

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

Exploring a 'post-normal' science-policy interface for Integrated Coastal Management

A thesis presented in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

in

Environmental Governance

at Massey University, Palmerston North, New Zealand

Scott Ronald Bremer

2011

Abstract

This thesis is broadly about mobilising knowledge for the governance of the coast and specifically about the introduction of a 'post-normal' science-policy interface to Integrated Coastal Management. It begins by acknowledging the unique resource management challenges of the coast and follows the field of Integrated Coastal Management (ICM) as a widely endorsed framework for addressing these challenges. Contemporary developments in this field have seen ICM recognise the uncertainty, plurality and high political stakes characterising many issues on the coast and the attendant need to shift from models of 'management' to models of 'governance.' This thesis specifically engages debates on the epistemological implications of governance, which within ICM have led to calls to democratise the science-policy interface according to norms of dialogue, inclusiveness, integration and quality. Taking this as its point of departure, this thesis explores the 'post-normal science' perspective offered by Funtowicz and Ravetz, as a way of framing the science-policy interface.

This research began by viewing the complexity of coastal management through the particular lens offered by the model of 'interactive governance,' as a compelling perspective on ICM that is gaining credence. Interactive governance focuses on certain features of coastal management, and introduces certain measures of 'quality,' which were formulated into a novel evaluation framework for ICM. The research went on to explore how a 'post-normal science' approach may contribute to 'high quality' ICM, framed according to interactive governance. This occurred first via a literature review, and second through cross-scale empirical research. Internationally, the research followed the SPICOSA Project, as a Europe-wide focus on the science-policy interface for coastal management. Nationally, the research explored New Zealand's coastal management framework, mapping the emergence of new 'norms of governance' within the science-policy interface and their contribution to quality institutions, before interrogating three local-scale initiatives that gave effect to a post-normal science approach; in Whangamata, Waikaraka and Gisborne.

This research arrived at three key findings on the meaningfulness of a post-normal science-policy interface. First, that there are many ways to give effect to this approach, contingent on scale and context. Second, that this approach has significant potential for promoting high quality ICM according to measures of institutional quality and stakeholder interactional quality. And third, that the most significant threat to this approach is power; most notably the power of science to subsume other knowledge systems.

Preface and acknowledgements

My motivation for embarking on this research was drawn from a number of years working as a young coastal planner in New Zealand local government, and the problems that I faced. After finishing my degree in Resource and Environmental Planning, I found myself increasingly disillusioned with the messy and muddled decision-making that I faced on the coast, which departed so significantly from the 'scientific' process I had associated with planning. In conversations with other planners, I began to think reflexively on the way we managed the coast. I began to feel a degree of doubt; to what extent was I having any useful influence on the coastline, or the community that lived there? Increasingly I perceived the management regime that I worked within to be detached from the real coastal community and environment. I pictured a hulking 'coastal management machine,' operated by planners, that chugged away behind the locked door of the Council Chamber, and was only noticeable from the outside by the smoke and hot air shooting out the chimney.

I became uncomfortable with the way this machine addressed the uncertainty inherent on the coast, and condensed power within the hands of a few scientifically and legally literate 'technocrats.' I was frustrated by the fragility of the knowledge base on which decisions were built. In auditing Environmental Impact Assessments, I found it was less a question of finding the gaps in the knowledge, and more a case of finding the small islands of solid grounding in a sea of uncertainty. The knowledge foundation resembled rather an aggregate of fragile knowledge fragments, cemented together with gross generalisations. I found I needed to arrive at a hard line in the sand, sometimes quite literally, from very 'soft' knowledge. However, rather than recognise these uncertainties, the tendency was often to down-play them as unimportant. At the same time, I came to realise how many conflicting perspectives presented themselves within a coastal community, and the significant power planners wielded in determining which were admitted as 'legitimate' to the decision-making process. While pretending to some 'scientific determination' of stakeholders, these decisions could in reality be quite arbitrary and exclusive; admitting only those with a 'legally defensible' perspective. This revealed to me the planner's first duty was to uphold the integrity of the scientific and legalistic process, rather than the quality of the decision, or any subsequent outcomes. Those members of society not initiated in the ways of science or resource management seemed to be stripped of their power to turn the wheels of the machine.

However on the other hand, I also came to see that far from scientific, decision-making was fundamentally political. Local government technocrats were influenced by local politicians, who were influenced by their constituents. Because the issue or project was always so uncertain, it

could be legitimately framed in any number of ways, with power and political influence often the shaping force behind how the issue was finally defined and addressed. Decisions were more often based in personality and friendships of a local politician than any professional advice on my part. And though the decision could then progress to the Environment Court, this was rarely better because again the process favoured those able to communicate in that litigious court setting, or those with the wherewithal to employ legions of legal and technical expertise. I felt that if decisions were to depart from science, and be debated in a political arena, such arenas ought to at least take a more participatory form.

Then, finally, a realisation that the true power to shape coastal communities lay outside the Council Chamber; far beyond the huffing and puffing of the bureaucratic machine and the political masters. The coastal community was not determined by our rule-book, it was determined by the individual decisions and actions made by all of our constituents. Our coloured zones and coded rules did not have any omnipotent power to shape the destiny of the coastline; that was being constructed incrementally, every moment of every day, by the commercial fishers, the sand-dredgers, the local aquarium, and the family at the beach. No matter how tightly we drew our net of rules, activities would always slip through the gaps. Many people in our small community had no idea that the rules existed, and others did not accept them as legitimate. Our ideas of centralised control were illusory; collective decision-making, real collective decision-making, had to be considered as the collective sum of our community's different actions.

These three reflections served as both the normative motivation and means of orientating my research on better coastal decision-making. It begins from the personal realisation that a purely scientific process is untenable given the significant uncertainty associated with the coast, and undesirable given the exclusivity of a decision-making arena which places power in the hands of planners, consultants, and lawyers. It also begins from recognition of the power structures within fickle local government representative democracy, and the need to arrive at collective decisions a community can agree is legitimate, and not arbitrary. It seeks decision-making that gives equal consideration to principles of rationality and democracy. To this end, the thesis focuses specifically on the way knowledge can be mobilised in support of decisions.

This research was steered significantly by the lens offered by my academic and professional background in planning. As an inherently inter-disciplinary profession, a planner is often labelled as 'jack of all trades, master of none.' Significantly, I see that my professional background, and the focus on ICM as itself an interdisciplinary field, explains the way in which this research brought together a broad array of disciplines and bodies of thought, ranging from political science, to planning and resource management, to the philosophy of science. I see this as a strength, as it

reflects the complexity of coastal management, and cross-germination active in the social sciences and resource management. It constitutes an expression of the interdisciplinary and cross-scale kind of research and action increasingly demanded by coastal management.

However, I could not have completed this thesis alone. That this research has come to a culmination is testament to the huge amount of support that I have had over the past four years, across three different countries and tens of thousands of kilometres.

It began in New Zealand with a serendipitous phone-call to an old lecturer and friend Nigel Jollands, and then through the support of Ecological Economics Research New Zealand. Thank you to my lead supervisor Murray Patterson for his guidance in those early days when all things academic seemed...academic. Also a huge thank you to my co-supervisor Bruce Glavovic, who took me in after I turned up like an orphan on his doorstep, and provided an invaluable and formative influence throughout my tenure. I also need to acknowledge the Ryochi Sasakawa Scholarship, which was extremely generous, and particularly Jackie Koenders for her help. Still in New Zealand I need to thank my family for their patience and support through the high points and low. Thank you mum for actually reading my work, and putting a roof over my head when I needed it, and thank you dad and Lyn for taking a genuine interest in all things 'post-normal.' Also thank you to my friends and flatmates in Palmerston North and beyond.

In August 2007, this thesis took me to L'Université de Versailles Saint-Quentin, and forever broadened my horizons. Thank you to all those at REEDS who helped me to make a life in Paris. In particular, thank you to my two supervisors there, Martin O'Connor and Jean-Paul Vanderlinden, for opening up untold new experiences and opportunities through the SPICOSA Project and scientific voyages along the West African coast. Finally in France, I must acknowledge the generous support of the Eiffel Scholarship.

In August 2010, as I began to write the final chapters, I moved to Bergen in Norway. I went with many hopes but no expectations of what I would find in the cold 'North Way.' What I found at the Senter for Vitskapsteori was such an overwhelming welcome, compassion and support that I could not have imagined. This is truly a centre of excellence in every sense. Thank you Roger Strand for all of your help, and thank you Matthias Kaiser for taking me on and opening up a world beyond the PhD, which is filled with promise and new opportunities.

Finally, and most of all, I need to thank my partner Anne for her unflinching love and support. She is the thread that links these three distant lands, and a future we cannot know. For us to share a life beyond a PhD thesis has been an enormous motivation.

Table of Contents

Abstract.....	i
Preface and acknowledgements.....	iii
Table of Contents.....	vii
List of Figures.....	xv
List of Tables.....	xvi
PART I: INTRODUCTION AND CONTEXT.....	1
Introduction.....	3
1. A focus on the coast.....	3
1.1 Rich in natural resources, with a diversity of ecosystems.....	3
1.2 The primary habitat of humanity.....	3
1.3 Managing society's conflicting claims to a common coastal resource.....	4
1.4 A dynamic environment; sensitive to global environmental change and unpredictable.....	4
2. Integrated Coastal Management.....	5
2.1 ICM as conflict resolution and collective decision-making for the coastal commons.....	6
2.2 The evolution of ICM scholarship and practice as a robust framework.....	8
2.3 Critiques of ICM.....	9
2.4 Viewing ICM through the lens of 'interactive governance'.....	10
3. Rational decision-making in the face of uncertainty, plurality and high stakes.....	13
4. Exploring a dialogic epistemology for ICM framed as 'interactive governance'.....	15
4.1 What is knowledge?.....	15
4.2 Beginning from a dialogic epistemology.....	16
4.3 The science-policy interface for ICM.....	17
4.4 The post-normal science perspective.....	18
5. The research questions and objectives.....	19
5.1 Evaluating ICM as 'interactive governance'.....	21
5.2 Exploring the contributions of post-normal science to high quality ICM.....	22
6. Research method.....	23
6.1 Exploring ICM practice in the literature: the first iteration.....	24
6.2 Multi-scale empirical studies: the second iteration.....	24
6.3 Returning to theory.....	26
7. Thesis roadmap: the structure of the thesis.....	26
Part I: Introduction and context.....	27
Part II: Conceptual framework: Evaluation and Epistemology for coastal governance.....	27
Part III: Focussing on the science-policy interface for Integrated Coastal Management: Introducing a post-normal science perspective.....	28
Part IV: Empirical Studies: Exploring the contributions of post-normal science to Integrated Coastal Management, from the international to the local scale.....	29
Part V: What has been revealed? Lessons learned and conclusions.....	30

Chapter 1: Implications of a complex system-to-be-governed: framing the governing system as ‘interactive governance.’	31
1. Challenging the modernist ‘system-to-be-governed’: Conceiving of a complex Nature.....	32
1.1 Debates within Ecology.....	32
1.2 Systems Thinking and Complexity	35
1.3 Complex Adaptive Systems.....	37
2. Complex systems-to-be-governed as a source of uncertainty	38
2.1 Uncertainty within the ‘modernist’ model	39
2.2 The Study of Uncertainty	40
2.3 Sources and types of uncertainty	40
2.4 Analysis of Uncertainty	42
3. Society’s collective decisions within a ‘governing system’	42
3.1 A plurality of valid perspectives.....	42
3.2 Making collective choices in a high-stakes governing system	45
3.3 Participatory democracy for living with uncertainty and pluralism.....	46
4. Framing the ‘governing system’ as interactive governance	47
4.1 A diversity of governance models.....	49
4.2 Defining interactive governance; interactions, institutions and principles	52
4.3 Visualising interactive governance	55
4.4 Interactive governance as multi-scale governance.....	57
4.5 The interactive governance terms used in this thesis	58
4.6 Limitations of the interactive governance model	59
5. Conclusion	63

PART II: CONCEPTUAL FRAMEWORK: EVALUATION AND EPISTEMOLOGY FOR COASTAL GOVERNANCE..... 65

Chapter 2: Conceptualising an evaluation framework for Integrated Coastal Management as ‘interactive governance’	67
1. Introduction.....	67
2. Integrated Coastal Management as interactive governance.....	69
2.1 The complex coastal ‘system-to-be-governed’	69
2.2 ICM within a ‘governing system’	70
2.3 ICM through the ‘interactive governance’ lens	71
2.4 Matching ICM evaluation to an interactive governance perspective	74
3. Evaluating ICM, and the implications of a governance perspective	75
3.1 The current terrain of ICM evaluation	76
3.2 Causal models: linking ICM initiatives to environmental outcomes.....	77
3.3 Evaluating ICM institutions	79
3.4 ICM evaluation within a ‘resource management’ paradigm	81
3.5 Governance perspectives providing new norms of evaluation	82
4. Constructing an evaluation framework for ICM as interactive governance.....	84
4.1 Setting the foundations in interactive governance.....	84
4.2 Institutional quality.....	86

4.3	Interactional quality	86
4.4	Unpacking the capital framework as a measure of interactional quality.....	90
5.	Introducing an evaluation framework for interactive coastal governance.....	94
6.	Conclusion	97

Chapter 3: Mobilising high-quality knowledge for governance through dialogue: a comparison of approaches and their institutional settings 99

1.	Introduction	99
2.	Epistemological traditions in environmental governance	101
2.1	From technocratic to dialogic governance	101
2.2	The multiple imperatives for dialogic governance	103
2.3	Mobilising high quality knowledge through a dialogic epistemology	104
3.	Classifying the diversity of dialogue in the ‘governing system’	105
4.	Introducing three epistemological perspectives on dialogic environmental governance	109
4.1	Deliberative Democracy	109
4.2	Collaborative Learning.....	111
4.3	Post-normal science	113
5.	Comparing dialogic epistemological perspectives	116
6.	Conclusion	122

PART III: FOCUSING ON THE SCIENCE-POLICY INTERFACE FOR INTEGRATED COASTAL MANAGEMENT: INTRODUCING A POST-NORMAL SCIENCE PERSPECTIVE..... 125

Chapter 4: Mobilising knowledge for coastal governance: re-framing the science-policy interface for Integrated Coastal Management..... 127

1.	Introduction	127
2.	ICM as ‘interactive governance:’ implications for the mobilisation of knowledge.....	128
2.1	Diffused knowledge mobilised through dialogue within institutions	128
2.2	Creating institutional settings for the integration of knowledge	130
2.3	A focus on the institution of the science-policy interface.....	131
3.	ICM and the science-policy interface setting	132
3.1	The evolution of the science-policy interface for ICM	132
3.2	Theories and principles shaping the ICM science-policy interface.....	133
3.3	The science-policy interface in ICM practice	137
4.	Principles for framing the science-policy interface as a governance setting	140
4.1	Framing the science-policy interface as a governance setting.....	140
4.2	Addressing knowledge quality	140
4.3	Distilling four key principles for framing the science-policy interface	141
5.	Conclusion	142

Chapter 5: How can a ‘post-normal’ science-policy interface contribute to Integrated Coastal Management? A review of the literature. 145

1.	Introduction	145
2.	Focussing on post-normal science	146

3.	The theoretical potential of a ‘post-normal’ science-policy interface for ICM.....	148
3.1	The potential contribution of PNS to institutional quality.....	148
3.2	The potential contribution of PNS to interactional quality.....	151
3.3	Moving from theory to practice.....	152
4.	Employing a post-normal science approach for ICM: a review of practice from the literature	153
4.1	Coastal management initiatives giving effect to post-normal science	154
4.2	Mobilising high quality knowledge by ‘post-normal’ means	156
4.3	The influence of a PNS approach on institutional quality in practice	157
4.4	The influence of a PNS approach on interactional quality in practice	157
5.	Conclusion	158

PART IV: EMPIRICAL STUDIES: EXPLORING THE CONTRIBUTIONS OF POST-NORMAL SCIENCE TO INTEGRATED COASTAL MANAGEMENT, FROM THE INTERNATIONAL TO THE LOCAL SCALE 161

Chapter 6: The SPICOSA Project: Applying a post-normal science approach to Europe’s coastal management 163

1.	Introduction.....	163
2.	Introducing SPICOSA as a post-normal approach.....	164
2.1	Science and Policy Integration for Coastal System Assessment: The SPICOSA Project	164
2.2	SPICOSA’s ‘post-normal’ structuring of the science-policy interface	168
2.3	SPICOSA as a novel initiative for governance	172
3.	Studying the SPICOSA Project: conceptual framework and method.....	173
3.1	Conceptual framework for analysis and exploration	173
3.2	Research method within the SPICOSA Project.....	174
4.	Exploring the contribution of the SPICOSA Project to coastal governance in four study sites: Results and Discussion	176
4.1	Four different study sites.....	176
4.2	Analysis of the SPICOSA science-policy interface	179
4.3	Exploring governance outcomes: institutional quality	182
4.4	Exploring governance outcomes: interactional quality	184
5.	Conclusions.....	186
5.1	What form did the SPICOSA science-policy interface take?	186
5.2	How did SPICOSA contribute to the quality of coastal governance institutions?	187
5.3	How did SPICOSA contribute to the quality of coastal stakeholder interactions?	188
5.4	In conclusion	188

Chapter 7: The influence of the science-policy interface on Integrated Coastal Management across New Zealand nationally: legitimating new norms of participation and dialogue..... 191

1.	Introduction.....	191
2.	The pressures facing New Zealand’s coast, and its management response	193
2.1	The pressures on New Zealand’s coastal marine area.....	193
2.2	New Zealand’s coastal management regime	194

3.	Exploring the influence of the science-policy interface on coastal management institutions:	
	Conceptual framework and research method	196
3.1	Analysis of the science-policy interface institutional setting	197
3.2	Exploring the influence on coastal management institutions	198
3.3	Research method	199
4.	Analysing the science-policy interface: results and discussion	201
4.1	Elements of a science-based tradition	201
4.2	Elements of a participatory tradition	206
5.	Exploring the influence on the quality of institutions: results and discussion	209
6.	Conclusions	214

Chapter 8: ‘Post-normal’ approaches to coastal governance at the local scale: Lessons from three New

Zealand case studies	218	
1.	Introduction	218
2.	Research framework and method	221
2.1	Selection of the case studies	221
2.2	Interview framework	222
2.3	Research method	223
3.	Whangamata Harbour and Catchment Plan and the Iwi and Care Stakeholder Forum	224
4.	Waikaraka Estuary Managers Inc	227
5.	The Gisborne Wastewater Adjudgment Review Group	231
6.	Discussion: comparing and contrasting the three case studies	235
6.1	Community responses to post-normal issues	235
6.2	To what extent did initiatives create a ‘post-normal’ science-policy interface?	239
6.3	Have the initiatives created better quality institutions for coastal management?	245
6.4	Have the initiatives created better quality stakeholder interactions for collective decision-making?	249
7.	Conclusion	250

PART V: WHAT HAS BEEN REVEALED? LESSONS LEARNED AND CONCLUSIONS
253

Chapter 9: Lessons learned from the empirical research	255	
1.	Introduction; what has been revealed?	255
2.	What are the motivations and means for democratising the science-policy interface?	256
	Lesson 1: Coastal stakeholders sought to democratise the science-policy interface out of dissatisfaction with science-based management	256
	Lesson 2: The post-normal science approach has not found explicit practical application in ICM, though there are many ways to give effect to its principles	257
3.	What was learned about the value of a post-normal science approach for contributing to ICM, framed as interactive governance?	258
	Lesson 3: A post-normal science approach can contribute to better quality ICM institutions ..	258
	Lesson 4: A post-normal science approach can contribute to better quality stakeholder interactions for collective decision-making	259

4.	What are the most significant obstacles to the successful implementation of a post-normal science approach?.....	260
	Lesson 5: Science is powerful and there is a danger that all knowledge perspectives become subsumed within a scientific framework.....	260
	Lesson 6: Power is ever-present within any dialogic institutional setting, and influences the way knowledge is mobilised.....	260
5.	What are the consequences of applying a post-normal science approach in different contexts and at different scales?	261
	Lesson 7: Context matters; a post-normal science approach is best used to improve the quality of pre-established dialogue and collective decision-making.	261
	Lesson 8: Scale matters; a post-normal science approach works best at a scale close and salient to the issue.	262
6.	What promise does a post normal science approach hold for Integrated Coastal Management.....	263
	6.1 Not a blanket solution	264
	6.2 Contingent on context.....	265
	6.3 Depending on leadership.....	265
	6.4 Nurturing of reciprocal dialogue through deliberation support tools	265
	6.5 Explicitly recognising the influence of power	265
	6.6 Explicitly focussing on knowledge quality	266
	6.7 Disseminating the knowledge	266
7.	Coming to a conclusion.....	266
Conclusion		267
1.	The value of this research, for whom	267
	1.1 Unpacking a governance perspective on ICM	268
	1.2 The importance of appropriate evaluation	269
	1.3 Enriching the discussion on the ICM science-policy interface.....	270
2.	Reflecting on the research method	271
3.	What has been accomplished?.....	273
	3.1 Lessons from the literature: the theoretical potential of post-normal science	273
	3.2 Lessons from the literature: post-normal science in ICM practice.....	274
	3.3 Lessons from the empirical research.....	275
	3.4 'Post-normal' as a viable alternative to 'normal' science	277
4.	What has not been accomplished? Questions left unanswered	278
	4.1 Questions of power	279
	4.2 What about politicians?	279
	4.3 Which other stakeholders were excluded?	280
	4.4 Looking beyond the science-policy interface.....	281
5.	Returning to the research question.....	281
6.	Afterword	282
APPENDICES.....		283
Appendix A: The evolution of Integrated Coastal Management in theory and in practice		285
1.	The 'rise' stage: coastal zone management in the 1960's.....	286

1.1	Intellectual origins	286
2.	The ‘implementation’ stage: the 1970’s	287
2.1	Intellectual influence	288
3.	The ‘maturity’ stage: the 1980’s	288
3.1	Intellectual influence	289
4.	The ‘ICM’ stage: the 1990’s	290
4.1	Intellectual influence	292
5.	Integrated Coastal Governance? 2000 and beyond	292
5.1	Intellectual influence	293
6.	ICM as a reflexive field	294
Appendix B: Concepts of ‘rationality’ for social choice: environmental management versus environmental governance		297
1.	Defining rationality as ‘based on reason’	297
2.	Rationality in a modern world: how do we inform our social choices?	298
3.	Reconciling conflicting notions of rationality; Habermas vs Foucault	302
3.1	The rationality of power	302
3.2	Practical, pragmatic or communicative rationality	302
4.	Modernist environmental management	303
5.	A shift toward deliberative environmental governance	307
Appendix C: The concept of ‘capital’ and its use for describing stakeholder interaction		311
1.	Capital as an expanding economic concept	311
2.	The emergence of capital in the social and political sciences	314
3.	A focus on financial, social and human capital as indicators of interactive quality	316
a)	Financial Capital	317
b)	Social Capital	317
c)	Human Capital	320
Appendix D: The conceptual framework of analysis and evaluation		322
Appendix E: EU Eight Principles of Good ICZM		324
Appendix F: New Zealand’s science-policy interface for environmental management: a context within which to discuss coastal management		326
Appendix G: Presenting the analysis and exploration of the New Zealand local-scale case studies		330
1.	Whangamata Harbour and Catchment Plan and the Iwi and Care Stakeholder Forum	331
1.1	Analysing the Iwi and Care Stakeholder Forum through a post-normal science lens	331
1.2	Exploring the influence of the Forum on the quality of institutions	336
1.3	Exploring the influence of the Forum on the quality of stakeholder interactions	340
2.	Waikaraka Estuary Managers Inc	342
2.1	Analysing the Waikaraka Estuary Managers initiative through a post-normal science lens	342
2.2	Exploring the influence of the WEM initiative on the quality of institutions	348
2.3	Exploring the influence of the WEM initiative on the quality of stakeholder interactions	352

3. The Gisborne Wastewater Adjournment Review Group..... 354
3.1 Analysing the WARG process through a post-normal science lens 354
3.2 Exploring the influence of the WARG on the quality of institutions..... 359
3.3 Exploring the influence of the WARG process on the quality of stakeholder interactions 363

BIBLIOGRAPHY.....ERROR! BOOKMARK NOT DEFINED.

List of Figures

Figure 1	A simplified three-stage didactic model demonstrating ICM institutions as nurturing collective decision-making.	8
Figure 2	The structure of the thesis	27
Figure 3	Visualising Interactive Governance; three orders of governance within a governing system	56
Figure 4	The Four Orders of Coastal Governance Outcomes (Olsen, 2003)	78
Figure 5	Conceptualising six forms of dialogue between four categories of governing system stakeholders	106
Figure 6	Demonstrating the interaction between the Systems Approach Framework and deliberation within the policy sphere via SPICOSA Deliberation Support Tools (taken from SPICOSA (May 2010))	166
Figure 7	Location of the three New Zealand local-scale case studies	222
Figure 8	Aerial photograph of Whangamata Township and Harbour (Google Earth)	225
Figure 9	Aerial photograph of Waikaraka Estuary (Google Earth)	228
Figure 10	Aerial photograph of Poverty Bay, with Gisborne city identified (Google Earth)	232
Figure 11	Demonstrating the plurality of perspectives relative to water quality issues along an: (a) epistemological spectrum; and (b) value spectrum	237
Figure 12	Evaluating the contribution of the case studies to institutional quality relative to ICM Principles	246
Figure 13	Matrix demonstrating the importance of 'evaluating each approach by its right measure'	269
Figure 14	ICM as a reflexive field: demonstrating the mutually-influencing relationship between ICM principles (scholarship), and the institutions and stakeholder interactions (practice) within a governing system context	295

List of Tables

Table 1	Four common impetus for environmental governance theories	49
Table 2	Theoretical approaches to governance (taken from Kooiman, 1999)	51
Table 3	Principles of ICM (Stojanovic, Ballinger and Lalwani, 2004)	74
Table 4	Evaluation framework for Integrated Coastal Management as interactive governance	96
Table 5	Comparing the characteristics of post-normal science, collaborative learning and deliberative democracy	120
Table 6	Characteristics of the post-normal science approach	147
Table 7	Characterising the SPICOSA Project as a 'post-normal science' approach	170
Table 8	Key coastal issues as perceived by New Zealanders	194
Table 9	Framework for analysis of the New Zealand science-policy interface	198
Table 10	Comparing New Zealand local-scale case study performance against the characteristics of post-normal science	240
Table 11	Barriers and facilitators to running a post-normal science-policy interface	244
Table 12	Eight lessons learned from across the three empirical studies	276
Table 13	Demonstrating two different governance models across three dimensions	307