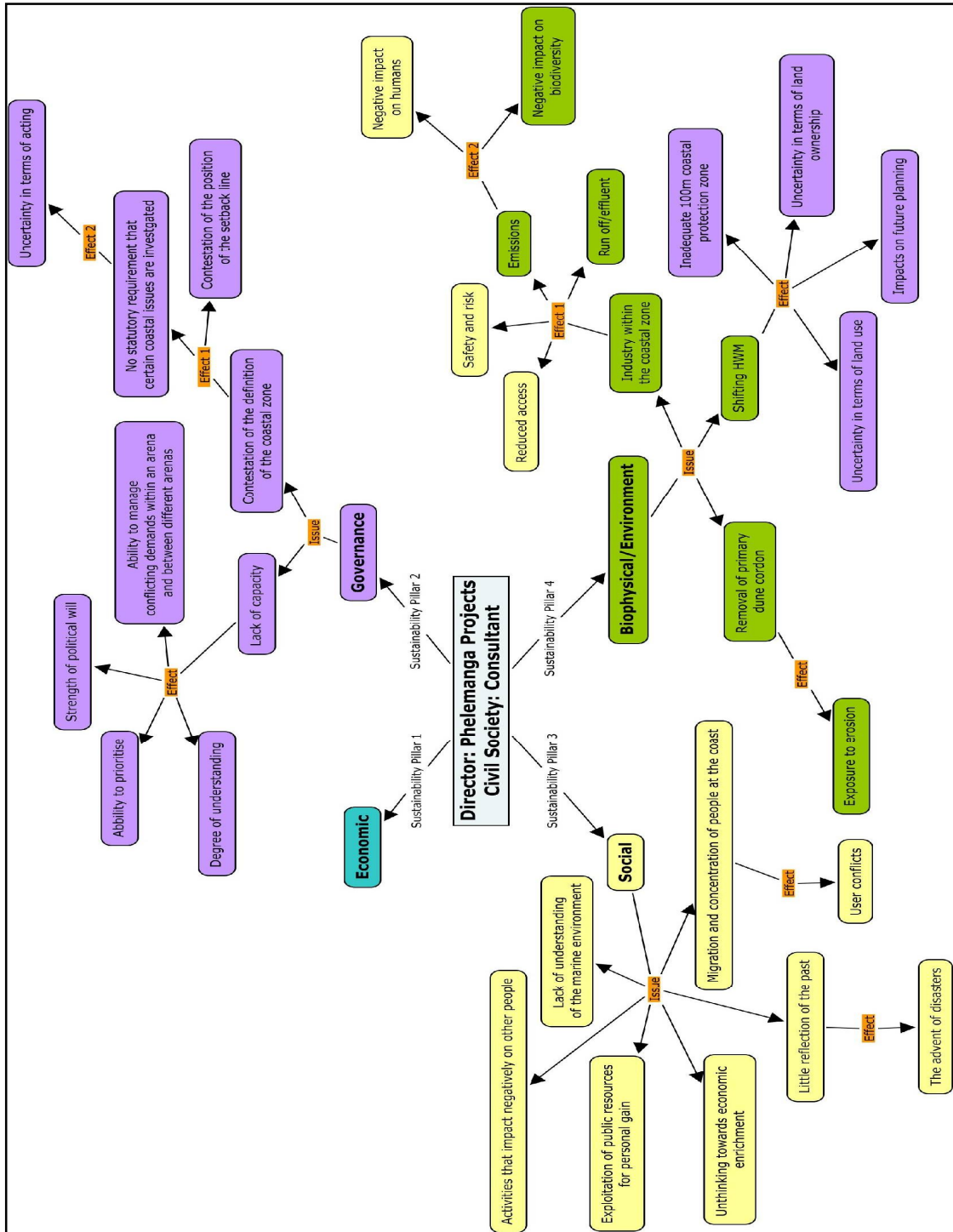
4.12: Sustainable Development Division Leader: Golder Associates



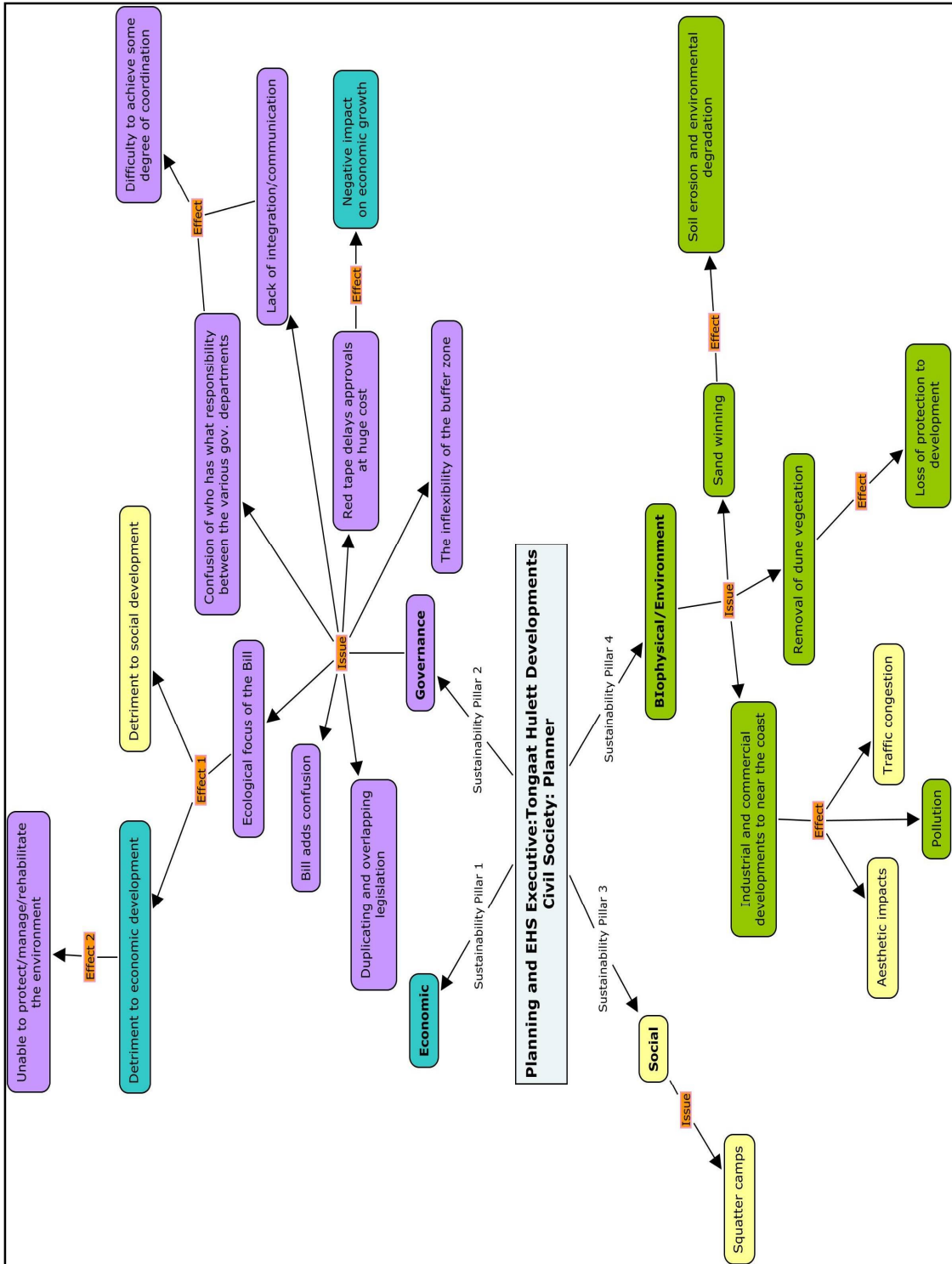
4.13: Director: Phelamanga Projects



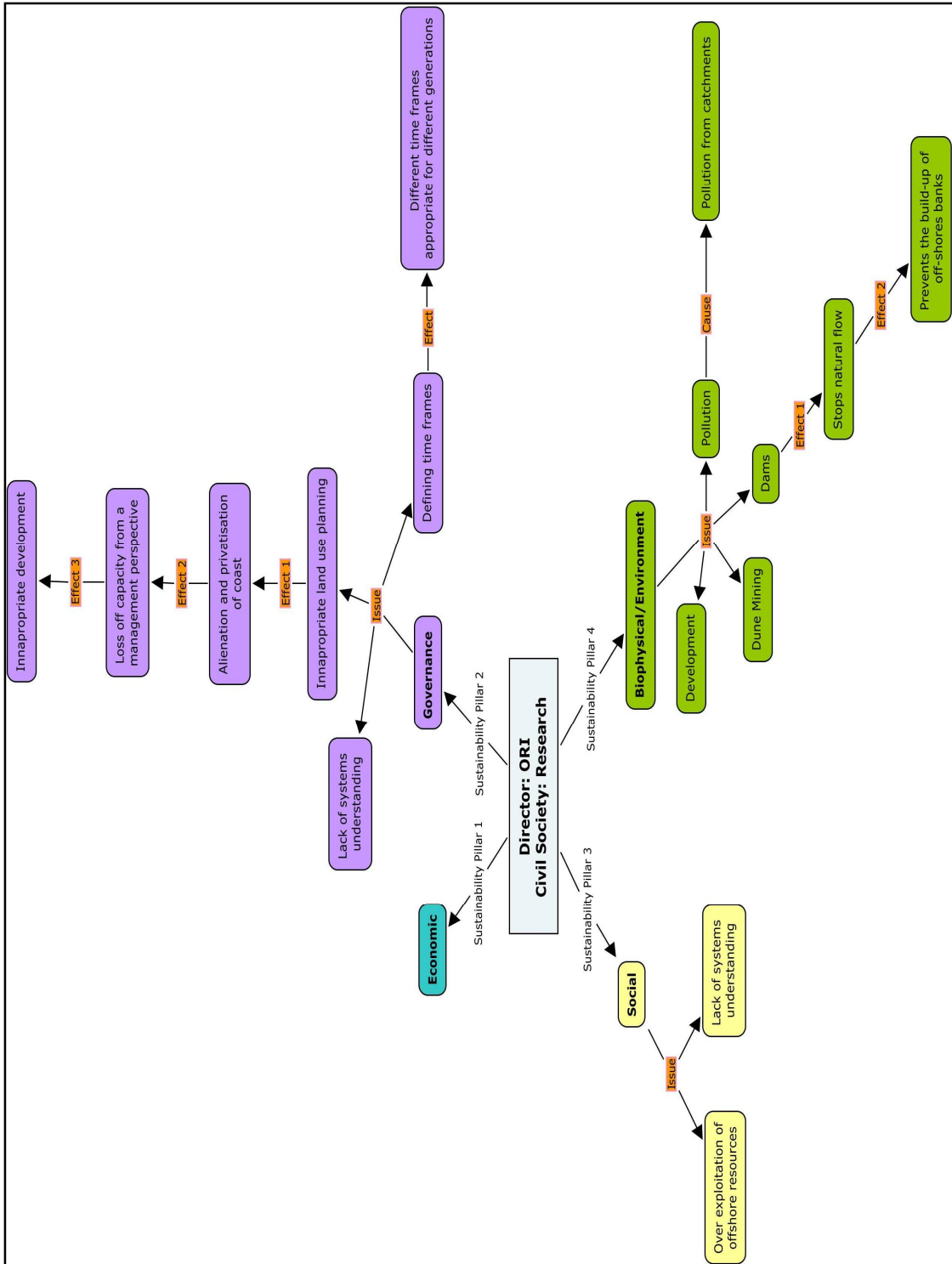
4.14: Natural Resource Manager: South African Cane Growers Association



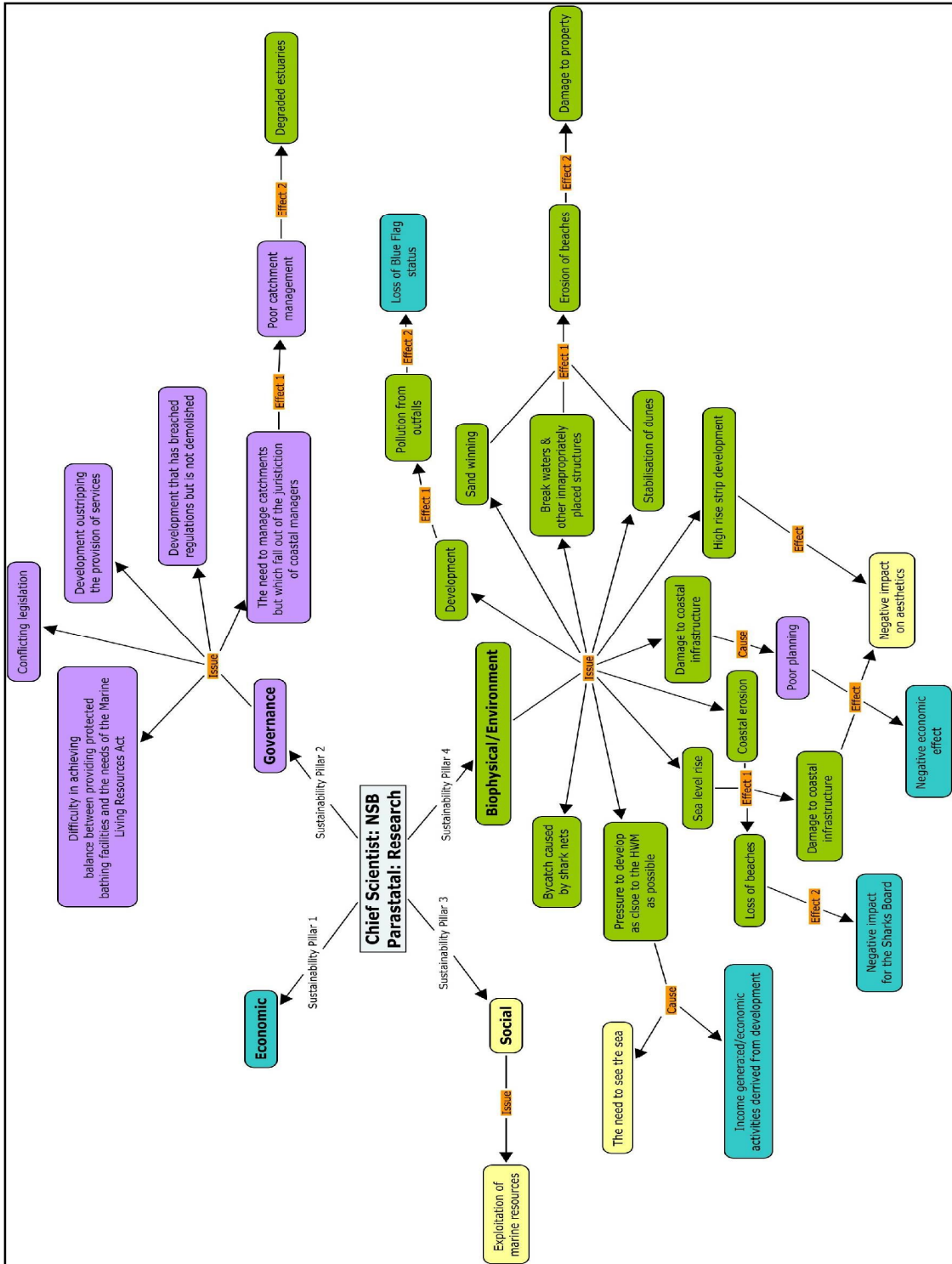
4.15: Planning and EHS Executive: Tongaat Hulett Developments



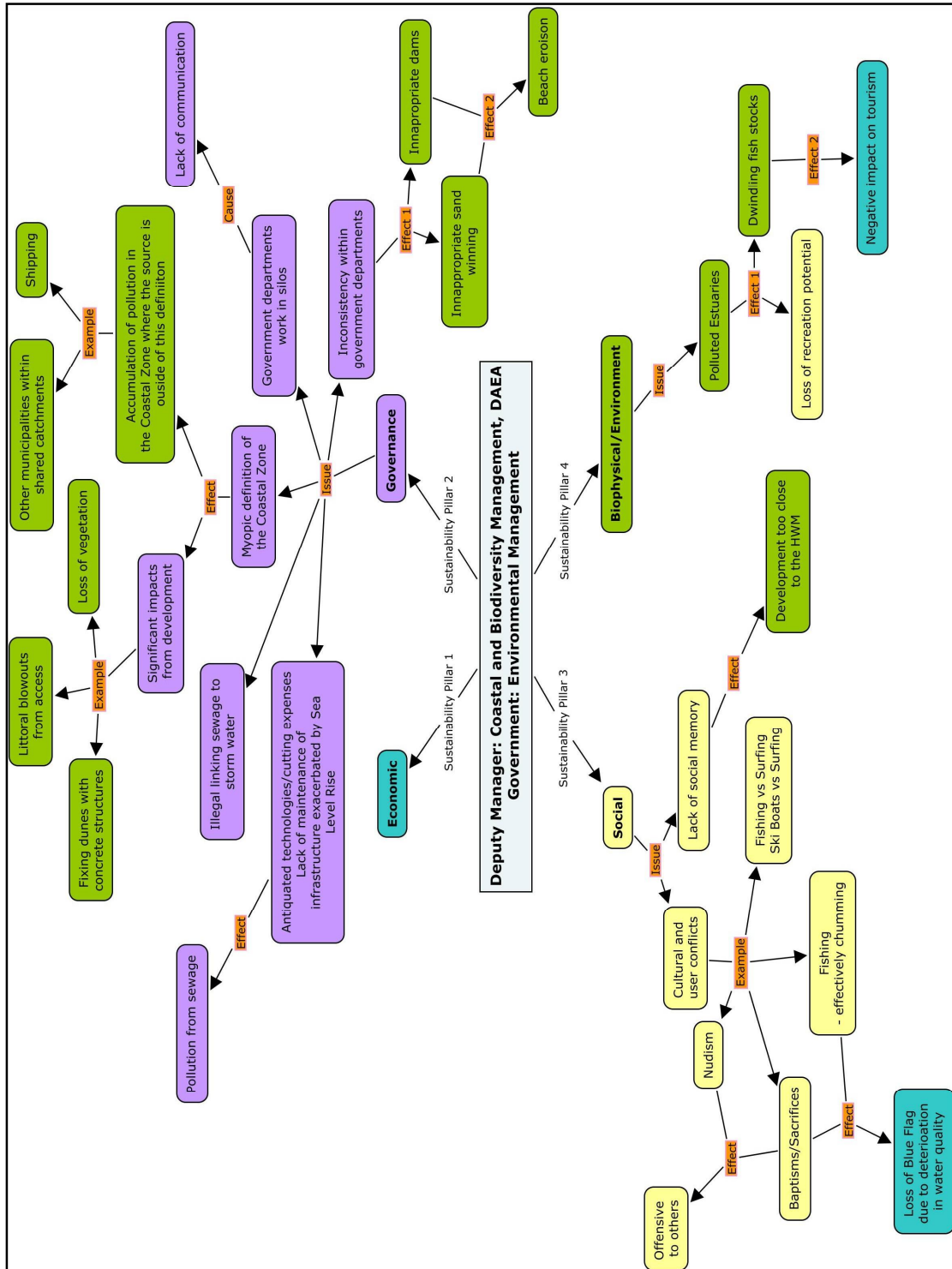
4.16: Director: Oceanographic Research Institute



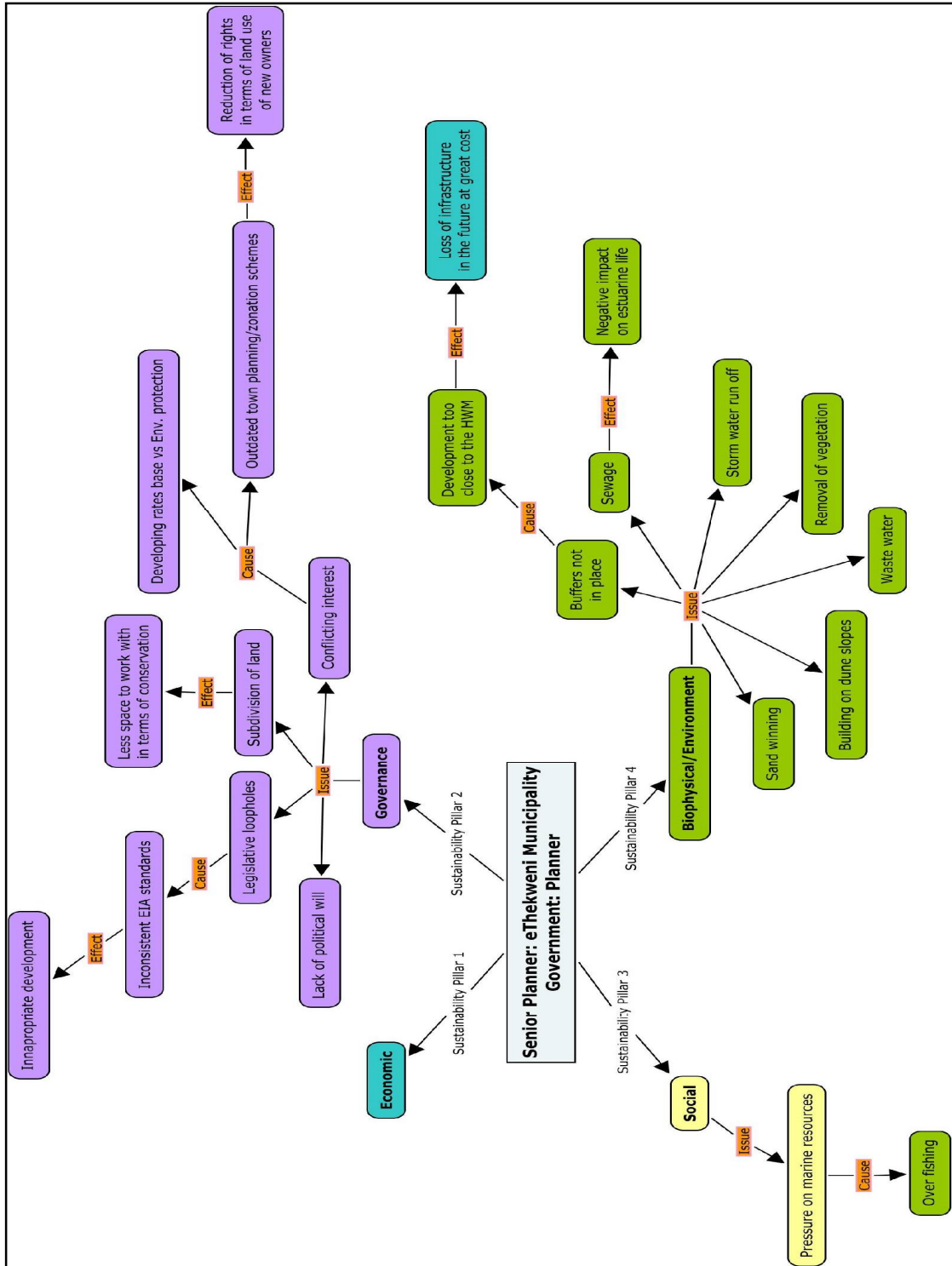
4.17: Chief Scientist: KwaZulu-Natal Sharks Board



4.18: Deputy Manager: Coastal and Biodiversity Management: Department of Agricultural and Environmental Affairs



4.19: Senior Planner: eThekweni Municipality



Appendix 5: Classification of respondents

ORGANISATION	TITLE	SECTOR	FUNCTION
KwaZulu-Natal Tourism	Manger: Research	Parastatal	Research
eThekwini Municipality	Project Executive: Coastal Policy	Government	Policy
Oceanographic Research Institute	Director	Civil Society	Research
Golder Associates	Sustainable Development Division Leader	Civil Society	Consultant
Department of Agricultural and Environment Affairs	Deputy Manager: Coastal and Biodiversity Management	Government	Environmental Management
EnvironDev	Director	Civil Society	Consultant
South African Cane Growers Association	Natural Resource Manager	Parastatal	Environmental Management
eThekwini municipality	Senior Planner	Government	Planner
South Durban Community Environmental Alliance	Chairman	Civil Society	Environmental NGO
Natal Sharks Board	Chief Scientist	Civil Society	Research
Ezemvelo KwaZulu-Natal Wildlife	Co-ordinator for Biodiversity Research	Parastatal	Research
Wildlife and Environment Society of South Africa	Regional Co-ordinator	Civil Society	Environmental NGO
Tongaat Hulett Developments	Planning and ESH Executive	Civil Society	Planning
National Ports Authority	Environmental Manager	Parastatal	Environmental Management
Department of Land Affairs	Surveyor General	Government	Surveyor General
Phelemanga Projects	Director	Civil Society	Consultant
eThekwini Municipality	Head: Environmental Management	Government	Environmental Management
Futureworks	Business Portfolio Leader	Civil Society	Consultant
Department of Environmental Affairs and Tourism	Deputy Director: Marine and Coastal Management	Government	Environmental Management

Appendix 6: Power ratings

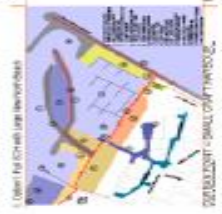
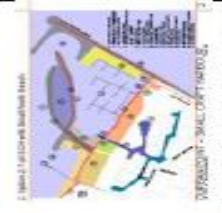


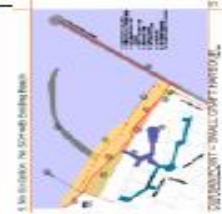

Component	Agency	POWER					SCORE
		Executive	Legislative	Political relevance	Moral Suasion	Enforcement	
National Government	DEAT	1.0	1.0	1.0	0.6	1.0	4.6
	DWAF	1.0	1.0	1.0	0.6	1.0	4.6
	DLA	1.0	1.0	1.0	0.6	0.8	4.4
	DPW	1.0	1.0	1.0	0.5	0.9	4.4
	SAPS	0.9	0.8	1.0	0.6	1.0	4.3
	Kwanaloga	0.3	0.3	1.0	0.5	0.0	2.1
	MCM	0.4	0.5	1.0	0.6	1.0	3.5
Provincial Government	DAEA	1.0	1.0	0.9	0.6	1.0	4.5
	DTLGA	1.0	1.0	0.9	0.6	0.6	4.1
	DACT	1.0	1.0	0.9	0.6	0.5	4
	CBMU	0.3	0.8	0.9	0.6	0.3	2.9
District Municipality (Coastal)	UThungulu	1.0	0.5	1.0	0.5	0.6	3.6
	Ilembe	1.0	0.5	1.0	0.5	0.6	3.6
	eThekwini	1.0	0.5	1.0	0.9	0.6	4
	Ugu	1.0	0.5	1.0	0.5	0.6	3.6
Parastatal	EKZNW	0.7	0.8	0.9	1.0	1.0	4.4
	KZNTA	0.3	0.3	0.9	1.0	0.3	2.8
	PPDC	0.3	0.3	0.9	0.5	0.3	2.3
	SAPA	0.8	0.9	0.9	0.5	0.4	3.5
	NPO	0.7	0.7	0.7	0.5	1.0	3.6
	Amafa	0.7	0.7	0.6	0.5	0.9	3.4
	GSLWPA	0.6	0.4	0.9	0.8	0.8	3.5
	NSB	0.3	0.3	0.3	0.8	0.3	2
	CSIR	0.3	0.3	0.3	0.5	0.1	1.5

Component	Agency	POWER					SCORE
		Executive	Legislative	Political	Moral Suasion	Enforcement	
Civil Society	ORI	0.3	0.3	0.4	0.6	0.1	1.7
	WESSA	0.3	0.3	0.8	1.0	0.0	2.4
	Coastwatch	0.0	0.0	0.6	0.8	0.4	1.8
	UKZN	0.3	0.3	0.3	0.5	0.0	1.4
	IAIA	0.3	0.3	0.3	0.5	0.0	1.4
	SAPOA	0.0	0.0	0.8	0.5	0.0	1.3
	SASA	0.3	0.3	0.8	0.4	0.0	1.8
	NCAU	0.0	0.0	0.6	0.5	0.3	1.4
	ZSAA	0.0	0.0	0.3	0.0	0.0	0.3
	NDSAA	0.0	0.0	0.3	0.5	0.0	0.8
	SADSAA	0.1	0.1	0.6	0.5	0.3	1.6
	FEDHASA	0.3	0.2	0.8	0.4	0.0	1.7
	INR	0.3	0.2	0.3	0.1	0.0	0.9
	Conservancies	0.0	0.0	0.5	0.8	0.3	1.6

Appendix 7: Definitions of power

- “*Political relevance* is the extent of which the institution has a political role to play in the policy issues being dealt with by the network. Some institutions are part of the public sector and have specific political roles to fulfil; some individuals might be elected officials with particular political scripts to follow, while some may have an ostensibly ‘politically neutral’ position, such as professional bodies or academic and research institutions.
- *Legislative power* i.e. the power to make rules and regulations, both formal and informal, will also differ from institution. Some institutions, such as organs of civil society, may have no legislative power, while organs of state – local, regional and national may have considerable power in their sphere.
- *Executive power* refers to the capacity to make decisions. This is a function of the organisation’s mandate. Some organisations will have been delegated power by government (national, regional or local) to make decisions that effect all citizens within their area of jurisdiction. Other organisations may only be able to make decisions that are binding on their members.
- Some organisations will have *moral power* or moral suasion out of all proportion to their scale. This power is the power to speak with authority on a topic and to bring the discussion, opinion and example that persuades others to follow the actor’s lead. It is expected that the issue being discussed is of scientific nature a research organisation with a high reputation will exert a large degree of influence simply by the weight of its moral authority.
- Organisations that form part of the network are also likely to have some degree of *enforcement power*, i.e. the power to compel either other members of the organisation, or members of the public, to comply with decisions made by the actor. This may be constitutionally created power such as that enjoyed by the police force, or it may be power assented to it by virtue of membership in a group, e.g., the power a club has to enforce it’s constitution and conditions of membership” (Celliers *et al*, 2007:378).

Appendix 8: Economic Impacts of the Small Craft Harbor

	OPTION 1: FULL SCH WITH LARGE NORTH BEACH	OPTION 2: FULL SCH WITH SMALL NORTH BEACH – RESULTING IN OPTION 3	OPTION 3B(i) PARTIAL SCH - RETAIN SMALL SECTION OF BEACH	OPTION 3B(ii) PARTIAL SCH - RETAIN SMALL, WIDER BEACH PORTION	OPTION 4: NO SCH OPTION WITH EXISTING BEACH	OPTION 5: NON ALIENATION OF STATE LAND BELOW HWM
						
	Similar to Option 2, with exception of additional submerged groyne proposed adjacent to UShaka Marine World to create alternative beach facilities.	No additional structures proposed to the north of the existing UShaka Pier. No submerged groyne and extended additional beach	A reduced SCH retaining a section of the existing beach.	Hotel/resort zone & mixed use zone reduced to increase size of beach between reduced SCH & base of Vetch's. Wider beach, development pushed back	Final phase Point development restricted to small Hotel/resort zone & mixed use zone above HWM/ erosion setback line. No canal link, existing beach & its uses retained.	Similar to option 2 but, no private development (Hotel and residential) on the proposed reclamation along north breakwater of the Port.
1. Total Contribution to GDP (R/bn) during development Phase (up to 2013) - after displacement	1474	2139	1990	1531	Not assessed	Not assessed
Hotel Contribution	598	598	388	267		
Residential Contribution	253	524	586	469		
Retail Contribution	60	125	140	112		
Offices Contribution	120	250	279	224		
Total GDP contribution with mitigation for potential water sport loss: No Loss	1474	2139	1990	1531		
Modest Loss	1279	1945	1795	1336		
Major Loss	968	1653	1504	1045		
Total Loss	826	1491	1342	883		
GDP Contribution Phase - Operation (R/bn/la)	1.1	1.5	0.997	0.888		

2. Total new Employment (no of jobs) all SCH assets during development phase (up to 2013) -after displacement	5488	7907	7316	5622	Not assessed	Not assessed
Hotels % Contribution	64	46	33	30		
Residential % Contribution	18	28	35	36		
Retail % Contribution	5	7	9	9		
Offices % Contribution	13	19	24	25		
Total Employment with mitigation for potential water sport loss: No Loss	5488	7907	7316	5622		
Modest Loss	3965	6384	5794	4099		
Major Loss	1681	4100	3509	1815		
Total Loss	412	2831	2240	546		
Employment Contribution during operation	4 506	7 185	5 890	4 877		
3. Total Contribution to Household income (Rm) from all SCH Assets up to 2013 (post displacement)	462	708	665	497	Not assessed	Not assessed
4. Contribution to Municipal Rates - 1st full year of operation (Rm)	68,3	75,0	73,8	67,0	Not assessed	not assessed
5. Estimated Value of Imports resulting from SCH development (Rm)	374	591	556	408	Not assessed	not assessed
6. Overall Conclusion of economic assessment	Contribution of existing water sport users is significant. However, economic estimates assume total economic loss of existing water sport users (Present GDP Contribution R490m/annum) - however considered inconceivable. The SCH and associated waterfront development should proceed promptly - all options generate positive employment and GDP contributions					
	Job creation potential very significant: 5600-7900 new jobs in construction. 4600-7100 new operational jobs from 2013. Excludes induced tourism - could add 1800 to 2800 additional jobs.					
	GDP R1,5 - R2,1bn, could add 435m to 750m from induced tourism. Regional GDP between R1,0 to R1,5 bn. Fully constructed the new development will contribute R64m - R75m per annum in municipal rates, conservatively estimated.					

7. Uncertainties	Achieving multipliers will require significant and focused upgrading of Point Road Corridor. Cannot dismiss possibility of Municipality being called in to bail out the project if severe financial downturn experienced.	Not assessed	Not assessed
8. Recommendations	<p>Port Development. Redevelopment of Victoria embankment. Redevelopment of Point Road Corridor</p> <p>Mix needs careful consideration. Explicit family and child friendly facilities. Cap residential to avoid dormitory syndrome. Increase cultural historic. Include historical quarter. Dedicated transport framework. End-use to be managed in detail-non compliance penalties and reversionary ownership clauses. Rapid relocation of water sport users to new facilities-flexible in accommodating transitional needs. Water sport users not to incur economic loss. Extreme care in treatment of Vetch's Pier. Active promotion of growth opportunities for water sports and related industries. Need to consider development model. Consider detailed induced tourism study.B14+B33</p>	Not assessed, as there is no compelling reason to assess a NO Go option from an economic perspective when the best option is being considered	Not assessed, as the public sector investment required for the cost of reclamation will definitely not be forthcoming

Appendix 9: Some of the Social Impacts of the Small Craft Harbour

SOCIAL IMPACTS	NATURE	EXTENT	DURATION	PROBABILITY	INTENSITY	SIGNIFICANCE	MOTIVATION OF SIGNIFICANCE
The EIA process is too long	Negative/ Positive	Local	Short term, but may have long term implications	Depending on further delays	High	Medium	There was concern expressed both by the developer and by the stakeholders, that the process had been delayed in the past. A longer process implies a thorough process, rather than a rushed one
Concern over perceived illegal development below the HWM of the sea	Neutral	Local	Short term	Probable	High	High	The public questioned the legality of development below the HWM. The NPA are the legal owners of the water area and sea bottom in the area of the SCH and are entitled to dispose of such land or water
Impact on public access	Neutral	Local, national & international	Permanent	Probable	High	Medium	Framework plan enforces concept that SCH must be developed as an active public space, however stakeholders are concerned that access to the public will be limited and that the project will become privatised and elitist, particularly in relation to access to the sea.
The ability of the water sports clubs to continue functioning	Neutral	Local and regional	Permanent	Probable	High	Medium	The ability of the private water sports clubs to continue functioning in its current form may be compromised.